Application Note

Assigning and Reducing the DNP V3.0 Points List on the ABB PCD

Timothy S. Fahey, PE

Introduction

This document defines a subset of the full points list given in the "DNP 3.0 Implementation Details for the ABB PCD" document, and illustrates how to create that subset. The points list reflects a re-assignment of points to different point indexes using the Assignable Points feature in the PCD. The points have been re-assigned with consideration to the status points most needed in a recloser application. This feature is available on PCDs with firmware version 2.52 or later. At this time, a configuration program is not available for re-assigning points. However, ABB can provide a command string that can be "manually" downloaded to the PCD using Hyperterminal or other communications programs, therefore obtaining this reduced points list without significant effort. Table 2 below identifies the Binary Input (recloser status) points and Table 3 contains the Analog Input (metering/fault information) points. This application note concludes with the necessary settings to send to the PCD, along with instructions.

Points and Scan Groups

The tables below list DNP 3.0 points with the original point index on the furthest left column, then the reassigned point index is identified. These points are rearranged from the full points list to better organize points by their function. For example, in Binary Input points, the operational status points are listed first, followed by the recloser status points, then the fault information points, and so on. To reduce the number of points (removing the points we don't want to reassign), use the Scan Group feature, which has always existed in the PCD. Scan Groups break the DNP points into **32 groups**. If a Scan Group is turned OFF, all points that fall within that group are disabled. The Scan Group Type is identified in the Static Data (Class 0) Scan Type Group column of Table 2. The active Scan Groups are specified in the PCD's Communication Settings menu. Scan groups are further explained in the ABB protocol implementation document. Parameter settings listed in Table 1 are recommended for specific applications to most efficiently use the points list. Note that Scan Groups turn on and off points for Class 0, 1, 2 and 3, and have a significant impact on what information is provided for SCADA.

Table 1. Scan Group Assignments

Parameter	Standard Recloser Applications	Single-Phase Trip Applications	Loop Control Applications
5	15	31	63
6	64	64	64
7	63	63	127
8	0	0	0

Binary Input Points

Binary Input Points report recloser status points to the SCADA master. The following DNP points list has been reduced from the full 206 points to 50 points.

By default, all binary input points are assigned class 1. If a class 1 event poll is performed, all binary input points that have changed state since the last event poll will be reported. The classes of all points have not been reassigned for this scaled down points list.

Table 2. Binary Input Points

Binary Input Points
Static (Steady-State) Object Number: **1**
Change Event Object Number: **2**
Request Function Codes Supported: **1 (read)**
Static Variation reported when variation 0 requested: **1 (Binary Input without status)**
Change Event Variation reported when variation 0 requested: **2 (Binary Input Change with Time)**

Default Point Index	User Assigned Point Index	Name/Description	Default[1] Change Event Assigned Class (1,2,3 or none)	User Assigned Class (1,2,3 or none)	Static Data (Class 0) Scan Type Group	User Assigned Scan Type Group
39	0	ALARM – Logical Output - Self Check Alarm Energized	1		0	
21	1	BFA – Logical Output - Breaker Failure Alarm Energized[7]	1		0	
85	2	STC – Logical Output – Settings Table Chg Alarm Energized	1		0	
145	3	LOAC – Loss Of AC Alarm	1		0	
17	4	52a – Logical Input – Input Enabled – from Input Tab[7]	1		0	
8	5	52b – Logical Input – Input Enabled – from Input Tab[7]	1		0	
66	6	79LOA – Logical Output – Recloser Lock Out Alarm Energized[7]	1		0	
146	7	Remote Block Asserted	1		0	
147	8	Ground Block Asserted	1		0	
149	9	Reclose Block Asserted[7]	1		1	
150	10	Primary Settings Group Active	1		1	
151	11	Primary Settings Group Pending	1		1	
152	12	Alternate Settings Group 1 Active	1		1	
153	13	Alternate Settings Group 1 Pending	1		1	
154	14	Alternate Settings Group 2 Active	1		1	
155	15	Alternate Settings Group 2 Pending	1		1	

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Default Point Index	User Assigned Point Index	Name/Description	Default[1] Change Event Assigned Class (1,2,3 or none)	User Assigned Class (1,2,3 or none)	Static Data (Class 0) Scan Type Group	User Assigned Scan Type Group
166	16	TAGOPN Status	1		1	
169	17	CLSBLK Status	1		2	
37	18	TRIP – Logical Output - Output contact Energized[7]	1		2	
38	19	CLOSE – Logical Output - Output Contact Energized[7]	1		2	
40	20	PATA – Logical Output - Phase A Target Alarm Energized	1		3	
41	21	PBTA – Logical Output - Phase B Target Alarm Energized	1		3	
42	22	PCTA – Logical Output - Phase C Target Alarm Energized	1		3	
65	23	PUA – Logical Output – Pick UP Alarm Energized	1		3	
67	24	PDA – Logical Output - Phs Demand Current Alarm Energized[2]	1		3	
68	25	NDA – Logical Output - Neutral Demand Current Alarm Energized[2]	1		3	
81	26	LOADA – Logical Output - Load Current Alarm Energized	1		3	
86	27	ZSC – Logical Output – Zone Sequence Coord. Alarm Energized[7]	1		3	
59	28	27-3P – Logical Output - Phase Under Voltage Trip	1		3	
142	29	27A - Phase A Undervoltage	1		3	
143	30	27B - Phase B Undervoltage	1		3	
144	31	27C - Phase C Undervoltage	1		3	
89	32	TRIPA – Logical Output - Single Pole Trip (phase A) [7]	1		3	
90	33	TRIPB – Logical Output - Single Pole Trip (phase B) [7]	1		3	
91	34	TRIPC – Logical Output - Single Pole Trip (phase C) [7]	1		3	

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Default Point Index	User Assigned Point Index	Name/Description	Default[1] Change Event Assigned Class (1,2,3 or none)	User Assigned Class (1,2,3 or none)	Static Data (Class 0) Scan Type Group	User Assigned Scan Type Group
173	35	Phase A 52a (Logical Input)[6, 7]	1		3	
174	36	Phase B 52a (Logical Input)[6, 7]	1		3	
175	37	Phase C 52a (Logical Input)[6, 7]	1		4	
176	38	Phase A 52b (Logical Input)[6, 7]	1		4	
177	39	Phase B 52b (Logical Input)[6, 7]	1		4	
178	40	Phase C 52b (Logical Input)[6, 7]	1		4	
197	41	LCM Active	1		4	
198	42	Voltage Source 1, Phase A, Live	1		4	
199	43	Voltage Source 1, Phase B, Live	1		4	
200	44	Voltage Source 1, Phase C, Live	1		5	
201	45	Voltage Source 2, Phase A, Live	1		5	
202	46	Voltage Source 2, Phase B, Live	1		5	
203	47	Voltage Source 2, Phase C, Live	1		5	
204	48	Source 1 Enabled / Disabled	1		5	
205	49	Source 2 Enabled / Disabled	1		5	
206	50	LCM Test Mode	1		5	

[1]The Change Event Class Assignment may be changed off-line through configuration software.
[2]Type 1 Alarm - One minute delay to alarm indication for analog threshold alarms. Alarm is self-resetting once the alarm conditions clear.
[3]Type 2 Alarm - Immediate indication once event counter reaches the threshold for digital inputs. Alarm must be reset to clear. Immediate indication on next event occurrence unless counter is reset.
[4]Sticky Point – Reset Alarm command is required to clear these points. Local settings change is indicated when a save on exit is done through the front panel. Power was Cycled is indicated any time power is restored to the unit.
[6]Point will return Off-Line status unless device is configured for per pole (Single Phase) operation.
[7]Valid only if the device is a PCD.

Analog Inputs

Analog Input Points report current, voltage, power, fault and other information on the recloser to the SCADA master. The following DNP points list has been reduced from 146 points on the full points list to 50 points.

By default, all analog input points are assigned class 2. When a class 2 event poll is performed, all analog input points that have changed state since the last event poll will be reported. The classes of all points have not been reassigned for this scaled down points list.

Table 3. Analog Input Points

Analog Inputs
Static (Steady-State) Object Number: **30**
Change Event Object Number: **32**
Request Function Codes supported: **1 (read)**
Static Variation reported when variation 0 requested: **2 (16-Bit Analog Input)**
Change Event Variation reported when variation 0 requested: **2 (Analog Change Event w/o Time)**

Point Index	User Assigned Point Index	Name/Description	Scaling (representation of 32767)	Default[3] Change Event Assigned Class (1,2,3 or none)	User Assigned Class (1,2,3 or none)	Static Data (Class 0) Scan Type Group	User Assigned Scan Type Group
0	0	Ia (Load Current)	32767 Amps	2		16	
1	1	Ib	32767 Amps	2		16	
2	2	Ic	32767 Amps	2		16	
3	3	In	32767 Amps	2		16	
4	4	Van (Mag)	32767 Volts	2		16	
5	5	Vbn (Mag)	32767 Volts	2		16	
6	6	Vcn (Mag)	32767 Volts	2		16	
27	7	Ia Angle	32767 degrees	2		16	
28	8	Ib Angle	32767 degrees	2		16	
29	9	Ic Angle	32767 degrees	2		16	
30	10	In Angle	32767 degrees	2		16	
31	11	Van (Ang)	32767 degrees	2		16	
32	12	Vbn (Ang)	32767 degrees	2		16	

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33	13	Vcn (Ang)	32767 degrees	2		16	
47	14	Frequency	327.67 Hz	2		17	
48	15	Power Factor (signed) (values will range from –100 to 100)	327.67	2		17	
49	16	Power Factor leading/lagging	0=lagging, non-zero=leading	2		17	
51	17	Demand Ia	32767 Amps	2		17	
52	18	Demand Ib	32767 Amps	2		17	
53	19	Demand Ic	32767 Amps	2		17	
54	20	Demand In	32767 Amps	2		17	
63	21	Max Ia	32767 Amps	2		17	
64	22	Max Ib	32767 Amps	2		17	
65	23	Max Ic	32767 Amps	2		17	
66	24	Max In	32767 Amps	2		17	
87	25	UPS Battery Voltage	655.34 Volts	2		17	
88	26	UPS Battery Charging Current	655.34 Amps	2		18	
89	27	UPS Battery Temperature	327.67 C	2		18	
90	28	UPS Battery Test Delta Voltage	655.34 Volts	2		18	
91	29	Last Fault: Record Number	65534	2		18	
92	30	Last Fault: Faulted Device	See Table 4	2		18	
93	31	Last Fault: Settings Group / Sequence Number	See Table 5	2		18	

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Point Index	User Assigned Point Index	Name/Description	Scaling (representation of 32767)	Default[3] Change Event Assigned Class (1,2,3 or none)	User Assigned Class (1,2,3 or none)	Static Data (Class 0) Scan Type Group	User Assigned Scan Type Group
94	32	Last Fault: Line Parameter	See Table 6	2		18	
95	33	Last Fault: Year	32767 Years	2		18	
96	34	Last Fault: Month	32767 Months	2		18	
97	35	Last Fault: Day	32767 Days	2		18	
98	36	Last Fault: Hour	32767 Hours	2		18	
99	37	Last Fault: Minute	32767 Minutes	2		19	
100	38	Last Fault: Second	32767 Seconds	2		19	
101	39	Last Fault: Millisecond	32767 Milli Sec.	2		19	
102	40	Last Fault: Phase A Current Magnitude	32767 Amps	2		19	
103	41	Last Fault: Phase B Current Magnitude	32767 Amps	2		19	
104	42	Last Fault: Phase C Current Magnitude	32767 Amps	2		19	
105	43	Last Fault: Neutral Current Magnitude	32767 Amps	2		19	
126	44	Last Fault: Fault Location	3276.7 mi/km	2		19	
127	45	Last Fault: Fault Impedance (Real)	32.767 ohms	2		19	
128	46	Last Fault: Fault Clearing Time	32.767 Sec.	2		19	
129	47	Last Fault: Relay Time	32.767 Sec.	2		20	
130	48	Firmware Version Number (CPU)	V327.67	2		20	
131	49	Unit Serial Number	32767	2		20	
132	50	Unit Information	See Table 7	2		21	

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67	51	Max KWan	32767 KWatts	2		22	
68	52	Max KWbn	32767 KWatts	2		22	
69	53	Max KWcn	32767 KWatts	2		22	
71	54	Max KVARan	32767 KVAR	2		22	
72	55	Max KVARbn	32767 KVAR	2		22	
73	56	Max KVARcn	32767 KVAR	2		22	
133	57	Voltage Source 1, Phase A magnitude	32767 V	2		22	
134	58	Voltage Source 1, Phase A angle[2]	N/A	2		22	
135	59	Voltage Source 1, Phase B magnitude	32767 V	2		22	
136	60	Voltage Source 1, Phase B angle[2]	N/A	2		22	
137	61	Voltage Source 1, Phase C magnitude	32767 V	2		22	
138	62	Voltage Source 1, Phase C angle[2]	N/A	2		22	
139	63	Voltage Source 2, Phase A magnitude	32767 V	2		22	
140	64	Voltage Source 2, Phase A angle[2]	N/A	2		22	
141	65	Voltage Source 2, Phase B magnitude	32767 V	2		22	
142	66	Voltage Source 2, Phase B angle[2]	N/A	2		22	
143	67	Voltage Source 2, Phase C magnitude	32767 V	2		22	
144	68	Voltage Source 2, Phase C angle[2]	N/A	2		22	

[1]Point will return Off-Line status. It is not currently supported but is reserved for future implementation.
[2]Point will return zero. Not currently supported, but is reserved for future implementation.
[3]The Change Event Class Assignment may be changed off-line through configuration software.

Table 4: Faulted Device Indices (Point 92)

Fault Index	Faulted Device Type
0	51P Trip
1	51N Trip
2	50P-1 Trip
3	50N-1 Trip
4	50P-2 Trip
5	50N-2 Trip
6	50P-3 Trip
7	50N-3 Trip
8	67P Trip
9	67N Trip
10	46 Trip
11	81 Trip
12	Zone Sequence Step
13	ECI1
14	ECI2
15	SEF Trip

Table 5: Active Setting and Sequence Number (Point 93)

Value (Decimal)	Definition
17	Primary - 1
18	Primary - 2
19	Primary - 3
20	Primary - 4
31	Primary - Lockout
33	ALT1 - 1
34	ALT1 - 2
35	ALT1 - 3
36	ALT1 - 4
47	ALT1 - Lockout
65	ALT2 - 1
66	ALT2 - 2
67	ALT2 - 3
68	ALT2 - 4
79	ALT2 - Lockout

Table 6: Line Parameter (Point 94)

Bit	Definition
0	Voltage Display Type 0 - Line to Neutral (Wye) 1 - Line to Line (Delta)
1	Record Type 0 - Fault 1 - Event Capture
2 – 15	Reserved

Table 7: Unit Information (Point 132)

Bit	Definition	
0-3	Phase Tap Range	
	0 : 25 - 400 Amps	4 : 1.0 - 16.0 Amps
	1 : 50 - 800 Amps	5 : 10 - 160 Amps
	2 : 100 - 1600 Amps	6 : 20 - 320 Amps
	3 : 0.2 - 3.2 Amps	
4-7	Neutral Tap Range	
	0 : 25 - 400 Amps	4 : 1.0 - 16.0 Amps
	1 : 50 - 800 Amps	5 : 10 - 160 Amps
	2 : 100 - 1600 Amps	6 : 20 - 320 Amps
	3 : 0.2 - 3.2 Amps	
8-9	SEF Tap Range	
	0 : SEF Disabled	1 : SEF Enabled
10-12	Curve Set	
	0 : ANSI	2 : Recloser
	1 : IEC	3-7 : Reserved
	2 : Recloser	
13	System Frequency	
	0 : 60 Hertz	1 : 50 Hertz
14	Cold Load Timer Mode	
	0 : Seconds	1 : Minutes
15	Programmable Curves	
	0 : Disabled	1 : Enabled
16	Version Select	
	0 : ANSI Mode	1 : IEC Mode
17	Tap Mode	
	0 : Primary Current	0 : Secondary Current
18	Breaker Mode	
	0 : Three Phase	1 : Single Phase
19-28	Reserved	
29-31	Unit Type	
	0 : PCD	
	1 : SCD	
	2-7 : Reserved	

Setting up the Assigned Points List

There are a couple of methods for assigning the points of the PCD. One method that uses the predefined string of points is shown here. ABB can generate a points list for your specific set of available points. The following items are necessary to transmit this pre-defined list of settings to the unit:

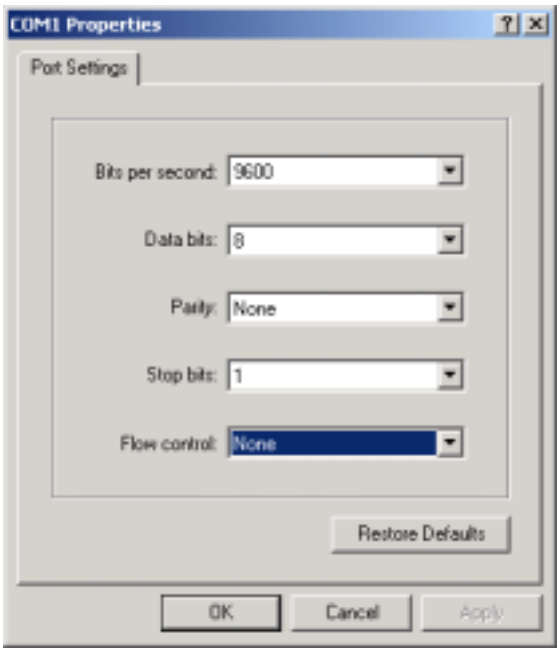
- PCD running firmware Ver 2.52 or later
- PC
- 9-pin communication cable
- Null modem cable
- Hyperterminal program (standard on most computers)
- Pre-defined points list (electronically)

Steps for setting the assignable points:

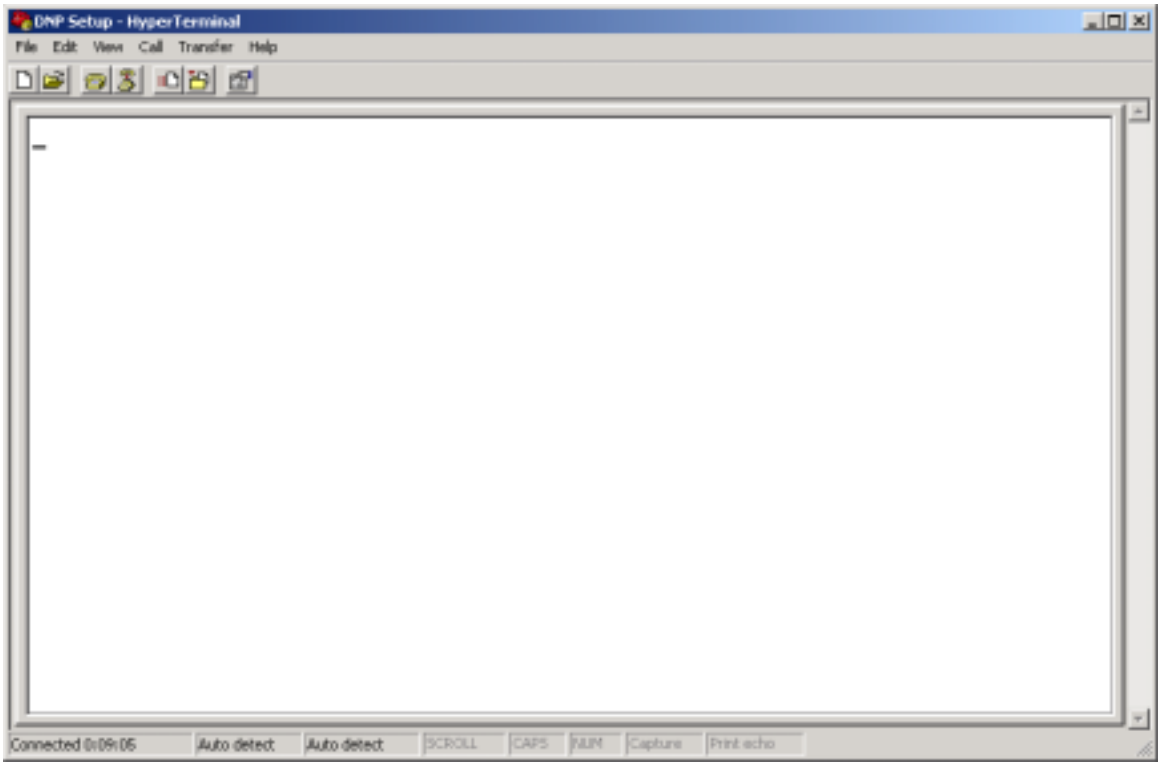
1. Place the predefined list of DNP points on any directory on your hard drive.
2. Set the PCD Unit Address to 1.
3. Using either WinPCD T2 or the front panel HMI, set the Scan Groups (Parameters 5, 6 , 7 and 8 as shown in Table 1) as desired (Standard, Single Phase Tripping, or Loop Control Setup)
4. Set the RP Protocol to Modbus ASCII OR DNP3.0 with parameter 24 to ENABLED
5. Connect your PC 9-pin Com port to the 9-pin RS-232 port on the Communications card of the PCD with a null modem cable. (To verify communication, open WinPCD VT2, but be sure to exit WinPCD T2 after verification.)
6. Open Hyperterminal.
7. Create a New Connection, assign a name, and select “OK”

8. In the "Connect to" window, change the "Connect using" option to the appropriate COM port for your computer and press "OK".

9. In the COMx Properties window, select the baud rate that the PCD is set to (normally 9600 baud), set the Flow control to "None", and press "OK"



10. The Hyperterminal screen should come up at this point. If you cannot communicate, make sure:
    - There is no other application using the COM port, such as WinPCD or a Palm Pilot.
    - The cable is good and connected properly.



11. Send the ASCII strings list below in the same order as shown. To send to the unit, individually highlight each of the strings below, and press <ctrl> C. Then, from the Hyperterminal top menu, select Edit – Paste to Host. This will send the data or command to the PCD.

DNP Setting Strings
Note: To send each of the strings, use <ctrl> C to copy, and <ctrl> V to paste into hyperterminal. Each string must be sent individually. After pasting, press enter to send the data to the PCD. Send each string in the order shown below.

Setting String: (Binary Input Point Index Registers 0 - 69) (Modbus Registers 65253 - 65322)

:0115930600011485004 6B1C55591A9934292059596979899 9A9BA604AFB0B201C64143 4451563B8E8F90595A5BADAE121300141516C7C8C9CACBCCCDCE333435363738393A 1C3C3D3E3F401706181945464748494A4B4C4D4E4F501A525354021B57582021225C5D 5E5F606162636465666768696A6B6C6D6E6F707172737475767778797A7B7C7D7E7F808 1828384858687888 98A8B22

Password String (Binary inputs)

:01150D06000114810003000120202020BD

Setting String: (Binary Input Point Index Registers 70 -103) (Modbus Registers 65323 - 65356)

:01154B06000114CB00228C8D1D1E1F03070894090A0B0C0D0E0F9C9D9E9FA0A1A2A3A4A510A7A811AAABAC232425262728B3B4B5B6B7B8B9BABBBCBDBEBFC0C1C2C3C4292A2B2C2D2E2F303132CFCE

Password String (Binary inputs)

:01150D06000114810003000120202020BD

Setting String: (Analog Input Point Index Registers 0 - 69) (Modbus Registers 65381 - 65450)

:011593060001150500460001020304050659 5A5B5C5D5E5F8182838F9045478B8C8D8E57580708090A0B0C0D606162636465666768697E7F800E0F10841112131448498586878889 8A151617183334354636373 84A4B4C4D4E4F505152535455561 91A1B1C1D1E1F202122232425262728292A2B6A6B6C6D6E6F707172737475767778797A7B7C7D2C2D2E2F303132393A3B3C3D3E3F72

Password String (Analog Inputs)

:01150D06000115010003000120202020 3C

Setting String: (Analog Input Point Index Registers 70 - 73) (Modbus Registers 65451 - 65454)

:01150F060001154B000440414243449192 9370

Password String (Analog Inputs)

:01150D06000115010003000120202020 3C

12. Verification: If accepted by the Modbus parser, the PCD will echo back the sent string. Verify the settings by reading back the values in the modbus registers. Note: this may not be possible with Hyperterminal, but other software packages such as Procomm+ have this capability.

Read Command: (Binary Input Point Index Registers 0 - 104) (Modbus Registers 65253 - 65356)

:01140706000114850068DC

Read Response

:0114D2D106B1C55591A9934292059596979899A9BA604AFB0B201C641434451563B8E8F90595A5BADAE121300141516C7C8C9CACBCCCDCE333435363738393A1C3C3D3E3F401706181945464748494A4B4C4D4E4F501A525354021B57582021225C5D5E5F606162636465666768696A6B6C6D6E6F707172737475767778797A7B7C7D7E7F808182838485868788898A8B8C8D1D1E1F03070894090A0B0C0D0E0F9C9D9E9FA0A1A2A3A4A510A7A811AAABAC232425262728B3B4B5B6B7B8B9BABBBCBDBEBFC0C1C2C3C4292A2B2C2D2E2F303132CF2A

Read Command: (Analog Input Point Index Registers 0 - 74) (Modbus Registers 65381 - 65454)

:01140706000115050 04A79

Read Response

:011496950600010203040506595A5B5C5D5E5F8182838F9045478B8C8D8E57580708090A0B0C0D606162636465666768697E7F800E0F1084111213144849858687888 98A1516171833343546363738 4A4B4C4D4E4F505152535455561 91A1B1C1D1E1F2021222324252627282 92A2B6A6B6C6D6E6F707172737475767778797A7B7C7D2C2D2E2F303132393A3B3C3D3E3F40414243449192933C

13. From this point, you may switch the unit over to DNP3.0 protocol, and use a test set or other DNP SCADA system to evaluate your selections. One useful tool is the ASE2000 DNP test set, which can be purchased from Applied Systems Engineering (www.applsyseng.com).

The latest information on the PCD control can be found at www.abb.com/mediumvoltage. (Select PCD from the dropdown Shortcuts menu.)

For additional support or information please call ABB Inc. at 1-800-929-7947 Ext. 5 or +1-407-732-2000 Ext. 2510.