DTS BACnet/IP Map
Version 2.0U

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1 SCOPE

1.1 IDENTIFICATION

This is a universal document that describes the BACnet Communications Object specification for the Measurlogic family of AC and DC energy sub-meters and transducers. Features are model dependent.

This document applies to models **DTS 305**, **DTS 310**, **DTS SMX**, **DTS SKTD** and **DTS DC**.

1.2 INTRODUCTION

The DTS family of meters is a range of compact DIN-rail, panel, weatherproof or socket mounted energy meters and transducers, with communications and I/O capability. Models are available for single-phase, 3-Phase 2 or 4-Quadrant, and DC measurement applications. Some models are available with optional backlit LCD display.

The remote communications is provided through:

- An Ethernet port using the BACnet IP protocol. The IP address of each device must be unique as per normal TCP networking requirements. In addition, there cannot be more than one BACnet device on the network with the same Device Object ID.

Unless specified**, the default BACnet Device Object ID will be 100**. This may be viewed and changed using the "Device_ID" object. See section 2.4.2 for details.

In addition to the primary BACnet IP protocol, Modbus/TCP is also available for configuration purposes only using DTSConfig.

NOTE

Capabilities are model dependant, so some registers may not be applicable to certain models.

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2 BACNET INTERFACE SPECIFICATION

2.1 GENERAL INFORMATION

2.1.1 BACnet Object_Types and Properties

The measured values of the AC and DC energy sub-meters and transducers are exposed using BACnet Objects and Properties. For convenience, all the DTS registers are arranged in the same space, and since some registers can be written, Analog_Output Objects were chosen for everything.

The following BACnet objects are supported:

- Device
- Analog_Output
- Digital_Output

The Analog_Output Instance_Number determines the information reported by that object. The value of the Object is contained in the Present_Value property. All Present_Value properties are 32-bit "float" values. As such they are able to represent floating point values, so always represent the appropriate engineering units, and thus no scaling is required. The Object_Name property contains the name of measurement quantity.

Therefore, the Objects in the tables below are all Analog_Output Objects. The tables show the Object_Name and the Object Instance_Number for each measurement quantity. Instance_Numbers are 1-based numbers.

The minimum and maximum values for same measurement values are considered separate Object Instances, each with there own Instance_Number. The value is contained in the Present_Value property.

In order to provide a compact table, Instantaneous, Minimum and Maximum Instances are shown in different columns. The Object_Name of the Instantaneous value is shown in the table. To determine the Object_Name of the Minimum or Maximum Object simply append "_Min" or "_Max" respectively to the Object_Name.

2.1.2 Measurement Object Subsets

Depending on the meter model, and also on the way in which the meter is connected and configured, not all of the available channels may be used, and thus not all of the measurement objects described in this document will be applicable. If only one or two channels are connected, then only objects applicable to those channels will contain measurement information. In addition, objects that contain processed information, such as Total or Average, will also contain valid information.

2.1.3 The Device Object

The ObjectName, VendorIdentifier and VendorName properties of the BACnet Device Object are also available for reading. The Device.ObjectName may be set by simply writing to that object from your BACnet host. Up to 31 alphanumeric characters are permitted. (Make sure that this object is marked as read/write in your BACnet host

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2.1.4 Power and Energy Register Resolutions and Roll Over

In order to handle the very wide range of possible Power and Energy values due to the flexibility of the DTS Family, it is necessary to vary the internal register resolution according to the total power levels being measured. The internal register resolutions for the power and the energy registers are the same, therefore a finer resolution provides more significant digits of measured power values, but decreases the total energy accumulation time before the energy registers overflow, and visa versa. The following table shows the ***suggested*** resolutions for various Total Power ranges. These provide 4 or 5 significant digits of power, while still allowing energy to accumulate for over a year before the register overflows:

Total Power			Register Resolution	EnerPowDivider	Energy Roll Over
		< 10 kW	0.1 W	100	99,999.9999 kWh
>= 10 kW	and	< 100 kW	1 W	1,000	999,999.999 kWh
>= 100 kW	and	< 1 MW	10 W	10,000	9,999,999.99 kWh
>= 1 MW	and	< 10 MW	100 W	100,000	99,999,999.9 kWh
>= 10 MW	and	< 100 MW	1 kW	1,000,000	999,999,999 kWh
>= 100 MW	and	< 1 GW	10 kW	10,000,000	9,999,999,990 kWh
>= 1 GW	and	< 10 GW	100 kW	100,000,000	99,999,999,900 kWh

The internal 32-bit energy registers always contain nine significant digits, so will accumulate up to 999,999,999 and then rollover to zero. The rollover point for different energy resolutions is also shown in the table above. ***For example:***

Example Service	Total Power	Register Resolution	EnerPowDivider	Energy Roll Over
Single Phase 3-Wire 120V/240V 200A	48 kW	1 W	1,000	999,999.999 kWh
3-Phase 3/4-Wire 120V/208V 600A	216 kW	10 W	10,000	9,999,999.99 kWh
3-Phase 3-Wire 277V/480V 3000A	2.5 MW	100 W	100,000	99,999,999.9 kWh

An internal divider, called "EnerPowDivider", is used to scale the register resolution of the Power and Energy registers values. The default value of the "EnerPowDivider" in the DTS is 100, which represents a resolution of 0.1W. The value of "EnerPowDivider" can be obtained from object 8023.

When using DTS Config to configure the attached DTS, the "EnerPowDivider", and hence the resolution scaling, is automatically configured according to the ranges in the above table. When manually configuring the DTS by setting the service voltage and current directly from the host application, it will also be necessary to manually setup "EnerPowDivider" according to the ranges in the above table.

BACnet PresentValues are floating point values, and the EnerPowDivider has already been used to scale the value so that is always in the standard "unit" form (e.g. Wh). There will still be a "resolution" in terms of the smallest difference in the numbers as they increment. For example: If the resolution is 10W, then the numbers jump by 0.01kWh, so they will go 0.0, 0.01, 0.02, 0.03 kWh etc. Remember though, that BACnet PresentValue objects are 32-bit floating point values, so there are only about 7 significant digits in the mantissa.

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2.2 AC MEASUREMENT REGISTERS

2.2.1 Measurement Values

Object_Name		Units	Object Instance_Number Instantaneous	Minimum	Maximum
Voltage_LN_1		V	5501	5801	6101
Voltage_LN_2		V	5502	5802	6102
Voltage_LN_3		V	5503	5803	6103
Voltage_LN_Average		V	5504	5804	6104
Voltage_LL_12		V	5505	5805	6105
Voltage_LL_23		V	5506	5806	6106
Voltage_LL_31		V	5507	5807	6107
Voltage_LL_Average		V	5508	5808	6108
Current_1		A	5513	5813	6113
Current_2		A	5514	5814	6114
Current_3		A	5515	5815	6115
Current_Average		A	5516	5816	6116
Current_Total		A	5517	5817	6117
Current_Neutral		A	5518	5818	6118
Frequency_1		Hz	5521	5821	6121
Frequency_2		Hz	5522	5822	6122
Frequency_3		Hz	5523	5823	6123
Frequency_Average		Hz	5524	5824	6124
PowerP_1	(Active)	W	5525	5825	6125
PowerP_2		W	5526	5826	6126
PowerP_3		W	5527	5827	6127
PowerP_Total		W	5528	5828	6128
PowerS_1	(Apparent)	VA	5529	5829	6129
PowerS_2		VA	5530	5830	6130
PowerS_3		VA	5531	5831	6131
PowerS_Total		VA	5532	5832	6132
PowerQ_1	(Reactive)	VAR	5533	5833	6133
PowerQ_2		VAR	5534	5834	6134
PowerQ_3		VAR	5535	5835	6135
PowerQ_Total		VAR	5536	5836	6136
DemandP_Total	(Active)	W	5629	5929	6229
PowerFactor_DTS_1			5551	5851	6151
PowerFactor_DTS_2			5552	5852	6152
PowerFactor_DTS_3			5553	5853	6153
PowerFactor_DTS_Overall			5554	5854	6154

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2.2.2 Measurement Values (Continued)

Object_Name	Units	Object Instance_Number Instantaneous	Minimum	Maximum
ACosPF_1	deg	5563	5863	6163
ACosPF_2	deg	5564	5864	6164
ACosPF_3	deg	5565	5865	6165
ACosPF_Overall	deg	5566	5866	6166
Voltage_Unbalance_LN_1	%	5571	5871	6171
Voltage_Unbalance_LN_2	%	5572	5872	6172
Voltage_Unbalance_LN_3	%	5573	5873	6173
Voltage_Unbalance_LN_Worst	%	5574	5874	6174
Voltage_Unbalance_LL_12	%	5575	5875	6175
Voltage_Unbalance_LL_23	%	5576	5876	6176
Voltage_Unbalance_LL_31	%	5577	5877	6177
Voltage_Unbalance_LL_Worst	%	5578	5878	6178
Current_Unbalance_1	%	5579	5879	6179
Current_Unbalance_2	%	5580	5880	6180
Current_Unbalance_3	%	5581	5881	6181
Current_Unbalance_Worst	%	5582	5882	6182
Current_SingleCycle_1	A	5613	5913	6213
Current_SingleCycle_2	A	5614	5914	6214
Current_SingleCycle_3	A	5615	5915	6215
Current_SingleCycle_Average	A	5616	5916	6216
Current_SingleCycle_Total	A	5617	5917	6217

NOTES

1. **Current_Neutral** is only available in meters with firmware V2.40 or later.

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2.2.3 Measurement Nett Counter Values

These counters contain the **nett** energy values. By convention, imported/consumed energies are positive, and exported/generated energies are negative. Therefore, the values in these counters may be positive or negative.

Object_Name		Units	Object Instance_Number Instantaneous
EnergyP_1	(Active)	Wh	7001
EnergyP_2		Wh	7002
EnergyP_3		Wh	7003
EnergyP_Total		Wh	7004
EnergyS_1	(Apparent)	VAh	7005
EnergyS_2		VAh	7006
EnergyS_3		VAh	7007
EnergyS_Total		VAh	7008
EnergyQ_1	(Reactive)	VARh	7009
EnergyQ_2		VARh	7010
EnergyQ_3		VARh	7011
EnergyQ_Total		VARh	7012

2.2.4 Measurement Split Counter Values (Advanced use only)

These counters contain the energies that have been accumulated in each operational area, and are therefore always positive values. There are import/consumed and exported/generated counters for both the active and reactive hemispheres. Similarly, each of the four quadrants each have active and reactive counters.

Object_Name	Units	Object Instance_Number Instantaneous
EnergyP_Total_Imp	Wh	7013
EnergyP_Total_Exp	Wh	7014
EnergyQ_Total_Imp	VARh	7015
EnergyQ_Total_Exp	VARh	7016
EnergyP_Total_Q1	Wh	7017
EnergyQ_Total_Q1	VARh	7018
EnergyP_Total_Q2	Wh	7019
EnergyQ_Total_Q2	VARh	7020
EnergyP_Total_Q3	Wh	7021
EnergyQ_Total_Q3	VARh	7022
EnergyP_Total_Q4	Wh	7023
EnergyQ_Total_Q4	VARh	7024

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2.3 DC MEASUREMENT REGISTERS

2.3.1 Measurement & Counter Values

Object_Name		Units	Object Instance_Number Instantaneous	Minimum	Maximum
Voltage_DC		V	5501	5801	6101
Current_DC		A	5513	5813	6113
Power_DC		W	5525	5825	6125
Demand_DC		W	5629	5929	6229
Energy_DC	(Nett)	Wh	7001		
Energy_DC_Imp	(Consumed)	Wh	7013		
Energy_DC_Exp	(Generated)	Wh	7014		

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2.4 OTHER REGISTERS

2.4.1 Special Objects

Object_Name	Units	Object Instance_Number Instantaneous
DTS_SerialNumber		5002
DTS_FW_Version		5005
DTS_Model_ID		5008
VoltagePrimary	V	8001
VoltageSecondary	V	8002
CurrentPrimary	A	8005
CurrentSecondary	A	8006
EnerPowDivider		8023

2.4.2 Communications Objects

Object_Name		Units	Object Instance_Number Instantaneous	
Device_ID	(Node_ID)		8086	1 - 4,194,303

NOTES

Unless specified**, the default BACnet Device Object ID will be 100**. This many be viewed and changed using the "Device_ID" object. The allowable range is 1 to 4,194,303. If this object is set to a value outside this range, the Device_ID will NOT be changed.

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2.4.3 Input & Output Status

AnalogOutput Object_Name		Object Instance_Number Object Instance	AnalogOutput Value	BinaryOutput Value	BinaryOutput Object_Name
IO_Channel_1	(AO/DO/DI)	7651	See Below	0 or 1	DO_Channel_1
IO_Channel_2	(AO/DO/DI)	7652	See Below	0 or 1	DO_Channel_2
IO_Channel_3	(AO/DO/DI)	7653	See Below	0 or 1	DO_Channel_3
IO_Channel_4	(AO/DO/DI)	7654	See Below	0 or 1	DO_Channel_4
IO_Channel_5	(AO/DO/DI)	7655	See Below	0 or 1	DO_Channel_5
IO_Channel_6	(AO/DO/DI)	7656	See Below	0 or 1	DO_Channel_6
IO_Channel_A	(DO/DI)	7659	See Below	0 or 1	DO_Channel_A
IO_Channel_B	(DO/DI)	7660	See Below	0 or 1	DO_Channel_B
IO_Channel_C	(DO/DI)	7661	See Below	0 or 1	DO_Channel_C
IO_Channel_D	(DO/DI)	7662	See Below	0 or 1	DO_Channel_D
InputStatus_A	(DI)	7663	See Below		DI_Channel_A
InputStatus_B	(DI)	7664	See Below		DI_Channel_B
InputStatus_C	(DI)	7665	See Below		DI_Channel_C
InputStatus_D	(DI)	7666	See Below		DI_Channel_D
IO_Channel_11	(DO)	7667	See Below	0 or 1	DO_Channel_11
IO_Channel_12	(DO)	7668	See Below	0 or 1	DO_Channel_12
IO_Channel_13	(DO)	7669	See Below	0 or 1	DO_Channel_13
IO_Channel_14	(DO)	7670	See Below	0 or 1	DO_Channel_14
IO_Channel_15	(DO)	7671	See Below	0 or 1	DO_Channel_15
IO_Channel_16	(DO)	7672	See Below	0 or 1	DO_Channel_16
IO_Channel_17	(DO)	7673	See Below	0 or 1	DO_Channel_17
IO_Channel_18	(DO)	7674	See Below	0 or 1	DO_Channel_18

The Present_Value of the Analog_Outputs and Binary_Outputs depends on the type of I/O fitted:

AO (Analog Output): The Analog_Output value represents the value of the analog output normalized to the rated output, and where 1,000,000 represents 1.0x. Binary_Outputs are not defined here and will always read as zero.

DO (Digital Output) & DI (Digital Input): The Analog_Output value is either the debounced status of the line, or the numbers of unprocessed pulses, depending on whether the Digital I/O is being used for status or counting respectively, as configured using DTSConfig. The Binary_Outputs always reflects the status of the Digital I/O line irrespective of usage.

Note that BinaryOutputs are only available for firmware V2.29 and later.

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2.4.4 Manual Setting of Digital Outputs (Advanced use only)

Normally the digital output mapping is configured using the "Configure | Outputs" screen in DTSConfig. In order to manually set and clear the digital outputs, the mapping for that output must first be set to "None". The values that should be written to a special Object 40001 in order to set and clear the digital outputs are shown in the table. Note that Present_Value will be reset to zero when the specified action is completed.

		Object Instance_Number		
Action	**Object_Name**		**Set Value**	**Clear Value**
Set or Clear Output A	DTS_Command	20001	2282225665	2282225664
Set or Clear Output B	DTS_Command	20001	2282291201	2282291200
Set or Clear Output C	DTS_Command	20001	2282356737	2282356736
Set or Clear Output D	DTS_Command	20001	2282422273	2282422272

2.4.5 General Counters

	Object Instance_Number
Object_Name	**Instantaneous**
GeneralCounter_1	7041
GeneralCounter_2	7042
GeneralCounter_3	7043
GeneralCounter_4	7044

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2.4.6 Input and Output Capabilities

The possible number and type of inputs and outputs will vary depending on the DTS model. Furthermore, the number and type of inputs and outputs actually fitted to any particular meter is determined by the options specified at the time of ordering.

Channel	DTS-305	DTS-310	DTS-SMX	DTS-SKTD	DTS-DC
IO_Channel_1	AO/DO	DO/DI	DO/DI	DO	DO/DI
IO_Channel_2	AO/DO	DO/DI	DO/Di		DO/DI
IO_Channel_3	AO/DO	DO	DO		DO
IO_Channel_4	AO/DO				
IO_Channel_5	AO/DO				
IO_Channel_6	AO/DO				
IO_Channel_A	DO				
IO_Channel_B	DO				
IO_Channel_C	DO				
IO_Channel_D/Pulse	DO				
InputStatus_A	DI				
InputStatus_B	DI				
InputStatus_C	DI				
InputStatus_D	DI				
IO_Channel_11			DO		
IO_Channel_12			DO		
IO_Channel_13			DO		
IO_Channel_14			DO		
IO_Channel_15			DO		
IO_Channel_16			DO		
IO_Channel_17			DO		
IO_Channel_18			DO		

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2.5 PICS (BACnet Protocol Implementation Conformance Statement)

- Vendor Name: Measurlogic Inc
- Vendor ID 473
- Product Name: DTS Family
- Product Model Numbers: DTS 305, DTS 310, DTS SMX, DTS SKTD and DTS DC
- Product Description: A range of 3-Phase 4-Quadrant energy meters and transducers.
- Product Type: Controller

2.5.1 BACnet Standarized Device Profile (Annex L)

- ☒ BACnet Smart Sensor (B-SS)
- ☒ BACnet Smart Actuator (B-SA)
- ☒ BACnet Application Specific Controller (B-ASC)

2.5.2 BACnet Interoperability Building Blocks Supported (Annex K)

- ☒ K.1.2 BIBB - Data Sharing - ReadProperty-B (DS-RP-B)
- ☒ K.1.8 BIBB - Data Sharing - WriteProperty-B (DS-WP-B)
- ☒ K.1.9 BIBB - Data Sharing - WritePropertyMultiple-A (DS-WPM-A)
- ☒ K.1.10 BIBB - Data Sharing - WritePropertyMultiple-B (DS-WPM-B)
- ☒ K.1.12 BIBB - Data Sharing - COV-B (DS-COV-B)
- ☒ K.2.2 BIBB - Alarm and Event-Notification Internal-B (AE-N-I-B)
- ☒ K.5.2 BIBB - Device Management - Dynamic Device Binding-B (DM-DDB-B)

2.5.3 Segmentation Capability

None

2.5.4 Standard Object Types Supported

- ☒ Device Object
- ☒ Analog Input
- ☒ Analog Output
- ☒ Analog Value
- ☒ Binary Input
- ☒ Binary Output
- ☒ Binary Value
- ☒ Multi State Input Output
- ☒ Multi State Output
- ☒ Multi State Value

Although the DTS is capable of all these Objects Types, only Device, Analog Output and Binary Output Object Types are used.

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2.5.5 Unsupported Properties and Restrictions

- Does not support BACnet CreateObject
- Does not support BACnet DeleteObject
- Does not support any optional properties
- No additional writeable properties exist
- No proprietary properties exist
- No range restrictions exist
- As a Client, the DTS supports reading the Present_Value of multiple sequential objects only.
  - For BACnet IP the maximum length that a DTS can poll is as follows:
    - Digital Values – 114
    - Analog/Multi-State Values – 92

2.5.6 Data Link Layer Options

☒ BACnet IP, (Annex J)

2.5.7 Device Address Binding

Not Supported

2.5.8 Character Sets Supported

Where support for multiple character sets is indicated, this does not imply that they can all be supported simultaneously.

☒ ANSI X3.4.
☐ ISO 10646 (UCS-2).
☐ IBM/Microsoft DBCS
☐ ISO 10646 (ICS-4)
☐ ISO 8859-1
☐ JIS C

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