

# PACiS MPP DNP3

Gateway and C264

MPP/EN DNP3/D10

PACiS V5

Master Protocol Profile  
DNP3

Issue A1



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## 1. INTRODUCTION

### 1.1 Scope of the document

This document is a chapter of MiCOM C264 and the PACiS GATEWAY documentation binders. It addresses protocol profile and specificity of the DNP3 Master Station communication protocol implemented on MiCOM C264 computer and PACiS GATEWAY .

This document deals with DNP3 communication with IEDs (Intelligent Electronic Devices) on legacy bus.

In this document, unless explicitly stated, the name Master will be used to designate either the "MiCOM C264" computer or the "PACiS GATEWAY" personal computer.

### 1.2 Glossary

<b>DE</b>	Direct Execute
<b>DPC</b>	Double Point Control
<b>DPS</b>	Double Point Status
<b>GI</b>	General Interrogation
<b>GPS</b>	Generic Product Specification
<b>IED</b>	Intelligent Electronic Device
<b>Master</b>	Used to designate either the "MiCOM C264" computer or the "PACiS GATEWAY" personal computer
<b>MV</b>	Measurement Value
<b>SBO</b>	Select Before Execute
<b>SPC</b>	Single Point Control
<b>SPS</b>	Single Point Status
<b>SP</b>	Setpoint
<b>UTC</b>	Universal Time Coordinated

## 2. DNP3 MASTER SPECIFICITY

### 2.1 Chapter Finality

The purpose of this chapter is not to describe the DNP3 protocol but to focus on both specificity of DNP3 functions and specificity of the implementation of DNP3 on the master equipment (MiCOM C264 or PACiS GATEWAY).

MiCOM C264 and PACiS GATEWAY communication protocols default behaviors are described in the communication GPS. Only parts which need precisions or present deviations are described here. Please, notice that there are some differences between MiCOM C264 and PACiS GATEWAY DNP3 Master management.

NOTE: The reader is supposed to know the DNP3 protocol.

### 2.2 Generic Behaviors

Physical layer (protocol communicate link):

C264	GTW	Description
S	N	Serial link
N	S	IP link

In the above table: S is standing for supported, N is standing for not supported.

Initialization frame:

- To connect an IED, a “Reset CU” (function 0) frame is sent to the IED.
- When the response is OK, the Master DNP3 send a message to the application to tell that connection step is passed.
- The polling period is defined using the *“Downgraded cycle”* parameter.

Synchronization process:

- The DNP3 object used to synchronize IEDs is “Write Date and Time Request (Object 50, Variation 1).
- The calculation of the transmission delay compensation is **not** performed.
- Synchronization is sent at connection of an IED and cyclically in broadcast. The Period of synchronization is configurable with *“synchronization cycle”* configuration parameter.

Dating specificity:

- The "master" handles the synchronization status of each IED. The synchronization status of a DNP3 IED is given by the IIN1.4 [NEED\_TIME] bit of DNP3 application message headers. The IED is considered synchronized when the “need time” bit is in reset state.
- Non-dated events sent by IED are time tagged, on reception, by the master.
- Synchronization status of dated events is given as follows:
  - ⇒ When the master is not synchronized, time tagged received events are tagged non-synchronized
  - ⇒ When the master is synchronized, synchronization tag is given by the synchronization status of the IED (coming from IIN1.4 [NEED\_TIME] bit).

## General Interrogation:

- GI is done using the class 0 (static data) read request (group “60” variation “1”). This allows the master to update his database with static data from the IEDs.
- GI is requested at IED connection. GI can be requested cyclically by the master. The GI polling period is configurable using the “*class 0 polling period*” configuration parameter. When this parameter is set to 0 second, there is no cyclic GI.
- On GTW: On IED connection, a warm restart is sent to the IED to clear event queues. The request is sent before the first GI request.

## Event management:

- The “master” implementation does not support unsolicited response.
- Events will only be transmitted on polling request (I.E. slave devices have to wait for being polled by the master to transmit an event).
- Polling of events is done cyclically on IEDs by using a class 1 to 3 read request (Group 60, variation 2, 3, 4).

## Polling sequencing:

- IEDs of the network are polled cyclically in sequence. The sequence may be momentarily interrupted to transmit a synchronization message or a command.

### 2.3 Data received from IEDs

Data from IED's are cyclically polled using object group 60 for GI and event polling.

Object group	Variation	Data	GI (optional polling)	Event Polling	Function
60	01	Class 0	◆		[1] READ
60	02, 03, 04	Class 1,2,3		◆	[1] READ

Class 0 objects (polled for GI) shall be:

Type of data	Object group	Data
SPS (1) (Single point Status)	01	Static Binary Input
Counter Value	20	Static Counter
MV (Measurement Value)	30	Static Analogue Input

Class 1 to 3 objects (polled for events acquisition) shall be:

Type of data	Object group	Data
SPS (1) (Single point Status)	02	Binary Input Event
Counter Value	22	Counter Event
MV (Measurement Value)	32	Analogue Input Event

(1): "Double-bit Binary Input" (object group "3") is not available in the actual version of DNP3 level 3 implementation.

**2.4 Data sent to IEDs**

Controls managed by C264:

- Digital controls (Set, Reset, Trip, Close): DNP3 object 12 is used with Variation 01.
- Set time control: DNP3 object 50 is used with Variation 01.

Table of used control objects and associated control functions:

Object	Variation	Data	Function
12	01	Binary Command - Control Relay Output Block (CROB)	3 (select)
			4 (operate)
			5 (direct op)
50	01	Time and Date – Absolute time	2 (write)

The DNP3 Master manages both direct controls sequence and Select Before Operate (SBO) control sequence.

Depending on the CROB parameters option selected, the bloc of information coding of g12V1 DNP3 object, applied to a single index, will be coded as follows:

	Transient Control Point				Permanent Control Point			
	ON order		OFF Order		ON order		OFF Order	
CROB Parameter	TCC	Op.Type	TCC	Op.Type	TCC	Op.Type	TCC	Op.Type
<b>Code</b> [Op.Type]	NUL	PULSE ON	NUL	PULSE OFF	NUL	LATCH ON	NUL	LATCH OFF
<b>Trip/Close</b> [TCC]	TRIP	NUL	CLOSE	NUL	TRIP	NUL	CLOSE	NUL
<b>Code &amp; Trip/Close</b> [Op.Type]& [TCC]	TRIP	PULSE ON	CLOSE	PULSE OFF	TRIP	LATCH ON	CLOSE	LATCH OFF

NOTE: CR=0, QU=0, Count=1, On-Time=10, Off-Time=10, RES=0, Status code=0.

Transient Control Point / OFF Order is not applicable.



Controls managed by GTW:

- Digital controls (Set, Reset, Trip, Close): DNP3 object 12 is used with Variation 01.
- Set time control: DNP3 object 50 is used with Variation 01.
- **Analog Control DNP3 object 41 is used with Variation 02.**

Table of used control objects and associated control functions:

Object	Variation	Data	Function
12	01	Binary Command - Control Relay Output Block (CROB)	3 (select)
			4 (operate)
			5 (direct op)
41	02	Analog output (16bits)	5 (direct op)
50	01	Time and Date – Absolute time	2 (write)

The DNP3 Master manages both direct controls sequence and Select Before Operate (SBO) control sequence for digital controls, and only Direct Operate (DO) for Analog Controls.

As CROB parameters are not accessible on DNP3 Master for GTW, following behavior has to be considered:

	Control code									DESCRIPTION
	Hex	TCC		CR	QU	OP Type				
		7	6	5	4	3	2	1	0	
<b>SPC</b>	0x03	0	0	0	0	0	0	1	1	LATCH ON
	0x04	0	0	0	0	0	1	0	0	LATCH OFF
	0x20	0	0	1	0	0	0	0	0	CANCEL
<b>DPC</b>	0x41	0	1	0	0	0	0	0	1	CLOSE/ PULSE ON
	0x81	1	0	0	0	0	0	0	1	TRIP/ PULSE ON
	0x20	0	0	1	0	0	0	0	0	CANCEL
<b>RAISE/LOWER</b>	0x41	1	0	0	0	0	0	0	1	RAISE
	0x81	0	1	0	0	0	0	0	1	LOWER
	0x20	0	0	1	0	0	0	0	0	CANCEL

Concerning other fields:

- **Count** Field: Always set to “1”
- **On-Time** field: Always set to “0”
- **Off-Time** field: Always set to “0”
- **“RES/Status Code”** = “0”

### 3. LIMITS AND PERFORMANCES

Disturbance management is not treated in DNP3 Protocol.

Tunneling management is not treated in DNP3 Protocol.

There is No Application Layer Re-tries.

Maximum Data Link Frame Size (octets):

- Transmitted: 292
- Received: (must be 292)

Maximum Application Fragment Size (octets):

- Transmitted (configurable: 15 to 2048 octets)
- Received 2048

#### 4. CONFIGURATION

The following parameters shall be available from configuration tool.

##### General attributes of DNP3 Master:

Parameter	Value	Comments
Master address	0 to 65535	DNP3 Master link address
Acknowledgement time-out (AT) (*)	1 to 300 [x100 ms]	Time out for data link. Default = 300
Number of retries (NT) (*)	1 to 10	Maximum number of retries in case of non response of an IED before declaring it disconnected. Default = 2
Class 0 polling period	0 to 3600 [seconds]	No polling when set to "0" Default = 0
Synchronization cycle	1 to 65535 [x10 seconds]	If set to "65535" synchronization is not sent cyclically.
Application time-out	0 to 255 [seconds]	Time-out for multifragments. 0: use auto calculated value, by the software. Default = 0
Downgraded cycle (DC) (*)	10 to 100 [x100 ms]	Deadline between two polling of a disconnected. Default = 50

(\*) Constraint to be respected:

If "N" is the number of IEDs on the DNP3 network, then  $DC > N * AT * NT$

##### CROB (Control Relay Output Block) configuration (Only used by C264):

Parameter	Value	Comments
CROB parameters	Exclusive choice of one usage: Usage of "Code" field Usage of "Trip/Close" field Usage of "Code" and "Trip/Close" fields	Group 12: binary output Command, Variation 1: Control Relay Output Block Note: "Code" stand for "Op.Type" (Operation Type field not null).

##### General attributes for DNP3 outstations (IEDs):

Parameter	Value	Comments
IED address	0 to 65535	Link Address of the device

**Outstation Data point addressing:**

Data point	Parameter		
SPS	address	0 to 65535	index over protocol
SPC	Address Order type	0 to 65535 SBO, DE	index over protocol Select Execute from the SCADA or Direct Execute (protocol view)
DPC	Address Order type	0 to 65535 SBO, DE	index over protocol Select Execute from the SCADA or Direct Execute (protocol view)
SP*	Address Order type	0 to 65535 DE	index over protocol Direct Execute (protocol view)
MV	address	0 to 65535	index over protocol
Counter	address	0 to 65535	index over protocol

(\*) Only managed by GTW

## 5. MASTER DNP3 PROFILE

### 5.1 Device properties

<b>DNP V3.00 Device Profile</b>																					
Vendor Name: SCHNEIDER ELECTRIC ENERGY SA																					
Device Name: MiCOM C264 Computer and PACiS GATEWAY																					
Highest DNP Level Supported: For Requests      Level 3 For Responses     Level 3	Device Function: <input checked="" type="checkbox"/> Master <input type="checkbox"/> Slave																				
Notable objects, functions, and/or qualifiers supported in addition to the Highest DNP Levels supported: ----- -----																					
Maximum Data Link Frame Size (octets):  Transmitted:   292 Received:       (must be 292)	Maximum Application Fragment Size (octets):  Transmitted:   2048  Received:      2048																				
Maximum Data Link Re-tries:  <input type="checkbox"/> None <input type="checkbox"/> Fixed at _____ <input checked="" type="checkbox"/> Configurable, range 1 to 10	Maximum Application Layer Re-tries:  <input checked="" type="checkbox"/> None <input type="checkbox"/> Configurable, range ____ to ____ ( Fixed is not permitted )																				
Requires Data Link Layer Confirmation:  <input type="checkbox"/> Never <input checked="" type="checkbox"/> Always <input type="checkbox"/> Sometimes If 'Sometimes', when? _____  <input type="checkbox"/> Configurable If 'Configurable', how? User option to set Data Link Confirmation to: • Always – device will always request Data Link Confirmations. • Multi-packet only – the device will request Data Link Confirmations when sending multi-packet responses. • Never – the device will never request Data Link Confirmations.																					
Requires Application Layer Confirmation:  <input checked="" type="checkbox"/> Never <input type="checkbox"/> Always (not recommended) <input type="checkbox"/> When reporting Event Data (Slave devices only) <input type="checkbox"/> When sending multi-fragment responses (Slave devices only) <input type="checkbox"/> Sometimes            If 'Sometimes', when? _____ <input type="checkbox"/> Configurable If 'Configurable', how? _____																					
Timeouts while waiting for:  <table style="width: 100%; border: none;"> <tr> <td style="width: 30%;">Data Link Confirm</td> <td><input type="checkbox"/> None</td> <td><input type="checkbox"/> Fixed at 3s</td> <td><input type="checkbox"/> Variable</td> <td><input checked="" type="checkbox"/> Configurable</td> </tr> <tr> <td>Complete Appl. Fragment</td> <td><input type="checkbox"/> None</td> <td><input type="checkbox"/> Fixed at ____</td> <td><input checked="" type="checkbox"/> Variable</td> <td><input type="checkbox"/> Configurable</td> </tr> <tr> <td>Application Confirm</td> <td><input checked="" type="checkbox"/> None</td> <td><input type="checkbox"/> Fixed at ____</td> <td><input type="checkbox"/> Variable</td> <td><input type="checkbox"/> Configurable</td> </tr> <tr> <td>Complete Appl. Response</td> <td><input type="checkbox"/> None</td> <td><input type="checkbox"/> Fixed at ____</td> <td><input checked="" type="checkbox"/> Variable</td> <td><input type="checkbox"/> Configurable</td> </tr> </table> Others _____  Attach explanation if 'Variable' or 'Configurable' was checked for any timeout		Data Link Confirm	<input type="checkbox"/> None	<input type="checkbox"/> Fixed at 3s	<input type="checkbox"/> Variable	<input checked="" type="checkbox"/> Configurable	Complete Appl. Fragment	<input type="checkbox"/> None	<input type="checkbox"/> Fixed at ____	<input checked="" type="checkbox"/> Variable	<input type="checkbox"/> Configurable	Application Confirm	<input checked="" type="checkbox"/> None	<input type="checkbox"/> Fixed at ____	<input type="checkbox"/> Variable	<input type="checkbox"/> Configurable	Complete Appl. Response	<input type="checkbox"/> None	<input type="checkbox"/> Fixed at ____	<input checked="" type="checkbox"/> Variable	<input type="checkbox"/> Configurable
Data Link Confirm	<input type="checkbox"/> None	<input type="checkbox"/> Fixed at 3s	<input type="checkbox"/> Variable	<input checked="" type="checkbox"/> Configurable																	
Complete Appl. Fragment	<input type="checkbox"/> None	<input type="checkbox"/> Fixed at ____	<input checked="" type="checkbox"/> Variable	<input type="checkbox"/> Configurable																	
Application Confirm	<input checked="" type="checkbox"/> None	<input type="checkbox"/> Fixed at ____	<input type="checkbox"/> Variable	<input type="checkbox"/> Configurable																	
Complete Appl. Response	<input type="checkbox"/> None	<input type="checkbox"/> Fixed at ____	<input checked="" type="checkbox"/> Variable	<input type="checkbox"/> Configurable																	

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### DNP V3.00 Device Profile

**Sends/Executes Control Operations:**

WRITE Binary Outputs	<input checked="" type="checkbox"/> Never	<input type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input type="checkbox"/> Configurable
SELECT/OPERATE	<input type="checkbox"/> Never	<input type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input checked="" type="checkbox"/> Configurable
DIRECT OPERATE	<input type="checkbox"/> Never	<input type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input checked="" type="checkbox"/> Configurable
DIRECT OPERATE - NO ACK	<input checked="" type="checkbox"/> Never	<input type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input type="checkbox"/> Configurable
Count > 1	<input checked="" type="checkbox"/> Never	<input type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input type="checkbox"/> Configurable
Pulse On	<input type="checkbox"/> Never	<input type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input checked="" type="checkbox"/> Configurable
Pulse Off	<input checked="" type="checkbox"/> Never	<input type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input type="checkbox"/> Configurable
Latch On	<input type="checkbox"/> Never	<input type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input checked="" type="checkbox"/> Configurable
Latch Off	<input type="checkbox"/> Never	<input type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input checked="" type="checkbox"/> Configurable
Queue	<input checked="" type="checkbox"/> Never	<input type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input type="checkbox"/> Configurable
Clear Queue	<input checked="" type="checkbox"/> Never	<input type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input type="checkbox"/> Configurable

- Select timeout: configurable

5.2 DNP.3 Level 3 IMPLEMENTATION TABLE (DNP3-L3)

*Strikethrough information in grey is not processed by the master (but must still be parsed)*  
 Functionality supported beyond the subset level are Highlighted

OBJECT			REQUEST (Master can issue)		RESPONSE (master parses)	
Grp.	Var.	Description	Func. Codes (dec)	Qualifier Codes (hex)	Function Codes	Qualifier Codes (hex)
1	0	Binary Input – Any Variation	<del>1 (read)</del> <del>22 (assign class)</del>	<del>00, 01 (start-stop)</del> <del>06 (no range, or all)</del>		
1	1	Binary Input – Packed format	<del>1 (read)</del>	<del>00, 01 (start-stop)</del> <del>06 (no range, or all)</del>	129 (response)	00, 01 (start-stop)
1	2	Binary Input – with flags	<del>1 (read)</del>	<del>00, 01 (start-stop)</del> <del>06 (no range, or all)</del>	129 (response)	00, 01 (start-stop)
2	0	Binary Input Event – Any Variation	<del>1 (read)</del>	<del>06 (no range, or all)</del> <del>07, 08 (limited qty)</del>		
2	1	Binary Input Event – without Time	<del>1 (read)</del>	<del>06 (no range, or all)</del> <del>07, 08 (limited qty)</del>	129 (response) <del>130 (unsol. Resp)</del>	17, 28 (index)
2	2	Binary Input Event – with AbsoluteTime	<del>1 (read)</del>	<del>06 (no range, or all)</del> <del>07, 08 (limited qty)</del>	129 (response) <del>130 (unsol. Resp)</del>	17, 28 (index)
<del>2</del>	<del>3</del>	<del>Binary Input Event – with Relative Time</del>	<del>1 (read)</del>	<del>06 (no range, or all)</del> <del>07, 08 (limited qty)</del>	<del>129 (response)</del> <del>130 (unsol. Resp)</del>	<del>17, 28 (index)</del>
<del>40</del>	<del>0</del>	<del>Binary Output – Any Variation</del>	<del>1 (read)</del>	<del>00, 01 (start-stop)</del> <del>06 (no range, or all)</del>		
<del>40</del>	<del>2</del>	<del>Binary Output – Output status with flags</del>	<del>1 (read)</del>	<del>00, 01 (start-stop)</del> <del>06 (no range, or all)</del>	<del>129 (response)</del>	<del>00, 01 (start-stop)</del>
12	1	Binary Command - Control Relay Output Block (CROB) (1)	3 (select) 4 (operate) 5 (direct op) <del>6 (dir. op, no ack)</del>	<del>17, 28 (index)</del>	129 (response)	Request echo
20	0	Counter - Any Variation	<del>1 (read)</del> <del>7 (freeze)</del> <del>8 (freeze noack)</del> <del>9 (freeze clear)</del> <del>10 (frz. cl. noack)</del>	<del>00, 01 (start-stop)</del> <del>06 (no range, or all)</del>		
20	1	Counter - 32-Bit with flag	<del>1 (read)</del>	<del>00, 01 (start-stop)</del> <del>06 (no range, or all)</del>	129 (response)	00, 01 (start-stop)
20	2	Counter - 16-Bit with flag	<del>1 (read)</del>	<del>00, 01 (start-stop)</del> <del>06 (no range, or all)</del>	129 (response)	00, 01 (start-stop)
20	5	Counter - 32-Bit without Flag	<del>1 (read)</del>	<del>00, 01 (start-stop)</del> <del>06 (no range, or all)</del>	129 (response)	00, 01 (start-stop)
20	6	Counter - 16-Bit without Flag	<del>1 (read)</del>	<del>00, 01 (start-stop)</del> <del>06 (no range, or all)</del>	129 (response)	00, 01 (start-stop)
<del>24</del>	<del>0</del>	<del>Frozen Counter – Any Variation</del>	<del>1 (read)</del> <del>22 (assign class)</del>	<del>00, 01 (start-stop)</del> <del>06 (no range, or all)</del>		
<del>24</del>	<del>4</del>	<del>Frozen Counter – 32-Bit with flag</del>	<del>1 (read)</del>	<del>00, 01 (start-stop)</del> <del>06 (no range, or all)</del>	<del>129 (response)</del>	<del>00, 01 (start-stop)</del>
<del>24</del>	<del>2</del>	<del>Frozen Counter – 16-Bit with flag</del>	<del>1 (read)</del>	<del>00, 01 (start-stop)</del> <del>06 (no range, or all)</del>	<del>129 (response)</del>	<del>00, 01 (start-stop)</del>
<del>24</del>	<del>9</del>	<del>Frozen Counter – 32-Bit without Flag</del>	<del>1 (read)</del>	<del>00, 01 (start-stop)</del> <del>06 (no range, or all)</del>	<del>129 (response)</del>	<del>00, 01 (start-stop)</del>
<del>24</del>	<del>10</del>	<del>Frozen Counter – 16-Bit without Flag</del>	<del>1 (read)</del>	<del>00, 01 (start-stop)</del> <del>06 (no range, or all)</del>	<del>129 (response)</del>	<del>00, 01 (start-stop)</del>
22	0	Counter Event - Any Variations	<del>1 (read)</del>	<del>06 (no range, or all)</del> <del>07, 08 (limited qty)</del>		
22	1	Counter Event - 32-Bit with flag	<del>1 (read)</del>	<del>06 (no range, or all)</del> <del>07, 08 (limited qty)</del>	129 (response) <del>130 (unsol. Resp)</del>	17, 28 (index)
22	2	Counter Event - 16-Bit with flag	<del>1 (read)</del>	<del>06 (no range, or all)</del> <del>07, 08 (limited qty)</del>	129 (response) <del>130 (unsol. Resp)</del>	17, 28 (index)

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OBJECT			REQUEST (Master can issue)		RESPONSE (master parses)	
Grp.	Var.	Description	Func. Codes (dec)	Qualifier Codes (hex)	Function Codes	Qualifier Codes (hex)
22	5	Counter Event - 32-Bit with time	<del>1 (read)</del>	<del>06 (no range, or all) 07, 08 (limited qty)</del>	129 (response) <del>130 (unsol. Resp)</del>	17, 28 (index)
22	6	Counter Event - 16-Bit with time	<del>1 (read)</del>	<del>06 (no range, or all) 07, 08 (limited qty)</del>	129 (response) <del>130 (unsol. Resp)</del>	17, 28 (index)
<del>23</del>	<del>0</del>	<del>Frozen Counter Event - Any Variation</del>	<del>1 (read)</del>	<del>06 (no range, or all) 07, 08 (limited qty)</del>		
<del>23</del>	<del>4</del>	<del>Frozen Counter Event - 32-Bit with flag</del>	<del>1 (read)</del>	<del>06 (no range, or all) 07, 08 (limited qty)</del>	<del>129 (response) 130 (unsol. Resp)</del>	<del>17, 28 (index)</del>
<del>23</del>	<del>2</del>	<del>Frozen Counter Event - 16-Bit with flag</del>	<del>1 (read)</del>	<del>06 (no range, or all) 07, 08 (limited qty)</del>	<del>129 (response) 130 (unsol. Resp)</del>	<del>17, 28 (index)</del>
30	0	Analogue Input - AnyVariation	<del>1 (read) 22 (assign class)</del>	<del>06 (no range, or all) 07, 08 (limited qty)</del>		
30	1	Analogue Input - 32-Bit with flag	<del>1 (read)</del>	<del>06 (no range, or all) 07, 08 (limited qty)</del>	129 (response)	00, 01 (start-stop)
30	2	Analogue Input - 16-Bit with flag	<del>1 (read)</del>	<del>06 (no range, or all) 07, 08 (limited qty)</del>	129 (response)	00, 01 (start-stop)
30	3	Analogue Input - 32-Bit without Flag	<del>1 (read)</del>	<del>06 (no range, or all) 07, 08 (limited qty)</del>	129 (response)	00, 01 (start-stop)
30	4	Analogue Input - 16-Bit without Flag	<del>1 (read)</del>	<del>06 (no range, or all) 07, 08 (limited qty)</del>	129 (response)	00, 01 (start-stop)
32	0	Analogue Input Event - Any Variation	<del>1 (read)</del>	<del>06 (no range, or all) 07, 08 (limited qty)</del>		
32	1	Analogue Input Event - 32-Bit without Time	<del>1 (read)</del>	<del>06 (no range, or all) 07, 08 (limited qty)</del>	129 (response) <del>130 (unsol. Resp)</del>	17, 28 (index)
32	2	Analogue Input Event - 16-Bit without Time	<del>1 (read)</del>	<del>06 (no range, or all) 07, 08 (limited qty)</del>	129 (response) <del>130 (unsol. Resp)</del>	17, 28 (index)
32	3	Analogue Input Event - 32-Bit with Time	<del>1 (read)</del>	<del>06 (no range, or all) 07, 08 (limited qty)</del>	129 (response) <del>130 (unsol. Resp)</del>	17, 28 (index)
32	4	Analogue Input Event - 16-Bit with Time	<del>1 (read)</del>	<del>06 (no range, or all) 07, 08 (limited qty)</del>	129 (response) <del>130 (unsol. Resp)</del>	17, 28 (index)
<del>40</del>	<del>0</del>	<del>Analogue Output Status - Any Variation</del>	<del>1 (read)</del>	<del>00, 01 (start-stop) 06 (no range, or all)</del>		
<del>40</del>	<del>4</del>	<del>Analogue Output Status - 32 with flag</del>	<del>1 (read)</del>	<del>00, 01 (start-stop) 06 (no range, or all)</del>	<del>129 (response)</del>	<del>00, 01 (start-stop)</del>
<del>40</del>	<del>2</del>	<del>Analogue Output Status - 16 with flag</del>	<del>1 (read)</del>	<del>00, 01 (start-stop) 06 (no range, or all)</del>	<del>129 (response)</del>	<del>00, 01 (start-stop)</del>
44	1	Analogue Output - 32-Bit	<del>3 (select) 4 (operate) 5 (direct op) 6 (dir. op, no ack)</del>	17, 28 (index)	129 (response)	Request echo
44	2	Analogue Output - 16-Bit	<del>3 (select) 4 (operate) 5 (direct op) 6 (dir. op, no ack)</del>	17, 28 (index)	129 (response)	Request echo
50	1	Time and Date - Absolute time	<del>1 (read) 2 (write)</del>	<del>07 (limited qty=1) 07 (limited qty=1)</del>	<del>129 (response)</del>	<del>07 (limited qty) (qty = 1)</del>
54	1	Time and Date CTO - Absolute time synchronized			<del>129 (response) 130 (unsol. Resp)</del>	<del>07 (limited qty) (qty = 1)</del>
54	2	Time and Date CTO - Absolute time unsynchronized			<del>129 (response) 130 (unsol. Resp)</del>	<del>07 (limited qty) (qty = 1)</del>
52	1	Time Delay - Coarse			<del>129 (response)</del>	<del>07 (limited qty) (qty = 1)</del>
52	2	Time Delay - Fine			<del>129 (response)</del>	<del>07 (limited qty) (qty = 1)</del>



OBJECT			REQUEST (Master can issue)		RESPONSE (master parses)	
Grp.	Var.	Description	Func. Codes (dec)	Qualifier Codes (hex)	Function Codes	Qualifier Codes (hex)
60	1	Class Objects = Class 0 Data	1 (read)	06 (no range, or all)		
60	2	Class Objects = Class 1 Data	1 (read)	06 (no range, or all) <del>07, 08 (limited qty)</del>		
			<del>20 (enbl. unsol.)</del>	<del>06 (no range, or all)</del>		
			<del>21 (dab. unsol.)</del> <del>22 (assign class)</del>			
60	3	Class Objects = Class 2 Data	1 (read)	06 (no range, or all) <del>07, 08 (limited qty)</del>		
			<del>20 (enbl. unsol.)</del>	<del>06 (no range, or all)</del>		
			<del>21 (dab. unsol.)</del> <del>22 (assign class)</del>			
60	4	Class Objects = Class 3 Data	1 (read)	06 (no range, or all) <del>07, 08 (limited qty)</del>		
			<del>20 (enbl. unsol.)</del>	<del>06 (no range, or all)</del>		
			<del>21 (dab. unsol.)</del> <del>22 (assign class)</del>			
80	4	<del>Internal Indications = Packed format</del>	2 (write)	<del>00 (start-stop)</del> <del>(index=7)</del>		
			1 (read)	<del>00,01 (start-stop)</del>	<del>129 (response)</del>	<del>00,01 (start-stop)</del>
<del>No Object (function code only)</del>			<del>13 (cold restart)</del>			
<del>No Object (function code only)</del>			<del>23 (delay meas)</del>			

Remarks: Object 12 Commands must be selected / executed on one data point

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**Publication: MPP/EN DNP3/D10**

Publishing: Schneider Electric

06/2013