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2 Purpose of this document

The purpose of this document is to provide a list and a simple explanation of the BACnet objects implemented in the "ecocirc XL" and "ecocirc XLplus" electronic drive.
For further information related to the BACnet standard protocol, refers to **"ANSI/ASHRAE Standard 135-2004, BACnet A Data Communication Protocol For Building Automation and Control Networks"** document or latest version of the same.

3 Legend

MS/TP	Master-Slave / Token Passing
UART	Universal Asynchronous Receiver/Transmitter
MIN	Minimum
MAX	Maximum
DEF	Default
R	Readable
R/W	Readable & Writable
RPM	Round per Minute
Q	Flow
H	Head
P	Power
PROP.	Proportional
W	Watt
A	Ampere
LSW / MSW	Least Significant Word / Most Significant Word
PWR	Power
FW	Firmware
KI	Integral constant
KP	Proportional constant
EIA	Electronic Industries Alliance
N.U.	Not Used
N.D.	Not Defined
N.A.	Not Accessible
N.P.	Not Present

4 BACnet Protocol Implementation Conformance Statement (PICS)

DATE	05 June 2014
VENDOR NAME	Xylem
PRODUCT NAME	ecocirc XL
PRODUCT MODEL NUMBER	ecocirc XL... (see table below)
APPLICATION SOFTWARE VERSION	-
FIRMWARE REVISION	00104
BACNET PROTOCOL VERSION	-

4.1 *Product model number*

The ecocirc XL is a range of electronic circulators based on the same software; the PICS are the same for all products listed below.

PRODUCT	OPTIONS
ecocirc XLplus 25-80	-
ecocirc XLplus 25-100	-
ecocirc XLplus 32-80	(F) (B)
ecocirc XLplus 32-100	(F) (B)
ecocirc XLplus 32-120 F	(D) (B)
ecocirc XLplus 40-80 F	(D)
ecocirc XLplus 40-100 F	(D)
ecocirc XLplus 40-120 F	(D) (B)
ecocirc XLplus 50-80 F	(D) (B)
ecocirc XLplus 50-100 F	-
ecocirc XLplus 50-120 F	(D) (B)
ecocirc XLplus 65-80 F	(D) (B)
ecocirc XLplus 65-120 F	(D) (B)
ecocirc XLplus 80-120 F	(D)
ecocirc XLplus 100-120 F	-
ecocirc XL 20-35	(B)
ecocirc XL 36-45	(B)
ecocirc XL 15-75	(B)
ecocirc XL 55-45	(B)
ecocirc XL 20-140	(B)
ecocirc XL 65-130	(B)
ecocirc XL 40-200	(B)
ecocirc XL 70-145	(B)
ecocirc XL 40-275	(B)
ecocirc XL 70-145	(B)

ecocirc XL 40-275	(B)
ecocirc XL 95-125	(B)
ecocirc XL 27-375	(B)
ecocirc XL 105-155	(B)
ecocirc XL 45-340	(B)

B = Bronze
F = Flanged
D = Twin

4.2 *Product description*

ecocirc XL and ecocirc XLplus is a wet rotor circulation pump with energy-efficient electronically commutated permanent magnet technology, ECM technology. Being equipped with an advance electronic drive with communication capabilities, the pump can be used as a stand-alone or network device with BACnet (or ModBus) communication

4.3 *BACnet standardized device profile (Annex L)*

☐	**BACnet Advanced Workstation**	(B-AWS)
☐	**BACnet Operator Workstation**	(B-OWS)
☐	**BACnet Operator Display**	(B-OD)
☐	**BACnet Building Controller**	(B-BC)
☐	**BACnet Advanced Application Controller**	(B-AAC)
☐	**BACnet Application Specific Controller**	(B-ASC)
☐	**BACnet Smart Sensor**	(B-SS)
☑	**BACnet Smart Actuator**	(B-SA)

4.4 *BACnet interoperability building blocks supported (Annex K)*

4.4.1 Data sharing

☐	**Data Sharing – Read Property-A**	DS-RP-A
☑	**Data Sharing – Read Property-B**	DS-RP-B
☐	**Data Sharing – Read Property Multiple-A**	DS-RPM-A
☐	**Data Sharing – Read Property Multiple-B**	DS-RPM-B
☐	**Data Sharing – Write Property-A**	DS-WP-A
☑	**Data Sharing – Write Property-B**	DS-WP-B
☐	**Data Sharing – Write Property Multiple-A**	DS-WPM-A
☐	**Data Sharing – Write Property Multiple-B**	DS-WPM-B
☐	**Data Sharing – Change of Value-A**	DS-COV-A
☐	**Data Sharing – Change of Value-B**	DS-COV-B

☐	**Data Sharing – Change of Value Property-A**	DS-COVP-A
☐	**Data Sharing – Change of Value Property-B**	DS-COVP-B
☐	**Data Sharing – Change of Value Unsolicited-A**	DS-COVU-A
☐	**Data Sharing – Change of Value Unsolicited-B**	DS-COVU-B
☐	**Data Sharing – View-A**	DS-V-A
☐	**Data Sharing – Advanced View-A**	DS-AV-A
☐	**Data Sharing – Modify-A**	DS-M-A
☐	**Data Sharing – Advanced Modify-A**	DS-AM-A

4.4.2 Alarm and event management

N.P.

4.4.3 Scheduling

N.P.

4.4.4 Trending

N.P.

4.4.5 Device Management

☐	**Device Management – Dynamic Device Binding-A**	DM-DDB-A
☑	**Device Management – Dynamic Device Binding-B**	DM-DDB-B
☐	**Device Management – Dynamic Object Binding-A**	DM-DOB-A
☐	**Device Management – Dynamic Object Binding-B**	DM-DOB-B
☐	**Device Management – Device Communication Control-A**	DM-DCC-A
☐	**Device Management – Device Communication Control -B**	DM-DCC-B
☐	**Device Management – Private Transfer-A**	DM-PT-A
☐	**Device Management – Private Transfer-B**	DM-PT-B
☐	**Device Management – Text Message-A**	DM-TM-A
☐	**Device Management – Text Message-B**	DM-TM-B
☐	**Device Management – Time Synchronization-A**	DM-TS-A
☐	**Device Management – Time Synchronization-B**	DM-TS-B
☐	**Device Management – UTC Time Synchronization-A**	DM-UTC-A
☐	**Device Management – UTC Time Synchronization-B**	DM-UTC-B
☐	**Device Management – Reinitialize Device-A**	DM-RD-A
☐	**Device Management – Reinitialize Device-B**	DM-RD-B
☐	**Device Management – Backup and Restore-A**	DM-BR-A
☐	**Device Management – Backup and Restore-B**	DM-BR-B

☐	**Device Management – Restart-A**	DM-R-A
☐	**Device Management – Restart-B**	DM-R-B
☐	**Device Management – List Manipulation-A**	DM-LM-A
☐	**Device Management – List Manipulation-B**	DM-LM-B
☐	**Device Management – Object Creation and Deletion-A**	DM-OCD-A
☐	**Device Management – Object Creation and Deletion-B**	DM-OCD-B
☐	**Device Management – Virtual Terminal-A**	DM-VT-A
☐	**Device Management – Virtual Terminal-B**	DM-VT-B
☐	**Device Management – Automatic Network Mapping-A**	DM-ANM-A
☐	**Device Management – Automatic Device Mapping-A**	DM-ADM-A
☐	**Device Management – Automatic Time Synchronization-A**	DM-ATS-A
☐	**Device Management – Manual Time Synchronization-A**	DM-MTS-A

4.4.6 Network Management

N.P.

4.5 *Standard object types supported*

OBJECT TYPE	SUPPORTED	CREATED DINAMICALLY	DELETED DINAMICALLY
Analog Input (*)	☑	☐	☐
Analog Output	☐	☐	☐
Analog Value (**)	☑	☐	☐

(*) See par. 6.2 for further specification
(**) See par. 6.1 for further specification

4.6 *Segmentation capability*

N.P.

4.7 *Data Link Layer options*

☐	**BACnet IP, (Annex J)**	
☐	**BACnet IP, (Annex J), Foreign Device**	
☐	**ISO 8802-3, Ethernet (Clause 7)**	
☐	**ANSI/ATA 878.1, 2.5Mb. ARCNET (Clause 8)**	
☐	**ANSI/ATA 878.1, 2.5Mb. ARCNET (Clause 8), baud rate(s)**	
☑	**MS/TP master (Clause 9), baud rate(s)**	4800 9600 14400 19200 38400 (*)

		56000 57600
☐	MS/TP slave (Clause 9), baud rate(s)	
☐	Point-To-Point, EIA 232 (Clause 10), baud rate(s)	
☐	Point-To-Point, modem (Clause 10), baud rate(s)	
☐	LonTalk (Clause 11), medium	
☐	Other	

(*) It's suggested to set a baud rate equal or greater than 38400bps to avoid timing issues

4.8 *Device address binding*

Is static device binding supported?	☐ Yes	☑ No

4.9 *Networking options*

N.P.

4.10 *Network security options*

N.P.

4.11 *Character sets supported*

N.P.

5 BACnet Device Object Identifier

For ecocirc XL and ecocirc XLplus, each device Object Identifier is calculated using the serial number ("S/N") printed on the silver label stuck on the drive side, and then following the next steps:

1. Perform the binary conversion (on 32 bits) of the hexadecimal serial number "S/N"
2. Remove the first 10 bits on the left of the binary number obtained after step 1
3. Perform the conversion, into a decimal number, of the 22 bits obtained after step 2
4. The Device Object Identifier is then the result of the decimal conversion in step 3

Example 1:
ecocirc XL "S/N" = 9F70E603

1) 9F70E603 = 1001 1111 0111 0000 1110 0110 0000 0011 (32 bits)
2) ~~1001 1111 01~~11 0000 1110 0110 0000 0011 → 11 0000 1110 0110 0000 0011(22 bits)
3) 11 0000 1110 0110 0000 0011 → 3204611

Object_id = 3204611.

Example 2:
ecocirc XL "S/N" = 3F10E603

1) 3F10E603 = 0011 1111 0001 0000 1110 0110 0000 0011 (32 bits)
2) ~~0011 1111 00~~01 0000 1110 0110 0000 0011 → 01 0000 1110 0110 0000 0011 (22 bits)
3) 01 0000 1110 0110 0000 0011 → 1107459

Object_id = 1107459.

6 BACnet Virtual Memory

The complete data-set managed by ecocirc XLplus is accessible considering a BACnet virtual memory made exclusively of 2 objects: *Analog Values* (whose "Present_Value" Property is readable and writable) and *Analog Inputs* (whose "Present_Value" Property is readable).

6.1 *Virtual Memory – Analog Values table*

It is a set of Analogue Values objects, whose "Present_Value" Property is readable and writable [**R/W**], used for *standard settings*: generally the same operations or functions a user can perform/activate through the user interface.

OBJECT_ IDENTIFIER	OBJECT_NAME	UNITS	PRESENT_VALUE			Description
			MIN	MAX	DEF	
0	**ON OFF**	-	0	1	1	**OPERATING MODE** 0 = OFF 1 = ON
1	**OP. MODALITY**	-	1	3	2	**CONTROL MODE**[1] 1 = CONSTANT PRESSURE 2 = PROPORTIONAL PRESSURE 3 = CONSTANT CURVE
2	**NIGHT MODE**	-	0	1	0	**NIGHT-MODE ACTIVATION** 0 = NOT ACTIVE 1 = ACTIVE
3	**AIR VENTING**	-	0	1	1	**AIR VENTING PROCEDURE** 0 = NOT ACTIVE 1 = ACTIVE
4	**A. VEN. PWR ON**	-	0	1	1	**AIR VENTING POWER ON** 0 = NOT ACTIVE 1 = ACTIVE
5	**PROP. H S.P.**	[m]	2,40	10,00	5,00	**PROPORTIONAL PRESSURE SETPOINT**[2] (for CONTROL MODE = 2)
6	**CONST. H S.P.**	[m]	1,20	9,00	5,00	**CONSTANT PRESSURE SETPOINT**[2] (for CONTROL MODE = 1)
7	**RPM S.P.**	[rpm]	1500	4500	2000	**CONSTANT CURVE SETPOINT**[2] (for CONTROL MODE = 3)
8	**T REG. TYPE**	-	0	2	0	**TEMPERATURE CONTROL MODE** 0 = NOT ACTIVE 1 = PROP. TEMPERATURE TO HEAD 2 = CONSTANT TEMPERATURE
9	**ABS T S.P.**	[°C]	(-10)30	110	50	**ABSOLUTE TEMPERATURE SETPOINT**[3]
10	**DIFF T S.P.**	[°C]	5	30	20	**DIFFERENTIAL TEMPERATURE SETPOINT**

11	**T ACQ. TYPE**	-	0	2	0	**TEMPERATURE PROBE** 0 = INTERNAL 1 = EXTERNAL 2 = DIFFERENTIAL
12	**T SLOPE**	-	0	1	0	**TEMPERATURE SLOPE** 0 = INCREASING 1 = DECREASING
13	**KP CONST. T**	-	1	5000	50	**K_P FOR TEMPERATURE CONTROL**
14	**KI CONST. T**	-	0	500	5	**K_I FOR TEMPERATURE CONTROL**
15	**T PI PERIOD**	[ms]	100	10000	1000	**TEMPERATURE CONTROL SAMPLING TIME**
16	**CIRC. CONF**	-	0	2	2	**CIRCULATOR CONFIGURATION** 0 = TWIN MASTER 1 = TWIN SLAVE 2 = SINGLE
17	**TWIN MOD.**	-	0	3	1	**TWIN PUMPS CONTROL MODE** 0 = BACKUP 1 = ALTERNATE 2 = PARALLEL 3 = FORCED PARALLEL
18	**LOG IDX SEL.**	-	0	7	0	**DATA-LOG MATRIX ROW INDEX[4]**

[1] [CONTROL MODE = 0] is reserved for future implementation
[2] The MIN, MAX and DEFAULT value depends strictly on the pump model: values in the table are only for reference.
[3] In case [T REG. TYPE = 1], the ABSOLUTE TEMPERATURE SET POINT can be set from 30°C to 110°C.
In case [T REG. TYPE = 2], the ABSOLUTE TEMPERATURE SET POINT can be set from -10°C to 110°C.
[4] This object is the selection index (from 0 to 7) of one of the 8 errors stored in the error queue; all the other information related to each error can be collected using the Analog Input Objects from 28 to 43 (see par. 6.2)

6.2 *Virtual Memory – Analog Inputs table*

It is a set of Analogue Inputs objects, whose "Present_Value" Property is readable [**R**], used for *standard settings*: generally the same data a user can acquire through the user interface.

OBJECT_ IDENTIFIER	OBJECT_NAME	UNITS	PRESENT_VALUE			Description
			MIN	MAX	DEF	
0	**POWER**	[W]	...	...	...	**INPUT POWER**[1]
1	**CURR. H**	[m]	...	...	...	**HEAD [H]**Error! Bookmark not defined.
2	**CURR. Q**	[m^3/h]	...	...	...	**FLOW [Q]**Error! Bookmark not defined.
3	**CURR. RPM**	[rpm]	...	...	...	**SPEED**Error! Bookmark not defined.
4	**CAN TEMP**	[°C]	-20,0	130,0	...	**WATER TEMPERATURE**[2]
5	**EXT. TEMP**	[°C]	-20,0	130,0	...	**EXTERNAL WATER TEMPERATURE2**
6	**WIND 1 TEMP**	[°C]	0	255	...	**WINDING 1 TEMPERATURE**[3]
7	**WIND 2 TEMP**	[°C]	0	255	...	**WINDING 2 TEMPERATURE3**
8	**WIND 3 TEMP**	[°C]	0	255	...	**WINDING 3 TEMPERATURE3**
9	**MODULE TEMP**	[°C]	0	255	...	**POWER MODULE TEMPERATURE3**
10	**IQ**	[A]	...	...	...	**QUADRATURE CURRENT**Error! Bookmark not defined.
11	**IO B.F. STS**	-	0	65535	0	**BIT FIELDS STATUS I/O**[4] Bit 0: 0/10V SIGNAL STATUS Bit 1: 4/20mA SIGNAL STATUS Bit 2: START/STOP SIGNAL STATUS Bit 3: TEMP PROBE SIGNAL STATUS Bit 4 ÷ 7: N. U. Bit 8: OUTPUT RELAY STATUS Bit 9 ÷ 15: N. U.
12	**ALARM 1 B.F.**	-	0	65535	0	**BIT FIELDS ALARM 14** Bit 0: WATER PROBE ALARM (A1) Bit 1: WATER OVERTEMPERATURE ALARM (A2) Bit 2: POWER MODULE OVERTEMP. ALARM (A3) Bit 3: N. U. Bit 4: DATA MEMORY CORRUPTED ALARM (A5) Bit 5: EXT. WATER TEMP. PROBE ALARM[5] (A6) Bit 6: PRESSURE SENSOR ALARM (A7) Bit 7 ÷ 10: N. U. Bit 11: TWIN COMM. LOST[6] (A12) Bit 12: TWIN COMM. LOST[7] (A12) Bit 13 ÷ 15: N. U.

13	**ALARM 2 B.F.**	-	0	65535	0	**BIT FIELDS ALARM 24** Bit 0: INTERNAL ALARM[8] (A20) Bit 1: INTERNAL ALARM[9] (A20) Bit 2: INTERNAL ALARM[10] (A20) Bit 3: INTERNAL ALARM[11] (A20) Bit 4: INTERNAL ALARM[12] (A20) Bit 5: INTERNAL ALARM[13] (A20) Bit 6: INTERNAL ALARM[14] (A20) Bit 7 ÷ 15 = N.U.
14	**ERROR 1 B.F.**	-	0	65535	0	**BIT FIELDS ERRORS4** Bit 0: INTERNAL COMM. LOST (E1) Bit 1: MOTOR OVERLOAD (E2) Bit 2: DC-BUS OVERVOLTAGE (E3) Bit 3: TRIP CONTROL ERROR (E4) Bit 4: DATA MEMORY CORRUPTED ERROR[15] (E5) Bit 5: GRID VOLTAGE ERROR (E6) Bit 6: MOTOR WINDING TEMPERATURE ERROR (E7) Bit 7: POWER MODULE TEMPERATURE ERROR (E8)[16] Bit 8: NTC HW ERROR (E9)[17] Bit 9: DATA MEMORY CORRUPTED ERROR[18] (E5) Bit 10: DATA MEMORY CORRUPTED ERROR[19] (E5) Bit 11: DRY-RUN DETECT (E10) Bit 12: NTC POWER MODULE FAIL (E9) Bit 13: ROTOR BLOCKED (E4) Bit 14: MOTOR UNCONNECTED (E9) Bit 15 = N.U.
15	**CURR. ERROR**	-	0	65535	0	**ACTIVE ERROR CODE** 0 = NO ERROR 1 = INTERNAL COMM. LOST 2 = MOTOR OVERLOAD 3 = DC-BUS OVERVOLTAGE 4 = TRIP CONTROL ERROR 5 = DATA MEMORY CORRUPTED ERROR 6 = GRID VOLTAGE ERROR 7 = MOTOR WINDING TEMPERATURE ERROR 8 = POWER MODULE TEMPERATURE ERROR 9 = GENERIC HW ERROR 10 = DRY-RUN DETECT
16	**SLAVE PWR**	[W]	…	…	…	**TWIN SLAVE INPUT POWER**[Error! Bookmark not defined.]
17	**SLAVE H**	[m]	…	…	…	**TWIN SLAVE HEAD [H]**[Error! Bookmark not defined.]
18	**SLAVE Q**	[m^3/h]-	…	…	…	**TWIN SLAVE FLOW [Q]**[Error! Bookmark not defined.]
19	**SLAVE RPM**	[rpm]	…	…	…	**TWIN SLAVE SPEED**[Error! Bookmark not defined.]
20	**SLAVE W.1 T**	[°C]	0	255	…	**TWIN SLAVE WINDING 1 TEMPERATURE3**
21	**SLAVE W.2 T**	[°C]	0	255	…	**TWIN SLAVE WINDING 2 TEMPERATURE3**
22	**SLAVE W.3 T**	[°C]	0	255	…	**TWIN SLAVE WINDING 3 TEMPERATURE3**
23	**SLAVE MOD. T**	[°C]	0	255	…	**TWIN SLAVE POWER MODULE TEMPERATURE3**
24	**SLAVE IQ**	[A]	…	…	…	**TWIN SLAVE QUADRATURE CURRENT**[Error! Bookmark not defined.]

25	**SLAVE B.F. A1**	-	0	65535	0	**TWIN SLAVE BIT FIELDS ALARM 1[20]**
26	**SLAVE B.F. A2**	-	0	65535	0	**TWIN SLAVE BIT FIELDS ALARM 2[21]**
27	**SLAVE B.F. E2**	-	0	65535	0	**TWIN SLAVE BIT FIELDS ERRORS[22]**
28	**LOG ACT ERR**	-	0	10	0	**ACTIVE ERROR CODE X[23]**
29	**LOG ERR STA T**	[s]	0	4294967296	0	**START TIME ERROR X23**
30	**LOG ERR END T**	[s]	0	4294967296	0	**END TIME ERROR X23**
31	**LOG ERR B.F.**	-	0	65535	0	**BIT FIELDS ERROR X23**
32	**LOG ERR COUNT**	-	0	40000	0	**COUNTER ERROR X23**
33	**LOG RPM SET**	[rpm]	...	...	...	**SPEED SETPOINT23**
34	**LOG RPM VALUE**	[rpm]	...	...	...	**SPEED23**
35	**LOG IQ**	[A]	...	...	...	**QUADRATURE CURRENT23**
36	**LOG AL 1 B.F.**	-	0	65535	0	**BIT FIELDS ALARM 123**
37	**LOG AL 2 B.F.**	-	0	65535	0	**BIT FIELDS ALARM 223**
38	**LOG B.F. IO**	-	0	65535	0	**BIT FIELDS STATUS I/O23**
39	**LOG PWR**	[W]	...	...	...	**INPUT POWER23**
40	**LOG Q**	[m^3/h]-	...	...	...	**FLOW [Q]23**
41	**LOG H**	[m]-	...	...	...	**HEAD [H]23**
42	**LOG PWR M T**	[°C]	0	255	...	**POWER MODULE TEMPERATURE23**
43	**LOG ON-OFF**	-	0	1	1	**OPERATING MODE23**
44	-	-	-	-	-	-
45	-	-	-	-	-	-
46	-	-	-	-	-	-
47	-	-	-	-	-	-
48	**LIFE TMR**	[s]	0	4294967296	0	**LIFE TIMER**
49	**TMR P 0-25**	[s]	0	4294967296	0	**POWER CONSUMPTION 0-25 TIMER**
50	**TMR P 25-50**	[s]	0	4294967296	0	**POWER CONSUMPTION 25-50 TIMER**

51	**TMR P 50-75**	[s]	0	4294967296	0	**POWER CONSUMPTION 50-75 TIMER**
52	**TMR P 75-100**	[s]	0	4294967296	0	**POWER CONSUMPTION 75-100 TIMER**

[1] The MIN, MAX and DEFAULT value depends strictly on the pump model.
[2] If Present Value = 3.40282347e+38F the temperature probe could be in a fault condition.
[3] If Present Value = 255 the temperature probe could be in a fault condition.
[4] The Present Value of this Object has to be converted in a 16bit binary data (i.e. 35 ⇒ 0b0000000000100011).
[5] This alarm is enabled only if "TEMP. CONTROL MODE" is active (> 0)
[6] This bit field is enabled only in Twin Slave
[7] This bit field is enabled only in Twin Master
[8] This bit field refers to internal communication problem, specifically UNKNOWN COMMAND
[9] This bit field refers to internal communication problem, specifically INCORRECT DATA LENGTH
[10] This bit field refers to internal communication problem, specifically INCORRECT DATA VALUE
[11] This bit field refers to internal communication problem, specifically INCORRECT MOTOR CONFIGURATION
[12] This bit field refers to internal communication problem, specifically INCORRECT PWM FREQUENCY
[13] This bit field refers to internal communication problem, specifically PARAMETER NOT SAVED
[14] This bit field refers to internal communication problem, specifically COMMAND NOT ACCEPTED
[15] This bit field refers to EEPROM data corruption
[16] This bit field refers to over-temperature, probe open or shortened
[17] This bit field refers to stuck probe
[18] This bit field refers to factory data corruption
[19] This bit field refers to hydraulic maps corruption
[20] Bit Field alarm with the same active bits as in object 12
[21] Bit Field alarm with the same active bits as in object 13
[22] Bit Field error with the same active bits as in object 14
[23] Log information referring to error number X, selected by Analog Value object n°18 (see par. 6.1)