The purpose of this Quick Start Guide is to familiarize the user with the configuration and implementation of the DTS Logging System.

This document explains how to set up the required registers in order to log values using the DTS sub-meter. Unless stated otherwise, all registers referenced in this guide are Modbus 32-bit Holding Registers and can be found in the Measurlogic Modbus Map documentation.

This guide will set up the DTS meter to log the following values given the following parameters:

- **Date: January 30, 2016 17:09:00**
- **Logging Period: 15 min**
- **Values to Log:**
  - **Total Active Power**
  - **Total Imported Energy (Active)**
  - **Total Active Demand**

1. Command Registers

This guide uses the Command Registers starting at Modbus address 40001. The Command Registers are used to set up the current time and specify the Modbus registers to log.

NOTE: The command structure must be written in one Modbus message. Alternatively, the parameters of the command structure can be written individually, in any order, but the Command word must be written last.

- **Status –** When a command is executed the status of the command is returned here.

  - 0 = Success
  - 2 = Invalid Address
  - 3 = Invalid Data
  - 4 = Invalid Message Length
  - 5 = Unknown Command
  - 7 = Data Temporarily Unavailable [Storage Busy]
  - 8 = No Logging Data Available
  - 9 = Logging Data is Corrupted

    NOTE: The Status Register changes its value depending on the success of the command. This register should be checked after the execution of each command.

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2. Setting Time

The DTS Meter must have the current time set to accurately log data. It is recommended that the time be updated daily to keep logging accuracy.

The following example sets the DTS Meter's Time to **January 30, 2016 17:09:00**

NOTE: The DTS meter represents time in 24-Hour format (i.e. 1pm in 12-hour format is 13pm in 24-hour format).

Setting Time (0xA0000000)		
Description	Modbus Address	Value (dec)
Command	40001	2684354560
Time Reg Address	40003	7039
Message Length	40005	6
Status	40007	Not Used
Year	40009	2016
Month	40011	1
Day	40013	30
Hour	40015	17
Minute	40017	9
Second	40019	0

Setting Time (0xA0000000) Response		
Description	Modbus Address	Value (dec)
Command	40001	0
Time Reg Address	40003	7039
Message Length	40005	**0**
Status	40007	**0**

NOTE: Upon completion of the Command the Status register should update with the value "0". If the Status Register Value is not "0" the command was not executed.

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3. Specifying Modbus Registers to Log

The DTS Meter can log any Modbus register specified in the Measurlogic Modbus Map documentation. This document refers to logged Modbus registers as "Log Tags".

3.1 Setting Log Tags

Continuing from the example on page 1:

- **Total Active Power**
- **Total Imported Energy (Active)**
- **Total Active Demand**

(For a full list of available Modbus registers see the DTS Modbus Map document)

The message length corresponds to the number of tags that are being defined; in this example the message length will be "3".

Setting Log Tags (0xA2101000)		
Description	**Modbus Address**	**Value (dec)**
Command	40001	2718961664
Tag Start	40003	0
Message Length	40005	3
Status	40007	Not Used
Total Active Power	40009	11055
Total Imported Energy	40011	14025
Total Active Demand	40013	11257

Setting Log Tags (0xA2101000) Response		
Description	**Modbus Address**	**Value (dec)**
Command	40001	0
Tag Start	40003	0
Message Length	40005	**0**
Status	40007	**0**

NOTE: Log data must be collected prior to changing Log Tags. If Log Tags are changed all previous Logging data will be lost!

4. Setting Logging Period

Once the time and tags have been set the next step is to set the logging period and turn on the logging. It is important to note that the logging period is in seconds, and normalized to the hour.

The logging interval is always in terms of seconds, i.e. a log interval of 15 min is represented as 900 sec (15 x 60 = 900). The minimum recommended log interval is 1 min (60 sec).

Log Interval	Current Time	Next Log Times	
15 min	12:05:30	12:15:00	12:30:00
20 min	12:05:30	12:20:00	12:40:00

To set the logging period write directly to the logging period register:

Description	Modbus Address	Value
Logging Period	16091	900 (sec)

5. DTS Logging

5.1 Logging Options

The DTS Logging feature of the DTS Meter comes with a variety of options to simplify the collection of measured data. This section will go over the various commands used to customize the DTS Logging feature.

5.1.1 Turn Logging ON/OFF

The DTS Logging feature can be turned on and off by writing the corresponding command to the Command Register. The DTS Meter will remember the last state of the Logging feature even if a reboot occurs.

Turn Logging ON (0xA1000100)/OFF (0xA1000000)		
Description	Modbus Address	Value (dec)
Turn Logging ON	40001	2701132032
Turn Logging OFF	40001	2701131776

5.1.2 Define Number of Log Events

The DTS Logging feature can be set up to return the maximum amount of Log Events possible or a defined set of Logging Events every time the Logging Data is read. The DTS Logging feature is defaulted to return the maximum amount of Logging Events when Logging Data is read. The amount of Logging Events that are returned is dependent on the amount of Logging Tags that are defined.

Define Number of Log Events (0XA1020000)			
Description	**Modbus Address**	**Value (dec)**	**Action**
Return Maximum Log Events	40001	2701262848 + 0	Return the maximum number of log events each read
Return Three Log Events	40001	2701262848 + 3	Return three Log Events each read
Return Ten Log Events	40001	2701262848 + 10	Return ten Log Events Each read

▪ If the host asks for more logging events than available, the meter will only return the events that are available.

▪ If the host asks for more events than what can be returned in the Polling Region, the meter will fill the Polling Region.

Note: It is important to note that only 60, 32-bit numbers can be returned in the Polling Region. Depending on the number of tags being logged only a certain number of log points can be returned.

The following table shows the maximum number of Logging Events that can be returned in the Polling Region given different numbers of defined Log Tags.

Number of Log Tags	Maximum Amount of Historical Points That Can Be Returned
3	15
5	10
10	5
20	3
31+	1

The equation for determining the number of Logging Events that can be returned to the Polling Region is as follows:

$$60 \div (\text{Number of Log Tags} + 1)$$

▪ Log Event Blocks contain the Time Stamp and Log Values in the same order that the Log Tags were defined.

▪ The Log Values are derived from the standard measurement registers in the DTS meter, so will have the exact same resolution as specified in the Measurlogic standard Modbus Map documentation.

Each Logging Data Event, which includes the values of all the defined Logging Tags, is timestamped with a Unix UTC value (Universal Time Coordinated) which is the number of seconds since January 1, 1970. For convenience, here is a link to a UTC to real time converter: http://www.epochconverter.com.

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5.1.3 Automate Acknowledge Data

The DTS Logging feature utilizes a handshaking method in order mitigate data loss. By default, acknowledging data is required and executed by using the "Acknowledge Log Events" command after reading Log Events. If the "Automate Acknowledge Data" command is set the DTS Meter will turn off handshaking and assume all log data is transmitted without error.

NOTE: If "Automate Acknowledge Data" is set, Log Data lost due to transmission failure cannot be retrieved.

Automate Acknowledge Data ON (0xA1010100)/OFF (0xA1010000)		
Description	**Modbus Address**	**Value (dec)**
Automatic Acknowledge ON	40001	2701197568
Automatic Acknowledge OFF	40001	2701197312

5.2   Read Logging Data

5.2.1 Log Data Region

The Log Data Region is where the DTS Meter stores the oldest Logged Event to be read by the host. When the host reads this region the DTS Meter then updates the region with the next available stored Log Data Event. As long as there is Log Events available the Log Data Region will always be updated with the oldest event.

- **Message Length –** When reading data, the length of the message is specified/returned here **[0-60]**.

- **Status –** When a command is executed the status of the command is returned here.

  - o 0 = Success
  - o 4 = Invalid Message Length
  - o 7 = Data Temporarily Unavailable [Storage Busy]
  - o 8 = No Logging Data Available
  - o 9 = Logging Data is Corrupted

Description	Modbus Address
Reserved	46001
Reserved	46003
Message Length	46005
Status	46007
Logged Data	46009

NOTE: The Status Register changes its value depending on the success of the command. This register should be checked after the execution of each command.

- **Logged Data –** The contents of a Log Event are stored here. Up to **60 values** can be stored in this region depending on the number of tags that are defined.

NOTE: How much data the DTS Meter can log is dependent on the amount of Log Tags Defined and the period that the meter is logging at.

Number of Log Tags	Logging Period	Time Until Flash is Full
10	15 min	7 months
10	1 min	2 weeks

5.3 Logging Examples

5.3.1 No Log Data Available

If there is no Log Data available, the "Status" register will contain the "No Logging Data Available" value. The message length will contain 0 (Zero) meaning that the message area has not been updated and any data in that area is invalid.

No Log Data Available		
Description	**Modbus Address**	**Value (dec)**
Message Length	46005	0
Status	46007	8
Logged Data	46009+	Not Valid

5.3.2 Read Maximum Data with Explicit Acknowledge

Turn Automatic Acknowledge off by writing the "Automatic Acknowledge OFF" command to the Command Register.

Turn Automatic Acknowledge OFF		
Description	**Modbus Address**	**Value (dec)**
Automatic Acknowledge OFF	40001	2701197312

Set the DTS Logging feature to return the maximum number of stored Log Events each read.

Set up the amount of Log Data to Read			
Description	**Modbus Address**	**Value (dec)**	**Action**
Return Maximum Log Events	40001	2701262848 + 0	Return the maximum number of log events each read

The DTS Meter will now return the maximum number of Log Events that it can fit into the 60 Message registers. Reading the Log Data can be repeated until no Log Data is available. The message length will contain the number of "Message" registers that were updated. In this example only 1 event has been returned, the time stamp and three values.

Read Log Data		
Description	**Modbus Address**	**Value (dec)**
Message Length	46005	4
Status	46007	0
Time Stamp	46009	1464966900
Total Active Power	46011	X
Total Imported Power	46013	X
Total Active Demand	46015	X

If handshaking is turned on Log Data needs to be acknowledged. The "Acknowledge Log Data" command needs to be issued to the Command Register when the finished reading Log Data. Several reads can occur before issuing the "Acknowledge Log Data" command.

For example, assume that each read returned 15 Log Events, if the Log Region is read 4 (Four) times 60 Log Events must be acknowledged.

Acknowledge 60 Log Events		
Description	**Modbus Address**	**Value (dec)**
Acknowledge 60 Log Events	40001	556793856 **+ 60**

5.3.3   Repeat Log Data

To repeat Logging Data simply issue the "Repeat Log Data" command to the Command Register.

Repeat Logging Data		
Description	**Modbus Address**	**Value (dec)**
Repeat Logging Data	40001	2703228928

The DTS Meter has now updated the Log Data Region with the oldest Log Event available and the host can re-read log data.

Repeated Log Data		
Description	**Modbus Address**	**Value (dec)**
Message Length	46005	0
Status	46007	0
Logged Data	46009+	Repeated Data

6.0 Trouble Shooting

DTS Logging is only available on Meters with serial numbers 201606XXX and greater. If the status register is updated with "Unknown Command" make sure that the number issued in the Command register is correct.

If the Serial Number and Command are correct, please contact Measrulogic Inc. Technical Support at 877 PQ-SOLNS (777-6567).

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