DTS DNP3.0 Map
Version 1.8U

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1 SCOPE

1.1 IDENTIFICATION

This is a universal document that describes the DNP3.0 Communications Point 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** 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 DNP3.0 Ethernet protocol. The IP address of each device must be unique as per normal TCP networking requirements.

Unless specified**, the default DNP address 100**.

In addition to the primary DNP3.0 Ethernet 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 DNP3.0 INTERFACE SPECIFICATION

2.1 GENERAL INFORMATION

2.1.1 DNP Object Point Registers

The measured values of the AC and DC energy sub-meters and transducers are exposed as DNP3 Objects within the DNP Object Groups.

The DNP implementation is Level 2, and the following DNP3.0 Object Groups are supported:

- 1 – Binary Inputs Data Class 1 Variation 1, 2
- 10 – Binary Outputs Data Class 0 Variation 2
- 20 – Counters Data Class 3 Variation 1,2,5,6
- 21 – Frozen Counters
- 30 – Analog Inputs Data Class 2 Variation 1,2,3,4
- 40 – Analog Outputs Data Class 0 Variation 2

The Index determines the specific Object within the Data Object Group, and is 0-based as per DNP naming conventions. The value of the Object is contained in the Value property. The native storage format for all objects in the DTS meters is **signed 32-bit values**, so that is the optimal Data Type to request. The resolution of each Object is given in the tables below.

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 Oblects described in this document will be applicable. If only one or two channels are connected, then only registers 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.

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2.1.3 Power and Energy Object 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 Object register resolution according to the total power levels being measured. The Object 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 Analog Input object 14.

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.

In order to obtain the engineering value of a power or energy, the values read from the power or energy registers must be scaled using a simple formula based on the value in the "EnerPowDivider".

EngineeringValue = RegisterValue * EnerPowDivider * 0.001 (W)

This equation produces engineering values in Watts. If kWatts are required, simply divide again by 1000.

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2.2 AC MEASUREMENT REGISTERS

2.2.1 Measurement Values

Analog Inputs, Group 30, Data Class 2

Description		Units	Resolution	Object Index Instantaneous
Voltage_LN_1		V	0.1	100
Voltage_LN_2		V	0.1	101
Voltage_LN_3		V	0.1	102
Voltage_LN_Average		V	0.1	103
Voltage_LL_12		V	0.1	104
Voltage_LL_23		V	0.1	105
Voltage_LL_31		V	0.1	106
Voltage_LL_Average		V	0.1	107
Current_1		A	0.001	112
Current_2		A	0.001	113
Current_3		A	0.001	114
Current_Average		A	0.001	115
Current_Total		A	0.001	116
Current_Neutral		A	0.001	117
Frequency_1		Hz	0.01	120
Frequency_2		Hz	0.01	121
Frequency_3		Hz	0.01	122
Frequency_Average		Hz	0.01	123
PowerP_1	(Active)	W	See pg 4	124
PowerP_2		W	See pg 4	125
PowerP_3		W	See pg 4	126
PowerP_Total		W	See pg 4	127
PowerS_1	(Apparent)	VA	See pg 4	128
PowerS_2		VA	See pg 4	129
PowerS_3		VA	See pg 4	130
PowerS_Total		VA	See pg 4	131
PowerQ_1	(Reactive)	VAR	See pg 4	132
PowerQ_2		VAR	See pg 4	133
PowerQ_3		VAR	See pg 4	134
PowerQ_Total		VAR	See pg 4	135

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2.2.2 Measurement Values (Continued)

Analog Inputs, Group 30, Data Class 2 Description		Units	Resolution	Object Index Instantaneous
PowerFactor_DTS_1		Special	1/32767	150
PowerFactor_DTS_2		Special	1/32767	151
PowerFactor_DTS_3		Special	1/32767	152
PowerFactor_DTS_Overall		Special	1/32767	153
ACosPF_1		deg	0.1	162
ACosPF_2		deg	0.1	163
ACosPF_3		deg	0.1	164
ACosPF_Overall		deg	0.1	165
DemandP_Total	(Active)	W	See pg 4	84
DemandP_Total_Max	(Active)	W	See pg 4	88

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2.2.3 Measurement Nett Energy 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.

Analog Inputs, Group 30, Data Class 2 Description		Units	Resolution	Object Index Instantaneous
EnergyP_1	(Active)	Wh	See pg 4	60
EnergyP_2		Wh	See pg 4	61
EnergyP_3		Wh	See pg 4	62
EnergyP_Total		Wh	See pg 4	63
EnergyS_1	(Apparent)	VAh	See pg 4	64
EnergyS_2		VAh	See pg 4	65
EnergyS_3		VAh	See pg 4	66
EnergyS_Total		VAh	See pg 4	67
EnergyQ_1	(Reactive)	VARh	See pg 4	68
EnergyQ_2		VARh	See pg 4	69
EnergyQ_3		VARh	See pg 4	70
EnergyQ_Total		VARh	See pg 4	71

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2.2.4 Measurement Counter Values

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.

Counters, Group 20 & 21, Data Class 3 Description	Units	Resolution	Object Index Instantaneous
EnergyP_Total_Imp	Wh	See pg 4	0
EnergyP_Total_Exp	Wh	See pg 4	1
EnergyQ_Total_Imp	VARh	See pg 4	2
EnergyQ_Total_Exp	VARh	See pg 4	3
EnergyP_Total_Q1	Wh	See pg 4	4
EnergyQ_Total_Q1	VARh	See pg 4	5
EnergyP_Total_Q2	Wh	See pg 4	6
EnergyQ_Total_Q2	VARh	See pg 4	7
EnergyP_Total_Q3	Wh	See pg 4	8
EnergyQ_Total_Q3	VARh	See pg 4	9
EnergyP_Total_Q4	Wh	See pg 4	10
EnergyQ_Total_Q4	VARh	See pg 4	11

Important Note

Counter Values in DNP are unsigned values, therefore the nett energies cannot be represented in the Counter Group. The Nett Energy values can be found in the Analog Inputs group.

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2.3 DC MEASUREMENT REGISTERS

2.3.1 Measurement Values

Analog Inputs, Group 30, Data Class 2

Description		Units	Resolution	Object Index Instantaneous	Object Index Minimum	Object Index Maximum
Voltage_DC		V	0.1	30	40	50
Current_DC		A	0.001	31	41	51
Power_DC		W	See pg 4	32	42	52
Demand_DC		W	See pg 4	33	43	53
Energy_DC	(Nett)	Wh	See pg 4	20		

2.3.2 Counter Values

Counters, Group 20 & 21, Data Class 3

Description		Units	Resolution	Object Index Instantaneous
Energy_DC_Imp	(Consumed)	Wh	See pg 4	0
Energy_DC_Exp	(Generated)	Wh	See pg 4	1

Note:

Counter Values in DNP are unsigned values, therefore the nett energy cannot be represented in the Counter Group. The Energy_DC (Nett) value can be found in the Analog Inputs group.

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2.4 OTHER REGISTERS

2.4.1 Special Registers

Analog Inputs, Group 30, Data Class 2 Description	Units	Resolution	Object Index Instantaneous
DTS_Model_ID		1	0
DTS_SerialNumber		1	1
DTS_FW_Version		0.0001	2
VoltagePrimary	V	0.1	10
VoltageSecondary	V	0.1	11
CurrentPrimary	A	0.001	12
CurrentSecondary	A	0.001	13
EnerPowDivider		1	14

2.4.2 Binary Input Values

Binary Input Objects are used to determine the state of the Digital Input Lines.

Counters, Group 1, Data Class 1 Description		Value	Object Index Instantaneous
IO_Channel_1	(BI)	0 or 1	0
IO_Channel_2	(BI)	0 or 1	2
InputStatus_A	(BI)	0 or 1	24
InputStatus_B	(BI)	0 or 1	26
InputStatus_C	(BI)	0 or 1	28
InputStatus_D	(BI)	0 or 1	30

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2.4.3 Binary Output Values

Binary Output Objects are used to manipulate the state of the Digital Output Lines. In addition, the equivalent Binary Input Objects can be used to read the actual status of the Digital Output Line.

Counters, Group 10, Data Class 0 Description			Object Index Instantaneous
IO_Channel_1	(B0)	See Below	0
IO_Channel_2	(B0)	See Below	2
IO_Channel_3	(B0)	See Below	4
IO_Channel_4	(B0)	See Below	6
IO_Channel_5	(B0)	See Below	8
IO_Channel_6	(B0)	See Below	10
IO_Channel_A	(B0)	See Below	16
IO_Channel_B	(B0)	See Below	18
IO_Channel_C	(B0)	See Below	20
IO_Channel_D	(B0)	See Below	22
IO_Channel_11	(B0)	See Below	32
IO_Channel_12	(B0)	See Below	34
IO_Channel_13	(B0)	See Below	36
IO_Channel_14	(B0)	See Below	38
IO_Channel_15	(B0)	See Below	40
IO_Channel_16	(B0)	See Below	42
IO_Channel_17	(B0)	See Below	44
IO_Channel_18	(B0)	See Below	46

For Binary Outputs, the following operations should be performed:

Pulse: Set the *OnTime* and *OffTime* parameters to the desired values, and initiate a *PulseOn* command (0x01).

Latch On: Set the *Ontime* to 4,294,967,295mS (which is a little short of 50 days) and initiate a *PulseOn* command (0x01). In order to keep the output in a *LatchOn* state, it should be refreshed before the *OnTime* expires, by repeating this procedure.

Latch Off: Set *OnTime* to zero, and initiate a *LatchOff* command (0x04). The output will remain in the *LatchOff* state indefinitely.

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2.4.4 General Counter Values

These counters can be used to accumulate pulse counts on the digital inputs.

Counters, Group 20 & 21, Data Class 3 Description	Units	Resolution	Object Index Instantaneous
GeneralCounter1		1	28
GeneralCounter2		1	29
GeneralCounter3		1	30
GeneralCounter4		1	31

2.4.5 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-SKT	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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3 REVISION HISTORY

Version	Date	Description	Authority
1.0	25-Mar-2011	Initial Release	JAS
1.1	31-Aug-2011	Restructure document and add Table of Contents	JAS
1.2	02-Sep-2011	Moved Units & Resolution columns to next to Description for clarity	JAS
1.3	01-Nov-2011	Minor changes	JAS
1.4	09-Nov-2011	Split Document into AC and DC Versions	JAS
1.5	04-May-2012	Minor changes	JAS
1.6	04-May-2012	Combine AC and DC Documents again	JAS
1.7	27-Aug-2012	Added rollover information for the energies	JAS
1.8	27-Nov-2012	Added Binary Input and Output Information	JAS

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