

# 1 Index

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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

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

## 4 BACnet Protocol Implementation Conformance Statement (PICS)

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

### 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)

|                                     |                                        |         |
|-------------------------------------|----------------------------------------|---------|
| <input type="checkbox"/>            | BACnet Advanced Workstation            | (B-AWS) |
| <input type="checkbox"/>            | BACnet Operator Workstation            | (B-OWS) |
| <input type="checkbox"/>            | BACnet Operator Display                | (B-OD)  |
| <input type="checkbox"/>            | BACnet Building Controller             | (B-BC)  |
| <input type="checkbox"/>            | BACnet Advanced Application Controller | (B-AAC) |
| <input type="checkbox"/>            | BACnet Application Specific Controller | (B-ASC) |
| <input type="checkbox"/>            | BACnet Smart Sensor                    | (B-SS)  |
| <input checked="" type="checkbox"/> | BACnet Smart Actuator                  | (B-SA)  |

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

### 4.4.1 Data sharing

|                                     |                                          |          |
|-------------------------------------|------------------------------------------|----------|
| <input type="checkbox"/>            | Data Sharing – Read Property-A           | DS-RP-A  |
| <input checked="" type="checkbox"/> | Data Sharing – Read Property-B           | DS-RP-B  |
| <input type="checkbox"/>            | Data Sharing – Read Property Multiple-A  | DS-RPM-A |
| <input type="checkbox"/>            | Data Sharing – Read Property Multiple-B  | DS-RPM-B |
| <input type="checkbox"/>            | Data Sharing – Write Property-A          | DS-WP-A  |
| <input checked="" type="checkbox"/> | Data Sharing – Write Property-B          | DS-WP-B  |
| <input type="checkbox"/>            | Data Sharing – Write Property Multiple-A | DS-WPM-A |
| <input type="checkbox"/>            | Data Sharing – Write Property Multiple-B | DS-WPM-B |
| <input type="checkbox"/>            | Data Sharing – Change of Value-A         | DS-COV-A |
| <input type="checkbox"/>            | Data Sharing – Change of Value-B         | DS-COV-B |

|                          |                                              |           |
|--------------------------|----------------------------------------------|-----------|
| <input type="checkbox"/> | Data Sharing – Change of Value Property-A    | DS-COVP-A |
| <input type="checkbox"/> | Data Sharing – Change of Value Property-B    | DS-COVP-B |
| <input type="checkbox"/> | Data Sharing – Change of Value Unsolicited-A | DS-COVU-A |
| <input type="checkbox"/> | Data Sharing – Change of Value Unsolicited-B | DS-COVU-B |
| <input type="checkbox"/> | Data Sharing – View-A                        | DS-V-A    |
| <input type="checkbox"/> | Data Sharing – Advanced View-A               | DS-AV-A   |
| <input type="checkbox"/> | Data Sharing – Modify-A                      | DS-M-A    |
| <input type="checkbox"/> | 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

|                                     |                                                     |          |
|-------------------------------------|-----------------------------------------------------|----------|
| <input type="checkbox"/>            | Device Management – Dynamic Device Binding-A        | DM-DDB-A |
| <input checked="" type="checkbox"/> | Device Management – Dynamic Device Binding-B        | DM-DDB-B |
| <input type="checkbox"/>            | Device Management – Dynamic Object Binding-A        | DM-DOB-A |
| <input type="checkbox"/>            | Device Management – Dynamic Object Binding-B        | DM-DOB-B |
| <input type="checkbox"/>            | Device Management – Device Communication Control-A  | DM-DCC-A |
| <input type="checkbox"/>            | Device Management – Device Communication Control -B | DM-DCC-B |
| <input type="checkbox"/>            | Device Management – Private Transfer-A              | DM-PT-A  |
| <input type="checkbox"/>            | Device Management – Private Transfer-B              | DM-PT-B  |
| <input type="checkbox"/>            | Device Management – Text Message-A                  | DM-TM-A  |
| <input type="checkbox"/>            | Device Management – Text Message-B                  | DM-TM-B  |
| <input type="checkbox"/>            | Device Management – Time Synchronization-A          | DM-TS-A  |
| <input type="checkbox"/>            | Device Management – Time Synchronization-B          | DM-TS-B  |
| <input type="checkbox"/>            | Device Management – UTC Time Synchronization-A      | DM-UTC-A |
| <input type="checkbox"/>            | Device Management – UTC Time Synchronization-B      | DM-UTC-B |
| <input type="checkbox"/>            | Device Management – Reinitialize Device-A           | DM-RD-A  |
| <input type="checkbox"/>            | Device Management – Reinitialize Device-B           | DM-RD-B  |
| <input type="checkbox"/>            | Device Management – Backup and Restore-A            | DM-BR-A  |
| <input type="checkbox"/>            | Device Management – Backup and Restore-B            | DM-BR-B  |

|                          |                                                      |          |
|--------------------------|------------------------------------------------------|----------|
| <input type="checkbox"/> | Device Management – Restart-A                        | DM-R-A   |
| <input type="checkbox"/> | Device Management – Restart-B                        | DM-R-B   |
| <input type="checkbox"/> | Device Management – List Manipulation-A              | DM-LM-A  |
| <input type="checkbox"/> | Device Management – List Manipulation-B              | DM-LM-B  |
| <input type="checkbox"/> | Device Management – Object Creation and Deletion-A   | DM-OCD-A |
| <input type="checkbox"/> | Device Management – Object Creation and Deletion-B   | DM-OCD-B |
| <input type="checkbox"/> | Device Management – Virtual Terminal-A               | DM-VT-A  |
| <input type="checkbox"/> | Device Management – Virtual Terminal-B               | DM-VT-B  |
| <input type="checkbox"/> | Device Management – Automatic Network Mapping-A      | DM-ANM-A |
| <input type="checkbox"/> | Device Management – Automatic Device Mapping-A       | DM-ADM-A |
| <input type="checkbox"/> | Device Management – Automatic Time Synchronization-A | DM-ATS-A |
| <input type="checkbox"/> | 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 (*)  | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Analog Output     | <input type="checkbox"/>            | <input type="checkbox"/> | <input type="checkbox"/> |
| Analog Value (**) | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

(\*) 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

|                                     |                                                        |                                             |
|-------------------------------------|--------------------------------------------------------|---------------------------------------------|
| <input type="checkbox"/>            | BACnet IP, (Annex J)                                   |                                             |
| <input type="checkbox"/>            | BACnet IP, (Annex J), Foreign Device                   |                                             |
| <input type="checkbox"/>            | ISO 8802-3, Ethernet (Clause 7)                        |                                             |
| <input type="checkbox"/>            | ANSI/ATA 878.1, 2.5Mb. ARCNET (Clause 8)               |                                             |
| <input type="checkbox"/>            | ANSI/ATA 878.1, 2.5Mb. ARCNET (Clause 8), baud rate(s) |                                             |
| <input checked="" type="checkbox"/> | MS/TP master (Clause 9), baud rate(s)                  | 4800<br>9600<br>14400<br>19200<br>38400 (*) |

|                          |                                                   |                |
|--------------------------|---------------------------------------------------|----------------|
|                          |                                                   | 56000<br>57600 |
| <input type="checkbox"/> | MS/TP slave (Clause 9), baud rate(s)              |                |
| <input type="checkbox"/> | Point-To-Point, EIA 232 (Clause 10), baud rate(s) |                |
| <input type="checkbox"/> | Point-To-Point, modem (Clause 10), baud rate(s)   |                |
| <input type="checkbox"/> | LonTalk (Clause 11), medium                       |                |
| <input type="checkbox"/> | 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? | <input type="checkbox"/> Yes | <input checked="" type="checkbox"/> 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    | <b>OPERATING MODE</b><br>0 = OFF<br>1 = ON                                                                     |
| 1                 | OP. MODALITY   | -     | 1             | 3     | 2    | <b>CONTROL MODE<sup>1</sup></b><br>1 = CONSTANT PRESSURE<br>2 = PROPORTIONAL PRESSURE<br>3 = CONSTANT CURVE    |
| 2                 | NIGHT MODE     | -     | 0             | 1     | 0    | <b>NIGHT-MODE ACTIVATION</b><br>0 = NOT ACTIVE<br>1 = ACTIVE                                                   |
| 3                 | AIR VENTING    | -     | 0             | 1     | 1    | <b>AIR VENTING PROCEDURE</b><br>0 = NOT ACTIVE<br>1 = ACTIVE                                                   |
| 4                 | A. VEN. PWR ON | -     | 0             | 1     | 1    | <b>AIR VENTING POWER ON</b><br>0 = NOT ACTIVE<br>1 = ACTIVE                                                    |
| 5                 | PROP. H S.P.   | [m]   | 2,40          | 10,00 | 5,00 | <b>PROPORTIONAL PRESSURE SETPOINT<sup>2</sup></b><br>(for CONTROL MODE = 2)                                    |
| 6                 | CONST. H S.P.  | [m]   | 1,20          | 9,00  | 5,00 | <b>CONSTANT PRESSURE SETPOINT<sup>2</sup></b><br>(for CONTROL MODE = 1)                                        |
| 7                 | RPM S.P.       | [rpm] | 1500          | 4500  | 2000 | <b>CONSTANT CURVE SETPOINT<sup>2</sup></b><br>(for CONTROL MODE = 3)                                           |
| 8                 | T REG. TYPE    | -     | 0             | 2     | 0    | <b>TEMPERATURE CONTROL MODE</b><br>0 = NOT ACTIVE<br>1 = PROP. TEMPERATURE TO HEAD<br>2 = CONSTANT TEMPERATURE |
| 9                 | ABS T S.P.     | [°C]  | (-10)30       | 110   | 50   | <b>ABSOLUTE TEMPERATURE SETPOINT<sup>3</sup></b>                                                               |
| 10                | DIFF T S.P.    | [°C]  | 5             | 30    | 20   | <b>DIFFERENTIAL TEMPERATURE SETPOINT</b>                                                                       |

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

<sup>1</sup> [CONTROL MODE = 0] is reserved for future implementation

<sup>2</sup> The MIN, MAX and DEFAULT value depends strictly on the pump model: values in the table are only for reference.

<sup>3</sup> 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.

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

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

|    |               |                      |     |            |     |                                             |
|----|---------------|----------------------|-----|------------|-----|---------------------------------------------|
| 25 | SLAVE B.F. A1 | -                    | 0   | 65535      | 0   | TWIN SLAVE BIT FIELDS ALARM 1 <sup>20</sup> |
| 26 | SLAVE B.F. A2 | -                    | 0   | 65535      | 0   | TWIN SLAVE BIT FIELDS ALARM 2 <sup>21</sup> |
| 27 | SLAVE B.F. E2 | -                    | 0   | 65535      | 0   | TWIN SLAVE BIT FIELDS ERRORS <sup>22</sup>  |
| 28 | LOG ACT ERR   | -                    | 0   | 10         | 0   | ACTIVE ERROR CODE X <sup>23</sup>           |
| 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 <sup>3</sup> /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 |

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