



## **SERIES PM172 POWERMETERS**

### **Application Note: DNP3-2000 Setup Using PAS V 1.2.5 - Report by Exception**

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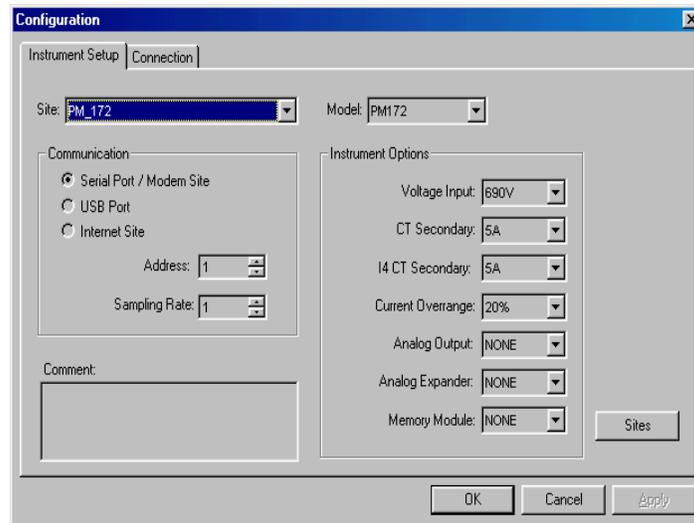
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## Introduction

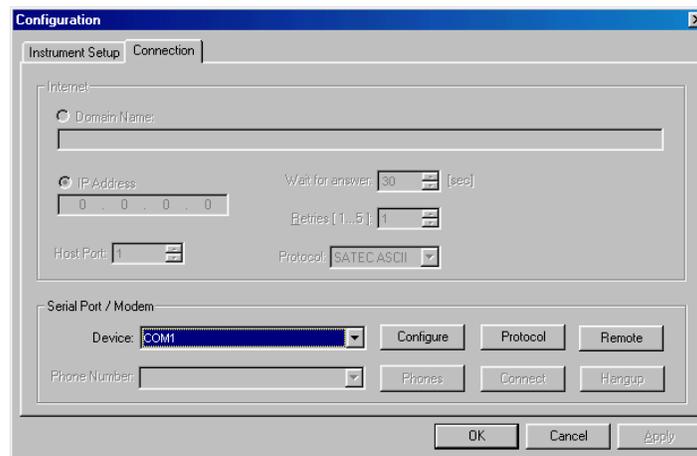
This document describes a DNP3-2000 serial communications session for transferring data between a master computer station and the Series PM172 Powermeters (Version 4.86 or later). PC master functionality, supported by the PAS V1.2.5 software, is illustrated by print screen pictures of the main menu window and appropriate dialog boxes. The document provides all necessary information for Report by Exception programming and explains the Communication Test dialog options for checking DNP events saving. A special connection between relay contacts and status inputs is used to demonstrate state-change events (digital inputs, relay status). Contents of the response to the Class 0 polling request may be defined in two different ways, also described in this document.

## Configuration Tools

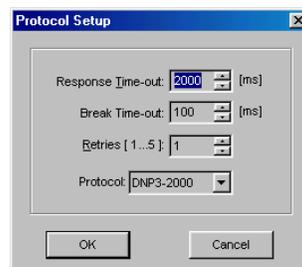
Pas V 1.2.5 communicates with the PM172E via PC COM1 and the SATEC RS-232 Communication Converter. Use the Tools -> Configuration option of the main menu to set configuration parameters:



In the Instrument Setup tab, set the instrument model and site. Click on the Connection tab - the following dialog appears:



Click on the Protocol button to open the Protocol Setup:



Click on the Configure button to open a Serial Port Setup:



Choose or edit parameters to set correct values and click on OK.

## On-line Switch

Choose the Monitor -> On-line option or Press the On-line button  of the PAS V1.2.5 main window Tools bar:



The On-line program status is indicated by the highlighted On-line button of the main window Tools bar:



## Protocol Setup

Choose the Meter Setup -> Protocol Setup option of the main window menu. After a communications delay the following dialog box appears:

Binary Inputs (BI)	
Number of BI to generate events	0
Binary Input Object	Single-bit
Binary Input Change Event Object	Without Time

Analog Inputs (AI)	
Number of AI to generate events	32
Analog Input Object	16-bit -Flag
Analog Input Change Event Object	16-bit -Time
Frozen Analog Input Object	N/A
Frozen Analog Change Event Object	N/A

Binary Counters (BC)	
Number of BC to generate events	0
Binary Counters Object	16-bit -Flag
Binary Counters Change Event Object	16-bit -Time
Frozen Binary Counters Object	16-bit -Flag
Frozen Counter Change Event Object	N/A

DNP General Options	
Scaling	Off
SBO Timeout	10
Time Sync Period	86400
Multi Fragment Interval	50

Buttons: Open, Save as..., Default, Print, Send, Receive, OK, Cancel, Apply

This dialog box contains four pages:

1. DNP Options Setup
2. DNP Events Setpoints
3. DNP Class 0 Group Assignment
4. DNP Class 0 Point Assignment

These pages are used to program an integrity polling of the DNP static and events data (DNP Class 0 - 3 polling).

## DNP Option Setup

The first page of the DNP Protocol Setup contains the DNP General Options and full definition of the DNP objects (Object : Variation) and number of the DNP points which can generate DNP events. Note that the sum of these points is less or equal to 32.

### DNP Points To Generate Events

The default setting defines 32 Analog Input points which can generate DNP events, therefore Binary Input points or Binary Counter points cannot be included as objects that generate DNP events. To define these objects to generate events you must choose fewer Analog Input objects. For example: suppose you want to define three voltage parameters and three current parameters from the Input Data Parameters table (see Communications Guide, Table 3-1) as 6 Analog Input points which generate events. Set the number of AI points to generate events to 6:

Analog Inputs (AI)	
Number of AI to generate events	32
Analog Input Object	4
Analog Input Change Event Object	5
Frozen Analog Input Object	6
Frozen Analog Change Event Object	7
	8
	9

Now the appropriate value of the Number of Binary Input points to generate events can be set:

Binary Inputs (BI)	
Number of BI to generate events	0
Binary Input Object	0
Binary Input Change Event Object	1
	2
	3
Analog Inputs (AI)	
Number of AI to generate events	4
Analog Input Object	16-bit -Flag
Analog Input Change Event Object	16-bit -Time
Frozen Analog Input Object	N/A
Frozen Analog Change Event Object	N/A

To demonstrate the Report by Exception DNP mode, besides the number of the AI and BI points, the Binary Input Change Event Object With Time, and 32-bit Analog Input Change Event Object With Time were selected. These definitions appear as follows:

Binary Inputs (BI)	
Number of BI to generate events	4
Binary Input Object	Single-bit
Binary Input Change Event Object	With Time
Analog Inputs (AI)	
Number of AI to generate events	6
Analog Input Object	16-bit -Flag
Analog Input Change Event Object	32-bit +Time
Frozen Analog Input Object	N/A
Frozen Analog Change Event Object	N/A

Click the Send button on the DNP Option Setup (see previous page) to write a new setup to the instrument. In this example, 4 Binary Input points and 6 Analog input points were selected to generate an event.

## Scaling Analog Input Objects

With the Analog-Input objects, any of variations 1 through 4 (32-bit, 16-bit, 32-bit without flag, 16-bit without flag Analog Input) can be used. Variations 1 or 3 should be used to read a full-range value without a possible over-range error when no scaling is used to accommodate the value to the requested object size.

When over-range occurs, a positive value is reported as 32767 and a negative value as -32768, with the over-range bit being set to 1 in the flag octet if a variation 2 is requested. To avoid over-range errors when a variation 2 or 4 is required, a linear scaling may be used to scale 32-bit analog readings to 16-bit Analog Input objects. By default, scaling is disabled:

DNP General Options	
Scaling	Off
SBO Timeout	10
Time Sync Period	86400
Multi Fragment Interval	50

The 'Time Sync Period' is in seconds (86400 seconds = 1 day).

Switch Scaling option to On to enable scaling mechanism. Click the Send button on the DNP Option Setup to write a new setup to the instrument.

When scaling is enabled, either analog input requested with variation 2 or 4 will be scaled to the range of -32768 to 32767 for bi-directional parameters (such as power and power factor), and to the range of 0 to 32767 for single-ended positive parameters (voltage, current, frequency, etc.). To get a true reading, the reverse conversion should be done using the following formula:

$$Y = ((X - \text{DNP\_LO}) \times (\text{HI} - \text{LO})) / (\text{DNP\_HI} - \text{DNP\_LO}) + \text{LO}$$

where:

- Y - the true reading in engineering units
- X - the raw input data in the range of DNP\_LO – DNP\_HI
- LO, HI - the data low and high scales in engineering units (specified for each Analog-Input point, see Section 3)
- DNP\_LO - DNP low conversion scale: DNP\_LO = -32768 for a point with a negative LO scale  
DNP\_LO = 0 for a point with a zero or positive LO scale
- DNP\_HI - DNP high conversion scale: DNP\_HI = 32767

### EXAMPLE

Suppose you have read a value of 201 for Analog Input point# 3 that contains a current reading. If your instrument has CT primary current 5000 A, then the current high scale is HI = 2.0×5000 = 10000, and in accordance with the above formula, the current reading in engineering units will be as follows:

$$(201 - 0) \times (10000 - 0) / (32767 - 0) + 0 = 61.34\text{A}$$

## DNP Events Setpoint

The DNP Event Setpoints were set to default value: Dead band set to 0, Event – disable, and so on - automatically, after saving the DNP Option Setup. To check and/or edit these Setpoints use the DNP Event Setpoints page of the Protocol Setup PM-172 dialog box:

No.	Obj (No.)	Ext	DNP No.	Group	Parameter	Dead Band	Ev	Frz	Ev Frz	Ev Class
1	AI#0	<input type="checkbox"/>	0	AVR PHASE	V1L12 AVR	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	#1
2	AI#1	<input type="checkbox"/>	1	AVR PHASE	V2L23 AVR	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	#1
3	AI#2	<input type="checkbox"/>	2	AVR PHASE	V3L31 AVR	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	#1
4	AI#3	<input type="checkbox"/>	3	AVR PHASE	I1 AVR	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	#1
5	AI#4	<input type="checkbox"/>	4	AVR PHASE	I2 AVR	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	#1
6	AI#5	<input type="checkbox"/>	5	AVR PHASE	I3 AVR	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	#1
7	BI#0	<input type="checkbox"/>	16	STAT INPS	STATUS INP #1	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	#1
8	BI#1	<input type="checkbox"/>	17	STAT INPS	STATUS INP #2	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	#1
9	BI#2	<input type="checkbox"/>	18	STAT INPS	STATUS INP #3	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	#1
10	BI#3	<input type="checkbox"/>	19	STAT INPS	STATUS INP #4	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	#1
11	NONE	<input type="checkbox"/>	NONE	NONE	NONE	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	NONE
12	NONE	<input type="checkbox"/>	NONE	NONE	NONE	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	NONE
13	NONE	<input type="checkbox"/>	NONE	NONE	NONE	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	NONE
14	NONE	<input type="checkbox"/>	NONE	NONE	NONE	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	NONE

The PM 172 DNP Communication Guide defines two Status Input points # 16-17 and two Relay Status point # 0-1. Replace points number 18 and 19 with points number 0 and 1 by selecting the Relays option from the appropriate list box:

9	BI#2	<input type="checkbox"/>	18	STAT INPS	STATUS INP #3	0
10	BI#3	<input type="checkbox"/>	19	STAT INPS	STATUS INP #4	0
11	NONE	<input type="checkbox"/>	NONE	RELAYS	NONE	0

Do the same for point # 19 and choose the appropriate relay number from the Relay list box. Assign all Analog Input Change Events to event Class 2, enable events and set dead band to value 1 (this value ensures an event generation for our test). The dialog box appears as follows:

Protocol Setup - PM\_172

DNP Options Setup | DNP Event Setpoints | DNP Class 0 Group Assignment | DNP Class 0 Point Assignment

Analog Inputs (AI) 6 Binary Inputs (BI) 4 Binary Counters (BC) 0

DNP Event Setpoints

No.	Obj (No.)	Ext	DNP No.	Group	Parameter	Dead Band	Ev	Frz	Ev Frz	Ev Class
1	AI#0	<input type="checkbox"/>	0	AVR PHASE	V1L12 AVR	1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	#2
2	AI#1	<input type="checkbox"/>	1	AVR PHASE	V2L23 AVR	1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	#2
3	AI#2	<input type="checkbox"/>	2	AVR PHASE	V3L31 AVR	1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	#2
4	AI#3	<input type="checkbox"/>	3	AVR PHASE	I1 AVR	1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	#2
5	AI#4	<input type="checkbox"/>	4	AVR PHASE	I2 AVR	1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	#2
6	AI#5	<input type="checkbox"/>	5	AVR PHASE	I3 AVR	1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	#2
7	BI#0	<input type="checkbox"/>	16	STAT INPS	STATUS INP #1	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	#1
8	BI#1	<input type="checkbox"/>	17	STAT INPS	STATUS INP #2	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	#1
9	BI#2	<input type="checkbox"/>	0	RELAYS	RELAY #1	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	#1
10	BI#3	<input type="checkbox"/>	1	RELAYS	RELAY #2	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	#1
11	NONE	<input type="checkbox"/>	NONE	NONE	NONE	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	NONE
12	NONE	<input type="checkbox"/>	NONE	NONE	NONE	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	NONE
13	NONE	<input type="checkbox"/>	NONE	NONE	NONE	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	NONE
14	NONE	<input type="checkbox"/>	NONE	NONE	NONE	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	NONE

Open Save as... Clear Print Send Receive

OK Cancel Apply

Click on Send to write the setup to the instrument. Now we have a definition for Analog Input Change Event Object points # 0 - 5, which represent events generated by Analog Input Object points # 0 -5, and Binary Input Change Event points # 0-3, which represent events generated by the Binary Input Object points #16,17, 0 and 1. Note that any Analog Input point defined in the Communication Guide can be chosen as a point to generate an event. For the purpose of keeping our example simple, only the first 6 points from Table 3-1 were chosen.

## Communication Test: Analog Input Change Events

As soon as instrument setup is complete, the PM 172 collects any DNP event, if the absolute value of the difference between the last reported value of the point and its current value exceeds the specified dead band value. Scanning rate for numeric Change Objects is 5 sec.

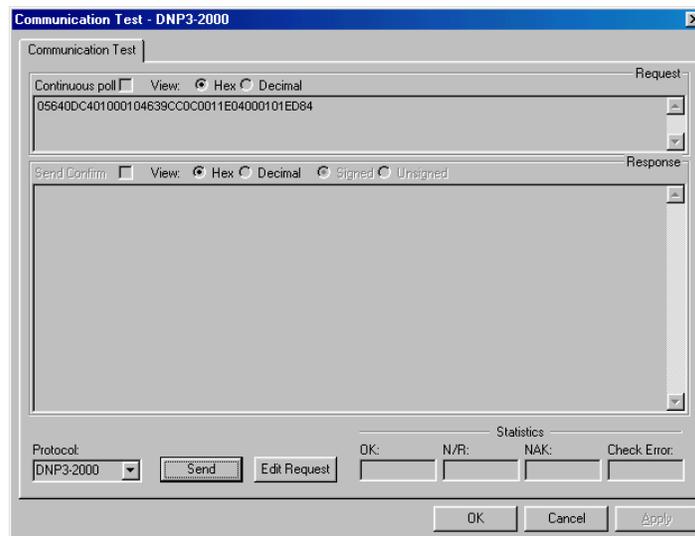
For state-change Objects an event is generated if the last reported state of the point differs from its current state. Scanning rate for this change is 1 sec.

Note that with a special cable the Relay contacts were connected to the instrument's Status Inputs in order to simulate digital input by the Relay control operation: Latch On, Latch Off, Pulse On and Pulse Off. To inspect the instrument events functionality, the Monitor -> Communication Test option of the main window menu can be used. This option is accessible Off-line only, so you must close the

Protocol Setup-PM\_172 dialog box and toggle the On-line button  of the PAS V1.2.5 main window Tools bar. Now you can use the following menu option:



The Communication Test - DNP 2000 dialog box is shown below.



This box supports the communications session and allows the professional user a deeper access to the instrument. Be careful when using DNP Write and DNP Operate functions, so as to avoid erasing the instrument setup. Click on Send to check communication. The hexadecimal representation of the instrument Response appears as follows:

0564114401040100FCEDC0C08194001E04000101F608

The highlighted field is a DNP Internal Indication (IIN) word. The first octet (94) has one (1) in the following bit position:

Bit 2 - Class 2 available, set when data that has been configured as Class 2 data is ready to be sent to the master. The master station should request this class data from the slave when this bit is set in a response.

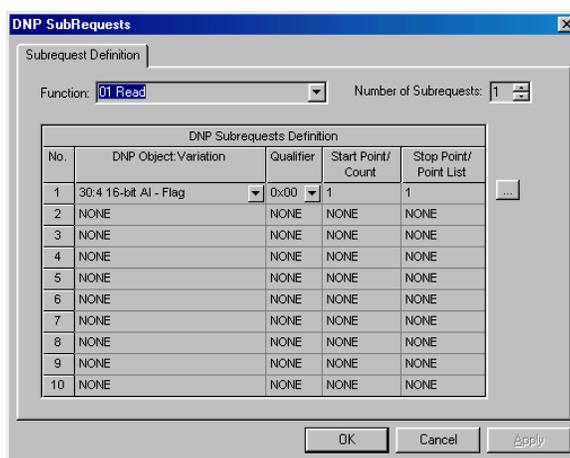
Bit 4 - Time synchronization required from the master.

Bit 7 - Device restart.

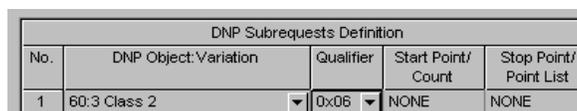
After some time interval in the second octet the instrument is set bit 3 – the Event buffer has overflowed:

0564114401040100FCEDC0C08194081E040001010709

This indicates that the instrument stops event collection and waits for the master to attempt to recover as much data as possible. To recover events data from the instrument the master must poll a Class data. Click on the Edit Request button to define Class data polling:



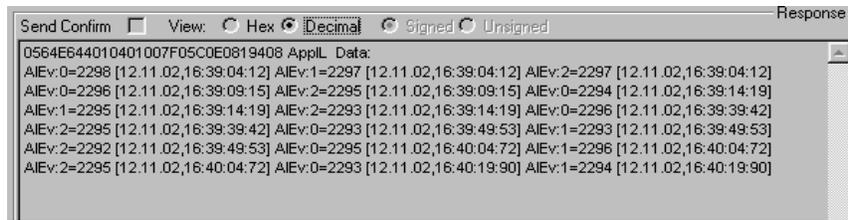
Chose appropriate DNP Object:Variation and Qualifier from the correspondent list boxes:



Click OK and then the Send button of the Communication Test - DNP 2000 dialog box. The response appears as follows:

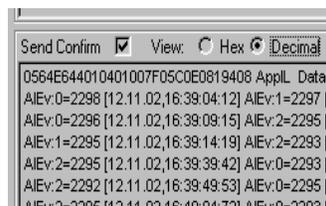
0564E644010401007F05C0E0819408200317120001FA080000B8\_\_401E79F1000101F9080000B84  
01E79F1\_\_000201F9080000B8401E79F1000001F8\_\_0800005E541E79F1000201F70800005E\_\_54  
1E79F1000001F60800000E681E79F1\_\_000101F70800000E681E79F1000201F5\_\_0800000E681E7  
9F1000001F80800009C\_\_CA1E79F1000201F70800009CCA1E79F1\_\_000001F50800001AF21E79F  
1000101F5\_\_0800001AF21E79F1000201F40800001A\_\_F21E79F1000001F7080000702D1F79F1\_\_  
000101F8080000702D1F79F1000201F7\_\_080000702D1F79F1000001F5080000BC\_\_681F79F1000  
101F6080000BC681F79F1\_\_00

Note that the CRC check sums are replaced with a double slash. To check the contents you may change the response view, from hexadecimal to decimal:

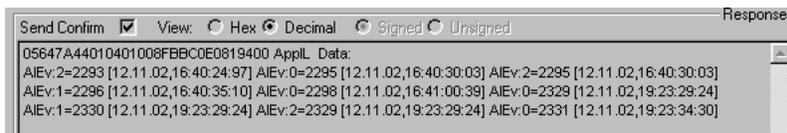


An abbreviation "AppL Data" designates a DNP Application Layer Data.

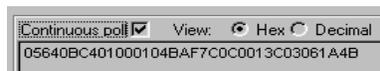
On this screen you can see a DNP Object, point #, saved value and DNP Time and Date stamp. The Send Confirm check box now is available. This means that the instrument requests a confirmation from the master. If the master sends confirmation, the instrument deletes all sent events, restructures internal buffers and continues new events collection. Repeating the request without a confirmation refers to the same response with the same objects, points#, values and DNP Time and Date stamps. To allow the master to send confirmation, check the Send Confirm check box:



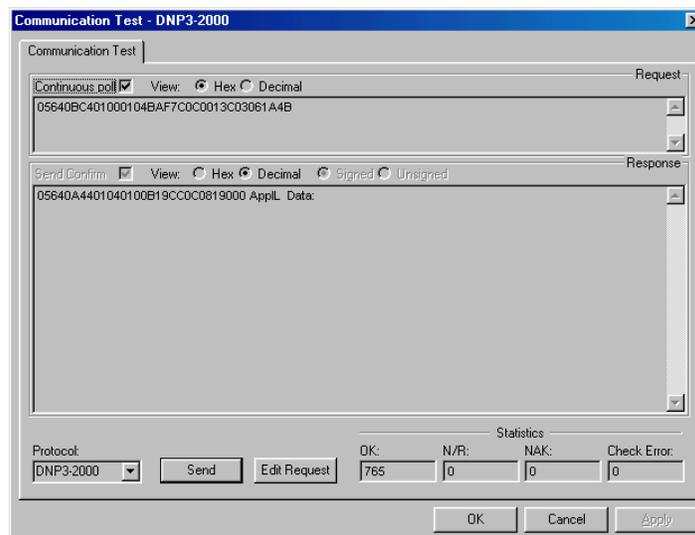
Repeat Send request twice and check response. You may see new events:



Note that instrument reset the IIN bit, which indicates a buffer overflow. You may set continuous polling by checking the Continuous Poll check box:

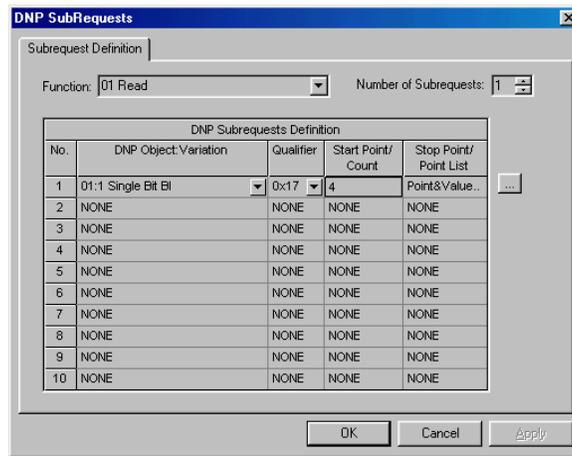


In the case of the Continuous Polling with master to slave confirmation, sometimes you may see a Null response (without Data). It means that the instrument does not have any saved events:

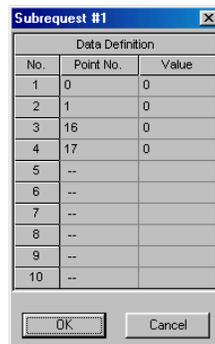


## Communication Test: Binary Input Change Events

The current status of the Binary Input points can be checked by using the DNP Read function applied to this DNP object. Click on Edit Request in the Communication Test DNP3-2000 dialog box. The DNP sub-requests dialog box appears. The DNP Communication Guide defines two Binary Input points # 0,1 to reflect Relay Status and two Binary Input points #16,17 to reflect the instrument's Status Input. To read the value of these points select Single Bit Binary Input object (Object 1: Variation 1) from the Object : Variation list box. The list of points (0, 1, 16, 17) we want to read is not sequential, therefore a qualifier 0x17 must be used. Select this qualifier from the Qualifier list box. Type the number of points to be read into the Start Point/Count field in the first row. Now the DNP Sub-requests dialog box appears as follows:



Next to row #1 of the table a button appears which opens a correspondent Subrequest #1 dialog box. Click on it. In the following dialog box type the number of points you want to read. Note that the Value column contains data which we can write to the instrument to change point values (with the appropriate DNP function). But we want to read points value only, so the content of this column is not important. The following dialog box contains the number of desired points.



Click on OK to close the Subrequest #1 dialog box. Click on OK to close the DNP Subrequests dialog box. Click on Send in the Communication Test DNP3-2000 dialog box. The Response contains the value of the requested points:

0564164401040100C233C0C0819000 Appl Data:  
BI:0=0 BI:1=0 BI:16=0 BI:17=0

The status of all requested points is 0. Now we can change the Relay Status using a DNP function Direct Operate with a DNP object Control Relay Output Block points # 80,81 (see the DNP Communication Guide). Open the DNP Subrequests dialog box by clicking on Edit Request. Choose a

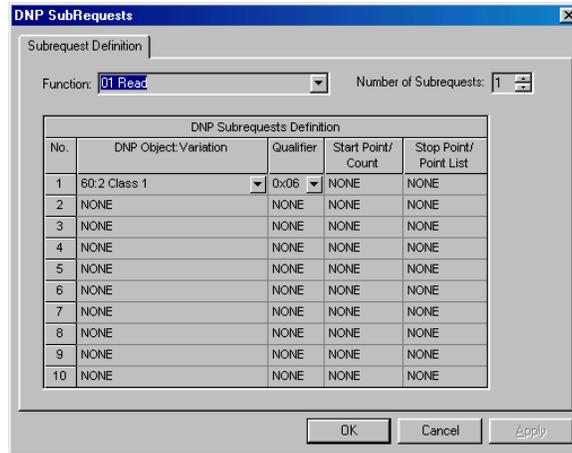
Function, Object:Variation and type the value 2 into the first row of the column Start Point/Count. The dialog box contains the following data:

No.	DNP Object:Variation	Qualifier	Start Point/Count	Stop Point/Point List
1	12:1 Relay Output Block	0x17	2	Point&Value...
2	NONE	NONE	NONE	NONE
3	NONE	NONE	NONE	NONE
4	NONE	NONE	NONE	NONE
5	NONE	NONE	NONE	NONE
6	NONE	NONE	NONE	NONE
7	NONE	NONE	NONE	NONE
8	NONE	NONE	NONE	NONE
9	NONE	NONE	NONE	NONE
10	NONE	NONE	NONE	NONE

Click on the  button next to the first row to open a Control Output Block: Subrequest #1 dialog box. Type the desired points number and choose a Control operation from the list box. Assume a Latch On operation must be applied to the first relay and Latch Off operation to the second relay. In this case the dialog box appears as follows:

No.	Point No.	Control	Queue	Clear	Trip/Close	Count	OnTime	OffTime
1	80	Latch On	Normal	Normal	None	0	0	0
2	81	Latch Off	Normal	Normal	None	0	0	0
3	NONE	None	Normal	Normal	None	0	0	0
4	NONE	None	Normal	Normal	None	0	0	0
5	NONE	None	Normal	Normal	None	0	0	0
6	NONE	None	Normal	Normal	None	0	0	0
7	NONE	None	Normal	Normal	None	0	0	0
8	NONE	None	Normal	Normal	None	0	0	0
9	NONE	None	Normal	Normal	None	0	0	0
10	NONE	None	Normal	Normal	None	0	0	0

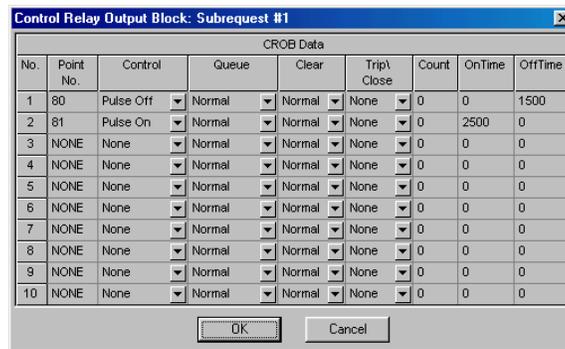
Click on OK to confirm the change and close the dialog. Click on OK in the DNP Subrequests dialog box and click on Send in the Communication Test DNP3-2000 dialog to execute the relay operation. As we assigned Binary Input Change Events to DNP Class 1 the appropriate request to check DNP events is shown in the following:



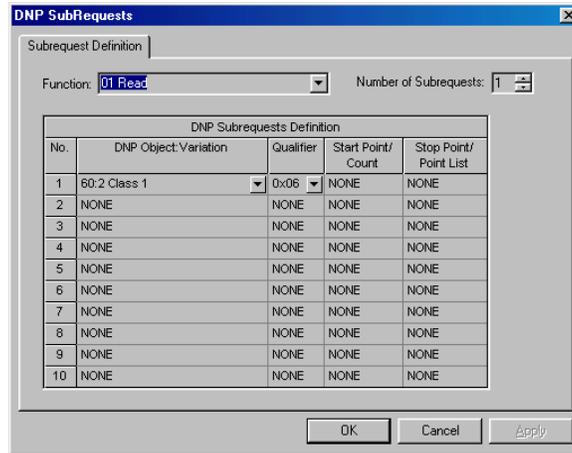
Click on OK to confirm the change and close the dialog. Click on Send in the Communication Test DNP3-2000 dialog to execute the request. The following response appears:

05641E44010401001EA9C0E0819608 Appl Data:  
 BIEv:0=129 [13.11.02,19:26:51:36] BIEv:2=129 [13.11.02,19:26:51:36]

The Binary Input Change Event point's #0 value is a decimal 129. This means that this point's value is Online (a DNP protocol term) and has a status equal to 1, which reflects that Binary Input point # 0 changed its own state from 0 to 1, November 13, 2002 at 19:26:51:36. The Binary Input Change Event point's #2 value is a decimal 129. This means that this point's value is Online (a DNP protocol term) and has a status equal to 1, which reflects that Binary Input point # 16 changed its own state from 0 to 1 at the same date and time. Recall that relay contacts were connected with the instrument's Status inputs. The received DNP events show that relay #1 contacts closes the instrument's Status input #1. The contacts of the relay #2 are unclosed, so the instrument's Status Input (Binary Input point # 17, see DNP Communication Guide) remain unchanged. To demonstrate a new Binary Change Events, let's execute a Pulse Off and Pulse On relay control operations. Click on Edit Request in the Communication Test DNP3-2000 dialog box. Choose A DNP Function Direct Operate, a Control Relay Output Block object (Object 12: Variation 1) from the Object:Variation list box. Set Qualifier to 0x17, Count to 2 and press a button next to the editing row. The Control Relay Output Block Subrequest #1 dialog box with correct settings appears as follows:



Check the appropriate points number, Control operation (Pulse Off, Pulse On ) and reasonable values for OffTime and OnTime. The last two parameters are a part of the DNP Control Relay Output Block object and must be set in milliseconds. Click on OK to confirm the change and close the dialog. Click on OK in the DNP Subrequests dialog box and click on Send in the Communication Test DNP3-2000 dialog to execute the desired relay operation. To check generated events the DNP function Read objects assigned to Class 1 must be prepared:

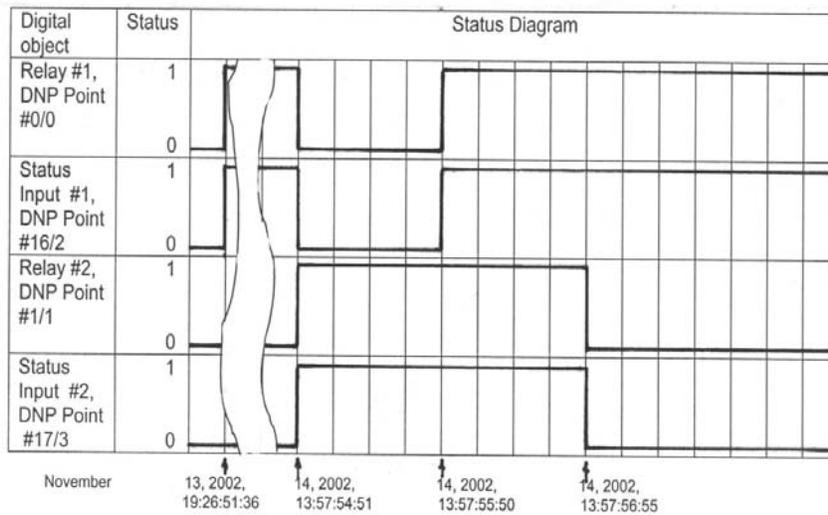


Click on OK to confirm the change and close the dialog. Click on OK in the DNP Subrequests dialog box and click on Send in the Communication Test DNP3-2000 dialog to read events assigned to Class 1.

The instrument's response contains the following events data:

```
05645E44010401006307C0E0819608 Appl Data:
BIEv:0=129 [13.11.02,19:26:51:36] BIEv:2=129 [13.11.02,19:26:51:36] BIEv:0=1
[14.11.02,13:57:54:51] BIEv:1=129 [14.11.02,13:57:54:51] BIEv:2=1 [14.11.02,13:57:54:51]
BIEv:3=129 [14.11.02,13:57:54:51] BIEv:0=129 [14.11.02,13:57:55:50] BIEv:2=129
[14.11.02,13:57:55:50] BIEv:1=1 [14.11.02,13:57:56:55] BIEv:3=1 [14.11.02,13:57:56:55]
```

The following picture explains received data:



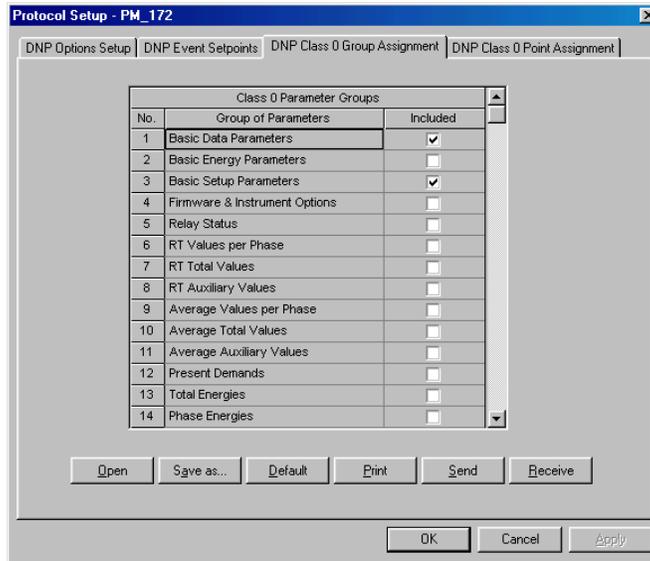
## DNP Class 0 Object Assignment

There are two options for assigning objects to be polled via Class 0 requests. The first uses the Class 0 Object Groups Assignment setup, and the second uses the Class 0 Point Assignment setup. When the latter is used, all assignments via the Class 0 Object Groups Assignment must be set to 0, and the Class 0 response includes all static object points specified by the Class 0 Point Assignment Setup. By default (see the DNP Communication Guide), the following points are specified by the Class 0 Point Assignment setup: 32 first Analog Input points from the Input Data Parameters (Table 3-1), 13 Analog Output points from the Basic Setup Registers (Table 3-2), 2 Binary Input points representing Status Inputs and 2 Binary Input points representing Relay Status (see Table 3-13).

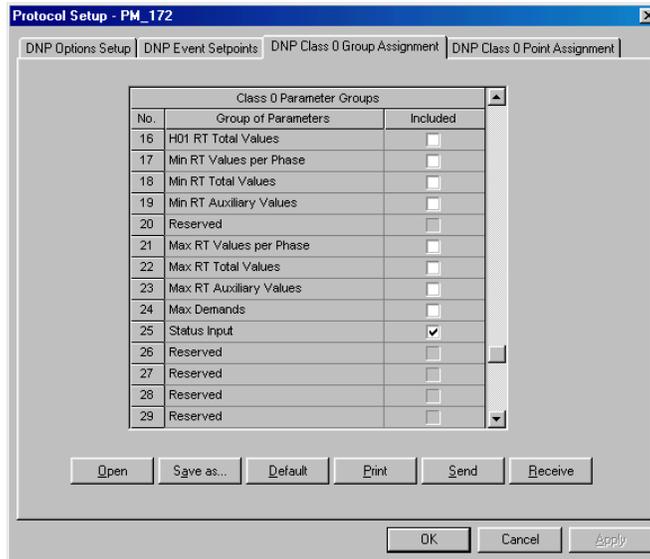
When the Class 0 Group Assignment is used, the instrument response message contains points specified in the Class 0 Group Assignment setup (see Table 3-30, *Class 0 Group Assignment*). These points can be read via Binary-Output-Status and can be changed by issuing the Direct-Operate (or SBO/Operate or SBO/Operate or Direct-Operate-No-Acknowledge) command to points 96 through 120 of the Control-Relay-Output-Block object. This setup is factory preset to include Analog-Input (see Table 3-1, *Input Data Parameters*), Analog-Output-Status (see Table 3-2, *Basic Setup Registers*) and Binary-Input (see Table 3-13, *Status Registers, BI:16-BI:17*) object points. In addition to checking and changing these setups use two pages of the Protocol Setup dialog box.

## DNP Class 0 Group Assignment

Close the Communication Test DNP3-2000 dialog box. Choose the Monitor -> On-line option or click on the On-line button  of the PAS V1.2.5 main window Tools bar. Choose the Meter Setup -> Protocol Setup option of the main window menu. After the communications delay the Protocol Setup PM\_172 dialog box appears. Select the DNP Class 0 Group Assignment page of this dialog. The DNP Class 0 Group Assignment dialog box appears as follows:



Scroll the table to see the last checked Status Input check box:



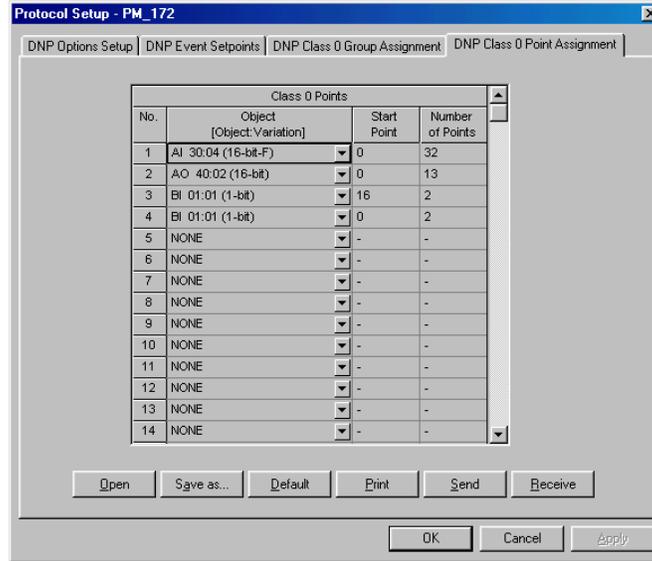
Checked boxes sign the parameters groups, which will be included in the Class 0 poll request. This setup is factory preset to include Analog-Input (see Table 3-1, *Input Data Parameters*), Analog-Output-Status (see Table 3-2, *Basic Setup Registers*) and Binary-Input (see Table 3-13, *Status Registers*,

BI:16-BI:17 ) object points. Click on OK to close the dialog box and toggle the On-line button  of the PAS V1.2.5 main window Tools bar to enable the Communication Test option. Open the



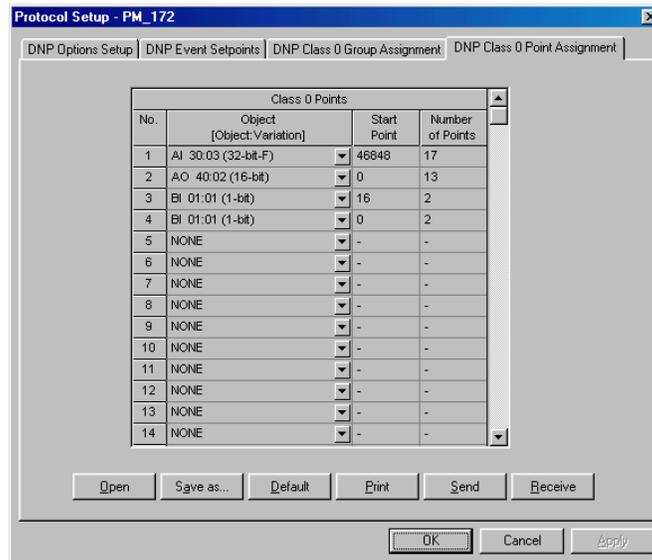
## DNP Class 0 Point Assignment

If the program executes the Communication Test DNP3-2000, close it. Choose the Monitor -> On-line option or click the On-line button  of the PAS V1.2.5 main window Tools bar. Choose the Meter Setup -> Protocol Setup option of the main window menu. After the communications delay the Protocol Setup PM\_172 dialog box appears. Select the DNP Class 0 Point Assignment page of this dialog. The DNP Class 0 Point Assignment dialog box appears as follows:



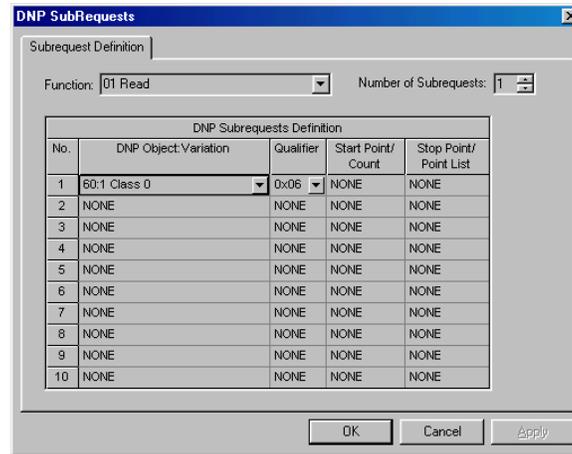
No.	Object [Object:Variation]	Start Point	Number of Points
1	AI 30:04 (16-bit-F)	0	32
2	AO 40:02 (16-bit)	0	13
3	BI 01:01 (1-bit)	16	2
4	BI 01:01 (1-bit)	0	2
5	NONE	-	-
6	NONE	-	-
7	NONE	-	-
8	NONE	-	-
9	NONE	-	-
10	NONE	-	-
11	NONE	-	-
12	NONE	-	-
13	NONE	-	-
14	NONE	-	-

By default (see DNP Communication Guide), the following points are specified by the Class 0 Point Assignment Setup: 32 first Analog Input points from the Input Data Parameters (Table 3-1), 13 Analog Output points from the Basic Setup Registers (Table 3-2), 2 Binary Input points represented Status Inputs and 2 Binary Input points represented Relay Status (see Table 3-13). You may change an Object, Start Point and Number of points. Suppose we want assign to Class 0 polling of the Maximum Demands (AI 30:03), Start Point 46848 and Number of points 17. The changed dialog box appears:



No.	Object [Object:Variation]	Start Point	Number of Points
1	AI 30:03 (32-bit-F)	46848	17
2	AO 40:02 (16-bit)	0	13
3	BI 01:01 (1-bit)	16	2
4	BI 01:01 (1-bit)	0	2
5	NONE	-	-
6	NONE	-	-
7	NONE	-	-
8	NONE	-	-
9	NONE	-	-
10	NONE	-	-
11	NONE	-	-
12	NONE	-	-
13	NONE	-	-
14	NONE	-	-

Click on Send to send the new setup to the instrument. Click on OK to close the dialog box and toggle the On-line button  of the PAS V1.2.5 main window Tools bar to enable the Communication Test option. Open the Communication Test dialog box, click on Edit Request to open the DNP Subrequests dialog box. Choose Class 0 object from the Object : Variation list box, and qualifier 0x06 from the Qualifier list box. The dialog box appears as follows:



Click on OK to close the dialog box and click on Send in the Communication Test DNP3-2000 dialog box to execute Class 0 polling. Note that if all check boxes of the DNP Class 0 Group Assignment dialog box (see above) were unchecked the following response appears:

```
0564934401040100C8DAC0C08194081E030100B710B74E090000__4D0900004D090000704B0100
964B0100__164C0100000000000000000000000000__71150900E0C30000FA18090000000000__00
000000000000094D308004480000__28020100000C00010100010A00018813__010F0001840301
080001010021FF7F01__010021FF7F21FF7F0132000100000101__01100011000101010100000100
01
```

Choose a Decimal representation of the response and you may see the following data:

```
0564934401040100C8DAC0C0819408 Appl Data:
AI:46848=2382 AI:46849=2381 AI:46850=2381 AI:46851=84848 AI:46852=84886 AI:46853=85014
AI:46854=0 AI:46855=0 AI:46856=0 AI:46857=595313 AI:46858=50144 AI:46859=596218
AI:46860=0 AI:46861=0 AI:46862=0 AI:46863=578452 AI:46864=32836
AO:0=1 AO:1=10 AO:2=5000 AO:3=15 AO:4=900 AO:5=8 AO:6=1 AO:7=32767 AO:8=1 AO:9=32767
AO:10=32767 AO:11=50 AO:12=0
BI:16=1 BI:17=0
BI:0=1 BI:1=0
```

All data we want to assign to Class 0 polling now can be read by executing a DNP Read function to the DNP object 60, variation 1.