Implementation of
SCADA Interface Protocol

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Revision A
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Introduction

Subject:
The scope of this document includes:

- A complete description of the operation of the Printer function in the meter used to communicate to an RTU/SCADA interface. This section includes the appropriate format of the X.20 command that puts the meter in “wait for request” mode.
- In appendix A, a listing of the data items that must appear in table 16 for the proper operation of the meter to an RTU/SCADA interface.

Audience:
This manual is directed to programming personnel responsible for implementing the SCADA interface function for a QUAD4/MAXsys meter.

Related Documents:
The latest revisions of the following documents should be consulted for related technical information:

<table>
<thead>
<tr>
<th>Document Number</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-117266</td>
<td>General Communications Protocol</td>
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<tr>
<td>A-117342</td>
<td>Standard Protocol Tables</td>
</tr>
</tbody>
</table>
1.0 Print Function Data Collection Interface

The Printer function of the QUAD4 Plus meter can be used as an interface to a data collection system. The Printer function can be used to supply meter data to a RTU/SCADA interface for remote data collection. A specific configuration is defined for using this interface. Table 16 must have special entries for the data required (refer to appendix A). Table 17 (normally the secondary display table) is dedicated to specifying the items sent out the printer port. Command X20 with a specific command bit pattern must be sent to the meter when it is formatted and after any cold start of the meter.

2.0 RTU/SCADA Interface

The QUAD4 Plus Solid-State meter can be configured to output data to an RTU/SCADA serial data interface. The QUAD4 Plus can be configured to send this data through either an RS232 interface or a current loop interface. The meter will send the data only when it is requested. The request includes the last four digits of the UNIT ID. This allows data to be requested from each meter individually. The meter can be configured to send a variable amount of data. The data has a code with each element to indicate what the data represents. The last element sent will always be configured to be the UNIT ID. The receipt of the UNIT ID will be the indication that it is the end of the data from that meter.

The data and the request for data are serial data streams. The format for both is: 1 start bit, 8 data bits (least significant bit first), no parity, 1 stop bit. 10 bits total per character.

By default, jumper E2 is present on the SuperBoard. Therefore, the baud rate of the current loop port is 300 baud and of the RS232 ports is 1200 baud. If E2 is removed, the baud rate of the current loop port is 1200 baud and of the RS232 ports is 9600 baud. The jumpers are only read at power up; therefore, if power is already applied to the meter, power down, remove the cap, then reapply power. If dealing with the older Display/Power Supply board in the meter, the baud rate is 300 or 1200 bits per second selected by jumper E1 on the rear of the board. The factory default is 300 baud; remove jumper E1 for 1200 baud.

The average data rate is now about 20 characters per second. There is no guarantee that this will not increase to the maximum allowed for the selected baud rate (zero idle time between characters) or slow down in the future. The time between characters is NOT uniform or consistent.

All characters are ASCII characters - 8th bit is always zero.

Data path can be either RS232 or Current loop:

RS232 - Mark - negative voltage, Space - positive voltage. Line idle in marking state. CTS signal is flow control. CTS space (positive voltage) allows data from the meter. CTS marking halts data from meter. There is no flow control on request data (to the meter). If multiple meters are to be connected to one RTU/SCADA interface, a buffer must be supplied to "fan out" the request data, and an ORing arrangement must be supplied to combine the data from the meters.
Current Loop - nominal 20 Ma current loop. Mark - current flowing (more than 10 ma). Space - no current flowing (less than 2 Ma). This is a passive current loop interface (i.e. RTU/SCADA device supplies the current, the meter only senses and switches it). The transmitter and receiver are in series (half duplex). The nominal voltage across a meter is 2 volts (3.5 Max) when mark, can stand off 40 volts max when space. The current loop allows several meters to be placed in series.

Both interfaces are on J10 on the older Display/Power Supply board:

RS232:
RXD (request data to meter) - Pin 7
TXD (data from meter) - Pin 8
CTS (flow control input) - Pin 6
GND (reference for 6,7,8) - Pin 5

Current Loop:
Positive (current goes into) - Pin 1
Negative (current comes out) - Pin 2

NOTE: the GND pin is isolated from both current loop pins.

Both interfaces are on J3 on the current SuperBoard:

RS232 #1:
RXD (request data to meter) - Pin 3
TXD (data from meter) - Pin 2
CTS (flow control input) - Pin 5
RTS (flow control input) - Pin 4
GND (reference for 2,3,4,5) - Pin 10

Current Loop:
Positive (current goes into) - Pin 12
Negative (current comes out) - Pin 11
GND - Pin 10

NOTE: The GND pin is isolated from both current loop pins.
3.0 Data Request to Meter

The data request is a 5-character string. The first character is an ASCII <STX> (02H, Control-B). The next four characters are the ASCII representation of the last 4 digits of the UNIT ID. The UNIT ID is an 8-digit number assigned when the meter is configured. The most significant digit is sent first (after the <STX>) and the least significant (left most) digit is sent last.

EXAMPLE:

Unit ID 012345678

send: "<STX>5678"
response:          "0000000.000 W010    ............"

EXAMPLE:

Unit ID 00000003

send: "<STX>0003"
response:          "0000011117. W006       0000003 W999<CR><LF>"

The response will start normally in about 50 to 100 milliseconds after the last character of the request. However, this time interval is not guaranteed and the time to start a response may reduce to zero time or extend out to about a second. We recommend you wait about 2 seconds before you do a retry if you do not see a response.

4.0 Data Response From Meter

For each type of data from the meter, there is a defined identification code. The codes are four characters long and of the form

"Wddd"

where ddd is a 3-digit number from 000 through 999, that is, the codes are from "W000" to "W999".

There will be a variable number of data items in the response. The last data item will always be the UNIT ID which will have data ID "W999". Use this data ID as the end of data indication.

Each piece of data will consist of 11 ASCII characters. In the case of numeric data (such as total kilowatt hours) it will consist of zero or more leading spaces, a possible minus sign ("-" ASCII 2DH), one or more integral digits, a possible decimal point ("." ASCII 2EH), zero or more decimal digits, and zero or more trailing spaces.

In the case of "set" data (such as phase voltage presence) it will consist of 1 to 8 "Y"'s or "N"'s with leading and/or trailing spaces. The basic data format is fixed for each particular piece of data. For each data type (defined by its data ID) you will know where each significant character is located and that data will always have that format. The decimal data will always have eleven characters, ten digits and one decimal point. However, the decimal point could occur anywhere in the number and the leading digit may be replaced by a minus sign. The formats for
each of the data items are defined in Appendix A of this document. NOTE that this list could expand in the future.

The eleven character data will be followed by a <SP> filler (" ") ASCII 20H) - usually a <SP>, it may very occasionally be an asterisk ("*" ASCII 2A). Accept either the space or asterisk character in this location. This filler character will be followed by the four character data ID.

This total of 16 characters will be referred as a data item.

There are two exceptions to the above format. The date/time data uses all 16 characters of the data item for data. Therefore, this item will not have a data ID in the form of "Wnnn". This data will be in the form:

" 10/27/92 10:47 "

You should use the fact that the data ID is of the form ":nn " to signify that this is a date/time format data of length 16 instead of data with a length of 11.

The second exception is the POTENTIAL indicator (SET type of display). The last four characters will always be spaces. This data will be in the form:

" YYY "

You should use the fact that the data ID is of the form " " to signify that this is the potential indicator.

Data items will always occur in pairs (there will be an even number of data items). A pair will consist of a data item, a filler of 4 <SP> characters, a second data item, a <CR> (0DH) character, and a <LF> (0AH) character. This makes a total of 38 characters per data pair. The last data pair will have the UNIT ID (data ID of "W999") as the second data item of the pair.

EXAMPLE:

Meter with UNIT ID 00111334, configured to respond with:

KW hours delivered
KVAR hours quadrant 1 & 2 (delivered)
KW delivered
Potential indicator
Total delivered Power Factor
Unit ID

Meter has presently lost phase A voltage.

Request: "<STX>1334"

Response: "0000345543. W002 0000544333. W008<CR><LF>001045.217 W010 YYN <CR><LF>0.777600000 W022 00111334 W999<CR><LF>

5.0 X20 Command Format

To get the QUAD4 Plus meter into the mode to respond to the request for data, a specific X20 command must be sent to the meter. The format of that command is as follows:
For RS232:

<table>
<thead>
<tr>
<th>byte</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>00</td>
<td>14</td>
<td>60</td>
<td>05</td>
<td>00</td>
<td>00</td>
</tr>
</tbody>
</table>

For Current Loop:

<table>
<thead>
<tr>
<th>byte</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>00</td>
<td>14</td>
<td>60</td>
<td>0D</td>
<td>00</td>
<td>00</td>
</tr>
</tbody>
</table>

The above are the command definition bytes for the X command. They are given in hexadecimal representation.

NOTE: This is a command, not a table entry. It must be sent after the meter is cold started and must be repeated if the meter is cold started again. The meter will stay in this mode through normal power failures as long as the battery is connected and charged.
APPENDIX A - Items and Item IDs for RTU/SCADA Interface

In the data examples, any digit can replace any digit

i.e. 0000000.000 could be 0004567.123.

There will be a digit in every place where a digit is shown.
The decimal point (if one) may occur in any position, e.g.,
the above data may be sent as shown or as 004567.1230. The way the
numeric data is shown in this appendix is "typical", but the decimal
point may be in a different location in a particular installation.
In the case of set data, each valid position will be a "Y" or "N".
All spaces will be the <SP> (ASCII 20H) character.

(the exception is the <SP> just before the "W", this may
occasionally be an asterisk "*"

The displacements in table 16 are shown as nn. These displacements
will vary based on which version of the QUAD4 Plus is being used.

POTENTIAL indications

format of data item:

```
1 1
position 1...5....0....5.
data " YYY 
meaning      ^^ ^ ||_ phase A indicator "Y" or "N"
            ||_ phase B indicator "Y" or "N"
            |__ phase C indicator "Y" or "N"
```

<table>
<thead>
<tr>
<th>table 16 entry:</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0&quot;, /* text; INT8[16] */</td>
</tr>
<tr>
<td>26,3,13,3,1,0,'R', /* ds,tb,tp,sz,chs,dec,jst;UINT16,6of UINT8 */</td>
</tr>
<tr>
<td>&quot;   &quot;, /* unit of measure; INT8[4] */</td>
</tr>
</tbody>
</table>

Date - Time

format of data item:

```
1 1
position 1...5....0....5.
data " 11/24/92 22:37 
meaning    ^^ ^^ ^^ ^ ||  Minutes
            ||  Hours
            ||  Year
            ||  Day
            ++- Month
```

<table>
<thead>
<tr>
<th>table 16 entry:</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0&quot;, /* text; INT8[16] */</td>
</tr>
<tr>
<td>0,1,11,16,16,0,'R', /* ds,tb,tp,sz,chs,dec,jst;UINT16,6of UINT8 */</td>
</tr>
<tr>
<td>&quot;   &quot;, /* unit of measure; INT8[4] */</td>
</tr>
</tbody>
</table>
Kilowatt hours delivered
data ID - W002

format of data item:

```
1 1
position  1...5....0....5.
data     "0000000000. W002"
      / kilowatt hours
```

table 16 entry:
```
"\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0", /* text; INT8[16] */
nn,15,1,1,11,0,'R', /* ds, tb, tp, sz, chs, dec, jst; UINT16, 6 of UINT8 */
"W002",
      /* unit of measure; INT8[4] */
```

Kilowatt hours received
data ID - W003

format of data item:

```
1 1
position  1...5....0....5.
data     "0000000000. W003"
      / kilowatt hours
```

table 16 entry:
```
"\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0", /* text; INT8[16] */
nn,15,1,1,11,0,'R', /* ds, tb, tp, sz, chs, dec, jst; UINT16, 6 of UINT8 */
"W003",
      /* unit of measure; INT8[4] */
```

Kilovolt-amps reactive hours, Quadrant 1
data ID - W004

format of data item:

```
1 1
position  1...5....0....5.
data     "0000000000. W004"
      / KVAR hours
```

table 16 entry:
```
"\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0", /* text; INT8[16] */
nn,15,1,1,11,0,'R', /* ds, tb, tp, sz, chs, dec, jst; UINT16, 6 of UINT8 */
"W004",
      /* unit of measure; INT8[4] */
```

Kilovolt-amps reactive hours, Quadrant 2
data ID - W005

format of data item:

```
1 1
position  1...5....0....5.
data     "0000000000. W005"
      / KVAR hours
```

table 16 entry:
```
"\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0", /* text; INT8[16] */
nn,15,1,1,11,0,'R', /* ds, tb, tp, sz, chs, dec, jst; UINT16, 6 of UINT8 */
"W005",
      /* unit of measure; INT8[4] */
```
Kilovolt-amps reactive hours, Quadrant 3  
data ID - W006
format of data item:
  1 1
position 1...5....0....5.
data "0000000000. W006"
  
  KVAR hours
table 16 entry:
  "\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0", /* text; INT8[16] */
  nn,15,1,1,11,0,'R', /* ds,tb,tp,sz,chs,dec,jst;UINT16,6of UINT8 */
  "W006", /* unit of measure; INT8[4] */

Kilovolt-amps reactive hours, Quadrant 4  
data ID - W007
format of data item:
  1 1
position 1...5....0....5.
data "0000000000. W007"
  
  KVAR hours
table 16 entry:
  "\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0", /* text; INT8[16] */
  nn,15,1,1,11,0,'R', /* ds,tb,tp,sz,chs,dec,jst;UINT16,6of UINT8 */
  "W007", /* unit of measure; INT8[4] */

Kilovolt-amps reactive hours delivered, Quadrant 1 & 2  
data ID - W008
format of data item:
  1 1
position 1...5....0....5.
data "0000000000. W008"
  
  KVAR hours
table 16 entry:
  "\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0", /* text; INT8[16] */
  nn,15,1,1,11,0,'R', /* ds,tb,tp,sz,chs,dec,jst;UINT16,6of UINT8 */
  "W008", /* unit of measure; INT8[4] */

Kilovolt-amps reactive hours received, Quadrant 3 & 4  
data ID - W009
format of data item:
  1 1
position 1...5....0....5.
data "0000000000. W009"
  
  KVAR hours
table 16 entry:
  "\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0", /* text; INT8[16] */
  nn,15,1,1,11,0,'R', /* ds,tb,tp,sz,chs,dec,jst;UINT16,6of UINT8 */
  "W009", /* unit of measure; INT8[4] */
Kilowatts delivered, data ID - W010

format of data item:
    position 1...5....0....5.
data "0000000.000 W010"

Kilowatts table 16 entry:
"\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0", /* text; INT8[16] */
nn,15,1,1,11,3,'R', /* ds, tb, tp, sz, chs, dec, jst; UINT16, 6of UINT8 */
"W010", /* unit of measure; INT8[4] */

Kilowatts received, data ID - W011

format of data item:
    position 1...5....0....5.
data "0000000.000 W011"

Kilowatts table 16 entry:
"\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0", /* text; INT8[16] */
nn,15,1,1,11,3,'R', /* ds, tb, tp, sz, chs, dec, jst; UINT16, 6of UINT8 */
"W011", /* unit of measure; INT8[4] */

Instantaneous Kilowatts delivered, data ID - W012

format of data item:
    position 1...5....0....5.
data "0000000.000 W012"

Instantaneous Kilowatts table 16 entry:
"\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0", /* text; INT8[16] */
nn,3,1,1,11,3,'R', /* ds, tb, tp, sz, chs, dec, jst; UINT16, 6of UINT8 */
"W012", /* unit of measure; INT8[4] */

Instantaneous Kilowatts received, data ID - W013

format of data item:
    position 1...5....0....5.
data "0000000.000 W013"

Instantaneous Kilowatts table 16 entry:
"\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0", /* text; INT8[16] */
nn,3,1,1,11,3,'R', /* ds, tb, tp, sz, chs, dec, jst; UINT16, 6of UINT8 */
"W013", /* unit of measure; INT8[4] */
Kilovolt-amps reactive, Quadrant 1  
format of data item:
  1
position 1...5....0....5.
data "0000000.000 W014"
  /  
KVAR

table 16 entry:
"\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0", /* text; INT8[16] */ 
nn,15,1,1,11,3,'R', /* ds, tb, tp, sz, chs, dec, jst; UINT16, 6of UINT8 */ 
"W014", /* unit of measure; INT8[4] */

Kilovolt-amps reactive, Quadrant 2  
format of data item:
  1
position 1...5....0....5.
data "0000000.000 W015"
  /  
KVAR

table 16 entry:
"\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0", /* text; INT8[16] */ 
nn,15,1,1,11,3,'R', /* ds, tb, tp, sz, chs, dec, jst; UINT16, 6of UINT8 */ 
"W015", /* unit of measure; INT8[4] */

Kilovolt-amps reactive, Quadrant 3  
format of data item:
  1
position 1...5....0....5.
data "0000000.000 W016"
  /  
KVAR

table 16 entry:
"\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0", /* text; INT8[16] */ 
nn,15,1,1,11,3,'R', /* ds, tb, tp, sz, chs, dec, jst; UINT16, 6of UINT8 */ 
"W016", /* unit of measure; INT8[4] */

Kilovolt-amps reactive, Quadrant 4  
format of data item:
  1
position 1...5....0....5.
data "0000000.000 W017"
  /  
KVAR

table 16 entry:
"\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0", /* text; INT8[16] */ 
nn,15,1,1,11,3,'R', /* ds, tb, tp, sz, chs, dec, jst; UINT16, 6of UINT8 */ 
"W017", /* unit of measure; INT8[4] */

10
Instantaneous Total delivered Kilovolt-amps reactive data ID - W018
format of data item:
  1  1
position 1...5....0....5.
data "0000000.000 W018"
  \  /  
  KVAR

table 16 entry:
"\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0", /* text; INT8[16] */
nn,3,1,1,11,3,'R', /* ds, tb, tp, sz, chs, dec, jst; UINT16, 6of UINT8 */
"W018", /* unit of measure; INT8[4] */

Instantaneous Total received Kilovolt-amps reactive data ID - W019
format of data item:
  1  1
position 1...5....0....5.
data "0000000.000 W019"
  \  /  
  KVAR

table 16 entry:
"\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0", /* text; INT8[16] */
nn,3,1,1,11,3,'R', /* ds, tb, tp, sz, chs, dec, jst; UINT16, 6of UINT8 */
"W019", /* unit of measure; INT8[4] */

Instantaneous Total delivered Kilovolt-amps data ID - W020
format of data item:
  1  1
position 1...5....0....5.
data "0000000.000 W020"
  \  /  
  KVA

table 16 entry:
"\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0", /* text; INT8[16] */
nn,3,1,1,11,3,'R', /* ds, tb, tp, sz, chs, dec, jst; UINT16, 6of UINT8 */
"W020", /* unit of measure; INT8[4] */

Instantaneous Total received Kilovolt-amps data ID - W021
format of data item:
  1  1
position 1...5....0....5.
data "0000000.000 W021"
  \  /  
  KVAR

table 16 entry:
"\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0", /* text; INT8[16] */
nn,3,1,1,11,3,'R', /* ds, tb, tp, sz, chs, dec, jst; UINT16, 6of UINT8 */
"W021", /* unit of measure; INT8[4] */
Total delivered Power Factor data ID - W022
format of data item:
  1 1
position 1...5....0....5.
data "0.000000000 W022"
   / PF
table 16 entry:
"\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0", /* text; INT8[16] */
nn,15,1,1,11,9,'R', /* ds, tb, tp, sz, chs, dec, jst; UINT16, 6of UINT8 */
"W022", /* unit of measure; INT8[4] */
________________________________________________________________________________

Total received Power Factor data ID - W023
format of data item:
  1 1
position 1...5....0....5.
data "0.000000000 W023"
   / PF
table 16 entry:
"\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0", /* text; INT8[16] */
nn,15,1,1,11,9,'R', /* ds, tb, tp, sz, chs, dec, jst; UINT16, 6of UINT8 */
"W023", /* unit of measure; INT8[4] */
________________________________________________________________________________

Previous Kilowatt hours delivered data ID - W024
format of data item:
  1 1
position 1...5....0....5.
data "0000000000. W024"
   / kilowatt hours
table 16 entry:
"\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0", /* text; INT8[16] */
nn,15,1,1,11,0,'R', /* ds, tb, tp, sz, chs, dec, jst; UINT16, 6of UINT8 */
"W024", /* unit of measure; INT8[4] */
________________________________________________________________________________

Previous Kilowatt hours received data ID - W025
format of data item:
  1 1
position 1...5....0....5.
data "0000000000. W025"
   / kilowatt hours
table 16 entry:
"\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0", /* text; INT8[16] */
nn,15,1,1,11,0,'R', /* ds, tb, tp, sz, chs, dec, jst; UINT16, 6of UINT8 */
"W025", /* unit of measure; INT8[4] */
Previous KVARh delivered, Quadrant 1 & 2 data ID - W030

format of data item:

- position: 1...5.0....5.
- data: "0000000000. W030"

KVAR hours

table 16 entry:
"\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0", /* text; INT8[16] */
nn,15,1,1,11,0,'R', /* ds,ts,tp,cs,dec,jst;UINT16,6of UINT8 */
"W030",
/* unit of measure; INT8[4] */

Previous KVARh received, Quadrant 3 & 4 data ID - W031

format of data item:

- position: 1...5.0....5.
- data: "0000000000. W031"

KVAR hours

table 16 entry:
"\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0", /* text; INT8[16] */
nn,15,1,1,11,0,'R', /* ds,ts,tp,cs,dec,jst;UINT16,6of UINT8 */
"W031",
/* unit of measure; INT8[4] */

Previous Kilowatts delivered, data ID - W032

format of data item:

- position: 1...5.0....5.
- data: "0000000.000 W032"

Kilowatts

table 16 entry:
"\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0", /* text; INT8[16] */
nn,15,1,1,11,3,'R', /* ds,ts,tp,cs,dec,jst;UINT16,6of UINT8 */
"W032",
/* unit of measure; INT8[4] */

Previous Kilowatts received, data ID - W033

format of data item:

- position: 1...5.0....5.
- data: "0000000.000 W033"

Kilowatts

table 16 entry:
"\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0", /* text; INT8[16] */
nn,15,1,1,11,3,'R', /* ds,ts,tp,cs,dec,jst;UINT16,6of UINT8 */
"W033",
/* unit of measure; INT8[4] */
Previous Kilovolt-amps reactive, Quadrant 1
data ID - W034
format of data item:
  1 1
position 1...5....0....5.
data "0000000.000 W034"
  
KVAR
table 16 entry:
"\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0", /* text; INT8[16] */
nn,15,1,1,11,3,'R', /* ds, tb, tp, sz, chs, dec, jst; UINT16, 6o of UINT8 */
"W034", /* unit of measure; INT8[4] */

Previous Kilovolt-amps reactive, Quadrant 2
data ID - W035
format of data item:
  1 1
position 1...5....0....5.
data "0000000.000 W035"
  
KVAR
table 16 entry:
"\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0", /* text; INT8[16] */
nn,15,1,1,11,3,'R', /* ds, tb, tp, sz, chs, dec, jst; UINT16, 6o of UINT8 */
"W035", /* unit of measure; INT8[4] */

Previous Kilovolt-amps reactive, Quadrant 3
data ID - W036
format of data item:
  1 1
position 1...5....0....5.
data "0000000.000 W036"
  
KVAR
table 16 entry:
"\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0", /* text; INT8[16] */
nn,15,1,1,11,3,'R', /* ds, tb, tp, sz, chs, dec, jst; UINT16, 6o of UINT8 */
"W036", /* unit of measure; INT8[4] */

Previous Kilovolt-amps reactive, Quadrant 4
data ID - W037
format of data item:
  1 1
position 1...5....0....5.
data "0000000.000 W037"
  
KVAR
table 16 entry:
"\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0", /* text; INT8[16] */
nn,15,1,1,11,3,'R', /* ds, tb, tp, sz, chs, dec, jst; UINT16, 6o of UINT8 */
"W037", /* unit of measure; INT8[4] */
Phase A VOLTS (average over last interval) data ID - W101
format of data item:
  1 1
position 1...5....0....5.
data "000000.000 W101"
  / Volts
table 16 entry:
"\0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0", /* text; INT8[16] */
nn,15,1,1,11,3,'R', /* ds, tb, tp, sz, chs, dec, jst; UINT16, 6 of UINT8 */
"W101", /* unit of measure; INT8[4] */
                _______________________________________________________________________________
Phase A AMPs (average over last interval) data ID - W104
format of data item:
  1 1
position 1...5....0....5.
data "0000000.000 W104"
  / Amps
table 16 entry:
"\0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0", /* text; INT8[16] */
nn,15,1,1,11,3,'R', /* ds, tb, tp, sz, chs, dec, jst; UINT16, 6 of UINT8 */
"W104", /* unit of measure; INT8[4] */
                _______________________________________________________________________________
Phase B AMPs (average over last interval) data Id - W105
format of data item:
  1 1
position 1...5.....0....5.
data "0000000.000 W105"
  
  Amps
table 16 entry:
"\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0", /* text; INT8[16] */
nn,15,1,11,3,'R', /* ds,tb,tp,sz,chs,dec,jst;UINT16,6of UINT8 */
"W105", /* unit of measure; INT8[4] */

Phase C AMPs (average over last interval) data Id - W106
format of data item:
  1 1
position 1...5.....0....5.
data "0000000.000 W106"
  
  Amps
table 16 entry:
"\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0", /* text; INT8[16] */
nn,15,1,11,3,'R', /* ds,tb,tp,sz,chs,dec,jst;UINT16,6of UINT8 */
"W106", /* unit of measure; INT8[4] */

Neutral AMPs (average over last interval) data Id - W107
format of data item:
  1 1
position 1...5.....0....5.
data "0000000.000 W107"
  
  Amps
table 16 entry:
"\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0", /* text; INT8[16] */
nn,15,1,11,3,'R', /* ds,tb,tp,sz,chs,dec,jst;UINT16,6of UINT8 */
"W107", /* unit of measure; INT8[4] */

Instantaneous Phase A VOLTS data Id - W108
format of data item:
  1 1
position 1...5.....0....5.
data "0000000.000 W108"
  
  Volts
table 16 entry:
"\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0", /* text; INT8[16] */
nn,3,1,11,3,'R', /* ds,tb,tp,sz,chs,dec,jst;UINT16,6of UINT8 */
"W108", /* unit of measure; INT8[4] */
Instantaneous Phase B VOLTS                           data Id - W109
format of data item:
  1    1
position   1...5....0....5.
data      "0000000.000 W109"
  /Volts

  table 16 entry:
  "\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0", /* text; INT8[16] */
nn,3,1,1,11,3,'R', /* ds,tb,tp,sz,chs,dec,jst;UINT16,6of UINT8 */
"W109",
  /
  /* unit of measure; INT8[4] */
________________________________________________________________________________

Instantaneous Phase C VOLTS                           data Id - W110
format of data item:
  1    1
position   1...5....0....5.
data      "0000000.000 W110"
  /Volts

  table 16 entry:
  "\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0", /* text; INT8[16] */
nn,3,1,1,11,3,'R', /* ds,tb,tp,sz,chs,dec,jst;UINT16,6of UINT8 */
"W110",
  /
  /* unit of measure; INT8[4] */
________________________________________________________________________________

Instantaneous Phase A AMPs                           data Id - W111
format of data item:
  1    1
position   1...5....0....5.
data      "0000000.000 W111"
  /Amps

  table 16 entry:
  "\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0", /* text; INT8[16] */
nn,3,1,1,11,3,'R', /* ds,tb,tp,sz,chs,dec,jst;UINT16,6of UINT8 */
"W111",
  /
  /* unit of measure; INT8[4] */
________________________________________________________________________________

Instantaneous Phase B AMPs                           data Id - W112
format of data item:
  1    1
position   1...5....0....5.
data      "0000000.000 W112"
  /Amps

  table 16 entry:
  "\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0", /* text; INT8[16] */
nn,3,1,1,11,3,'R', /* ds,tb,tp,sz,chs,dec,jst;UINT16,6of UINT8 */
"W112",
  /
  /* unit of measure; INT8[4] */
Instantaneous Phase C AMPS  
data Id - W113  
format of data item:  
\  1  1  
position 1...5....0....5.  
data "0000000.000 W113"  
\ /  
Amps  
table 16 entry:  
"\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0", /* text; INT8[16] */  
nn,3,1,1,11,3,'R',  /* ds, tb, tp, sz, chs, dec, jst; UINT16, 6of UINT8 */  
"W113",  /* unit of measure; INT8[4] */

Instantaneous Neutral AMPS  
data Id - W114  
format of data item:  
\  1  1  
position 1...5....0....5.  
data "0000000.000 W114"  
\ /  
Amps  
table 16 entry:  
"\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0", /* text; INT8[16] */  
nn,3,1,1,11,3,'R',  /* ds, tb, tp, sz, chs, dec, jst; UINT16, 6of UINT8 */  
"W114",  /* unit of measure; INT8[4] */

Phase A VOLT Squared Hours  
data Id - W115  
format of data item:  
\  1  1  
position 1...5....0....5.  
data "0000000000. W115"  
\ /  
Volt squared hours  
table 16 entry:  
"\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0", /* text; INT8[16] */  
nn,15,1,1,11,0,'R',  /* ds, tb, tp, sz, chs, dec, jst; UINT16, 6of UINT8 */  
"W115",  /* unit of measure; INT8[4] */

Phase B VOLT Squared Hours  
data Id - W116  
format of data item:  
\  1  1  
position 1...5....0....5.  
data "0000000000. W116"  
\ /  
Volt squared hours  
table 16 entry:  
"\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0", /* text; INT8[16] */  
nn,15,1,1,11,0,'R',  /* ds, tb, tp, sz, chs, dec, jst; UINT16, 6of UINT8 */  
"W116",  /* unit of measure; INT8[4] */
Phase C VOLT Squared Hours data Id - W117

format of data item:

position 1...5....0....5.
data "0000000000. W117"

Volt squared hours

table 16 entry:
"\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0", /* text; INT8[16] */

nn,15,1,1,11,0,'R', /* ds, tb, tp, sz, chs, dec, jst; UINT16, 6of UINT8 */

"W117",
/* unit of measure; INT8[4] */

Phase A AMP Squared Hours data Id - W118

format of data item:

position 1...5....0....5.
data "0000000000. W118"

Amp squared hours

table 16 entry:
"\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0", /* text; INT8[16] */

nn,15,1,1,11,0,'R', /* ds, tb, tp, sz, chs, dec, jst; UINT16, 6of UINT8 */

"W119",
/* unit of measure; INT8[4] */

Phase B AMP Squared Hours data Id - W119

format of data item:

position 1...5....0....5.
data "0000000000. W119"

Amp squared hours

table 16 entry:
"\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0", /* text; INT8[16] */

nn,15,1,1,11,0,'R', /* ds, tb, tp, sz, chs, dec, jst; UINT16, 6of UINT8 */

"W119",
/* unit of measure; INT8[4] */

Phase C AMP Squared Hours data Id - W120

format of data item:

position 1...5....0....5.
data "0000000000. W120"

Amp squared hours

table 16 entry:
"\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0", /* text; INT8[16] */

nn,15,1,1,11,0,'R', /* ds, tb, tp, sz, chs, dec, jst; UINT16, 6of UINT8 */

"W120",
/* unit of measure; INT8[4] */
Neutral AMP Squared Hours  

Data ID - W121  

Format of data item:  

| position | 1...5...0....5. |  
| data     | "0000000000. W121" | 

Amp squared hours  

Table 16 entry:  

"\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0", /* text; INT8[16] */  
\nnn,15,1,1,11,0,'R', /* ds, tb, tp, sz, chs, dec, jst; UINT16, 6 of UINT8 */  
"W121", /* unit of measure; INT8[4] */

Unit ID  

Data ID - W999  

Format of data item:  

| position | 1...5...0....5. |  
| data     | "00000000 W037" | 

Table 16 entry:  

"\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0,\0", /* text; INT8[16] */  
\n0,2,9,8,8,0,'R', /* ds, tb, tp, sz, chs, dec, jst; UINT16, 6 of UINT8 */  
"W037", /* unit of measure; INT8[4] */
Potential indications................................. 4 spaces
Date - Time........................................... "":nn 
Kilowatt hours delivered.......................... W002
Kilowatt hours received.......................... W003
Kilovolt-amps reactive hours, Quadrant 1..... W004
Kilovolt-amps reactive hours, Quadrant 2..... W005
Kilovolt-amps reactive hours, Quadrant 3..... W006
Kilovolt-amps reactive hours, Quadrant 4..... W007
Kilovolt-amps reactive hrs del, Quadrant 1 & 2.. W008
Kilovolt-amps reactive hours rec, Quadrant 3 & 4.. W009
Kilowatts delivered............................... W010
Kilowatts received............................... W011
Instantaneous Kilowatts delivered.............. W012
Instantaneous Kilowatts received............... W013
Kilovolt-amps reactive, Quadrant 1........... W014
Kilovolt-amps reactive, Quadrant 2........... W015
Kilovolt-amps reactive, Quadrant 3........... W016
Kilovolt-amps reactive, Quadrant 4........... W017
Inst Total del Kilovolt-amps reactive........ W018
Inst Total rec Kilovolt-amps reactive........ W019
Inst Total del Kilovolt-amps..................... W020
Inst Total rec Kilovolt-amps..................... W021
Total delivered Power Factor.................... W022
Total received Power Factor..................... W023
Previous Kilowatt hours delivered............. W024
Previous Kilowatt hours received.............. W025
Previous KVARh, Quadrant 1.................... W026
Previous KVARh, Quadrant 2.................... W027
Previous KVARh, Quadrant 3.................... W028
Previous KVARh, Quadrant 4.................... W029
Previous KVARh delivered, Quadrant 1 & 2..... W030
Previous KVARh received, Quadrant 3 & 4..... W031
Previous Kilowatts delivered.................... W032
Previous Kilowatts received.................... W033
Previous Kilovolt-amps reactive, Quadrant 1.. W034
Prev Kilovolt-amps reactive, Quadrant 2...... W035
Prev Kilovolt-amps reactive, Quadrant 3...... W036
Prev Kilovolt-amps reactive, Quadrant 4...... W037
Phase A VOLTS (average over last interval).... W101
Phase B VOLTS (average over last interval).... W102
Phase C VOLTS (average over last interval).... W103
Phase A AMPs (average over last interval)..... W104
Phase B AMPs (average over last interval)..... W105
Phase C AMPs (average over last interval)..... W106
Neutral AMPs (average over last interval)..... W107
Instantaneous Phase A VOLTS................... W108
Instantaneous Phase B VOLTS................... W109
Instantaneous Phase C VOLTS................... W110
Instantaneous Phase A AMPs.................... W111
Instantaneous Phase B AMPs.................... W112
Instantaneous Phase C AMPs.................... W113
Instantaneous Neutral AMPs.................... W114
Phase A VOLT Squared Hours..................... W115
Phase B VOLT Squared Hours..................... W116
Phase C VOLT Squared Hours..................... W117
Phase A AMP Squared Hours..................... W118
Phase B AMP Squared Hours.........................W119
Phase C AMP Squared Hours.........................W120
Neutral AMP Squared Hours.........................W121
Unit ID...........................................W999