

Rishabh Datalogger Manual



Rishabh Datalogger

The screenshot displays the Rishabh Datalogger software interface. On the left, a DMM 2 window shows a main display of 217.44 V AC and a sub display of 050.01 Hz. The main interface features a menu bar (File, Tools), a toolbar with various icons, and a control panel with 'Select Meter' set to 'DMM 2', 'Interval' set to '250 ms', and a '60000' counter. A data table displays the following information:

Row	Date	Time	Measurement	Value	Unit	Frequency	Value	Unit
73	7/15/2015	10:12:40 AM	V AC 10M	217.64	600V	Frequency	050.01	600 Hz
74	7/15/2015	10:12:40 AM	V AC 10M	217.66	600V	Frequency	050.01	600 Hz
75	7/15/2015	10:12:41 AM	V AC 10M	217.63	600V	Frequency	050.01	600 Hz
76	7/15/2015	10:12:41 AM	V AC 10M	217.61	600V	Frequency	050.01	600 Hz
77	7/15/2015	10:12:41 AM	V AC 10M	217.61	600V	Frequency	050.01	600 Hz
78	7/15/2015	10:12:41 AM	V AC 10M	217.58	600V	Frequency	050.01	600 Hz
79	7/15/2015	10:12:42 AM	V AC 10M	217.57	600V	Frequency	050.01	600 Hz
80	7/15/2015	10:12:42 AM	V AC 10M	217.48	600V	Frequency	050.01	600 Hz
80	7/15/2015	10:12:42 AM	V AC 10M	217.48	600V	Frequency	050.01	600 Hz
81	7/15/2015	10:12:42 AM	V AC 10M	217.44	600V	Frequency	050.01	600 Hz

Below the table is a 'Graphical Representation' section with a 'Min/Max' checkbox checked. The graph plots 'V AC 10M [V]' on the y-axis (ranging from 200.00 to 650.00) against 'Time' on the x-axis (ranging from 10:12:25 to 10:12:40). A legend indicates: V AC 10M [V], Min: 217.2 V, Max: 217.8 V, Avg: 217.48 V. The graph shows a nearly horizontal line at approximately 217.5 V. Buttons for 'Select Color' and 'Reset Zoom' are located at the bottom of the graph area.

15/07/2015 10:12:42

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**Subject to change without Notice

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1. Specification, Installation of Software, Starting Program, Closing Program & Uninstalling the Software

1.1 Specification

Rishabh Datalogger is a measurement data logging program for recording, visualizing, evaluating and documenting measured values with reference to time for Model 6012, Model 6013, Model 6015 & Model 6016. It can also be used to configure the parameters of multimeter.

As a rule, the PC and the measuring instrument communicate via a virtual COM port being assigned to an USB interface.

- Number of measuring channels: up to 3
- Start recording: Automatically or scheduled
- Stop recording: scheduled or Disconnect button Clicked or Communication Error Occured

1.2 Installation of Software

Refer Software Installation Manual

1.3 Starting Program

In order to start the program:

- Double click the Rishabh Datalogger.exe icon on the Windows desktop.

or

- Select the program from the Windows start menu:

Start : Programs : Rishabh Instruments Pvt. Ltd : Multimeter Software : Rishabh Datalogger.exe

The program is started.

1.4 Closing Program

In order to close the program:

- Click on File Menu then on Exit

or

- Simultaneously press the Alt+F4keys.

or

- Click the Close icon at the upper right-hand corner of the title bar.

The program is closed.

1.5 Uninstalling the Software

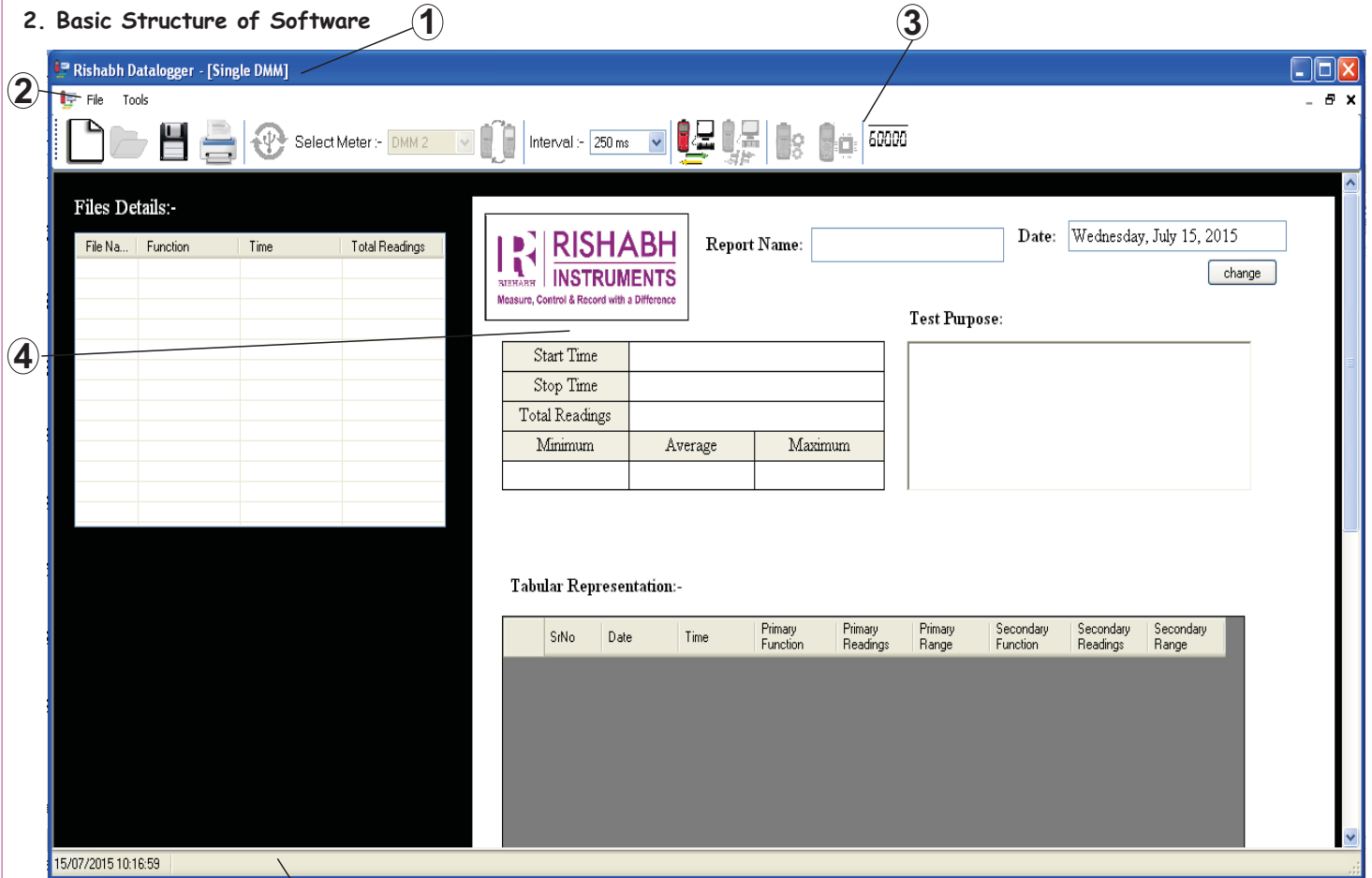
If desired, the program can be uninstalled by selecting

Window XP: Control Panel : Add or Remove Program : Multimeter Software: Remove

or

Window 7: Control Panel : Uninstall Program : Multimeter Software: Uninstall

2. Basic Structure of Software



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Fig 01. Software Structure

1. Title Bar

The horizontal bar at the top of the program window displays the program name, and the buttons to the right for minimizing, maximizing and closing the program window.

2. Menu Bar

The menu bar includes the names of the main menus from which the various menu functions and submenus can be accessed.

3. Tool Bar

The smart icons in the tool bar allow for quick access to frequently used commands and functions. The function of any given icon can be displayed by moving the mouse pointer to it, and is executed by clicking the icon.

4. Work Area

Measurement data are displayed in various views for analysis and processing in this main field, and various dialog boxes are opened here as well.

5. Info Bar

System Date and Time is shown.

3. Context Menu

A context menu appears after clicking the right mouse button with the mouse pointer in the work area. Just like the tool bar, it allows for quick access to frequently used functions.

3.1 Form Context

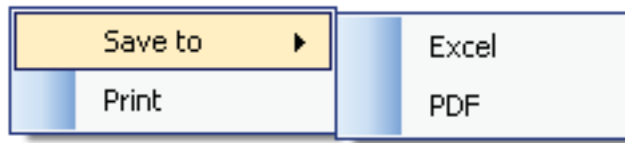


Fig 02. Form Right Click Menu

3.1.1 Save to

This option is used to save the form either in Excel or pdf format.

3.1.1.1 Excel

The file is generated in .xls format. In Excel, graph is not generated.

3.1.1.2 pdf

The file is generated in standard acrobat .pdf format. Here, graph is generated.

3.1.2 Print

Print is used to print the current form.

3.2 Graph Context

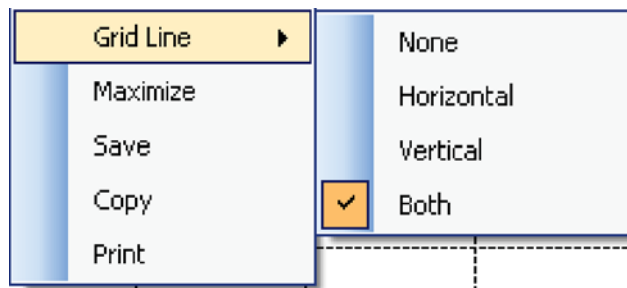


Fig 03. Graph Context Menu

3.2.1 Grid Line

A grid consisting of lines or dots can be displayed in graph area.

3.2.1.1 None

In viewing area of graph, there will be no grid line

3.2.1.2 Horizontal

In viewing area of graph, there will be Horizontal grid line

3.2.1.3 Vertical

In viewing area of graph, there will be Vertical grid line

3.2.1.4 Both

In viewing area of graph, there will be both Horizontal and vertical grid line

3.2.2 Maximize

Maximize will open a form where enlarged version of graph can be seen. Maximize graph cannot be seen in XY recorder.

3.2.3 Save

Save option is used to save the graph on following standard image format

- *.jpg
- *.bmp
- *.tif
- *.gif
- *.emf
- *.png

Default Save Format is *.jpg

3.2.4 Copy

Copy option is used to copy the graph image and can directly paste in paint or any other desired file. It works similar to *Print scrn*. Only *Print scrn* of graph is taken.

3.2.5 Print

Print is used to print the current form.

3.3 File Detail Context

File Detail Context is active in the form only when meter is disconnected or saved or offline data is read.

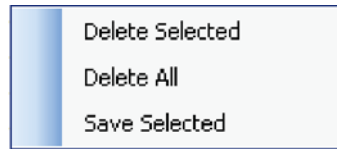


Fig 04. File Detail Context Menu

3.3.1 Delete Selected

Here, you can delete file from the form which is not necessary.

3.3.2 Delete All

It will delete all the file which are in file detail table.

3.3.3 Save Selected

It will save the selected file into desire location which has been provided.

4. Tool Bar



Fig 05. Tool Bar Item



New Form: This is used to open new form. The following form can be opened using this icon:

- Single DMM Analysis
This Form is used to log data of only one meter
- Multiple DMM Analysis
This Form is used to log data of one or more meter and meter can be added in this form dynamically
- X-Y Recorder
This Form is used to log data using 2 meter and reading are log in respective axis



Open Menu: This is used to open the save data. While viewing saved file, you can log data by using new form button



Save: This is used to save all the file in file detail table.



Select Meter :-

Scan: This is used to scan the meter. Drop Down Box shows detected meters.



Test: This is used to test the communication whether it is working or not. This can be used to identify meter also. In this case meter backlit will momentarily on & off.

Interval :-

Interval: This is used to as reference time to store the sample in table and update the graph.



Connect: This is used to start the communication when meter is disconnected or communication error occurs.



Disconnect: This is used to disconnect the communication between PC and Multimeter.



Setting: This is used to set the settable parameter in Multimeter. Parameter from meter can be read and then set again.



Memory: This is used to read the already logged data in memory of multimeter.



Virtual Display: This is used to re-create multimeter display on PC/system.

5. New Form DMM Analysis

5.1 Single DMM Analysis

The Single DMM Analysis is used to analyze only one meter at a time.

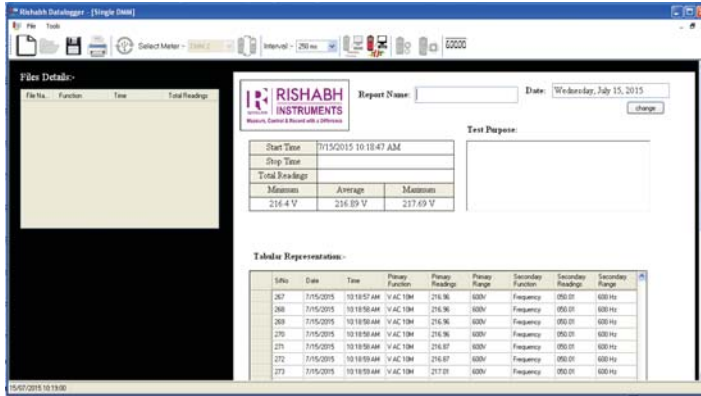


Fig 6.a Single DMM Analysis Basic Look

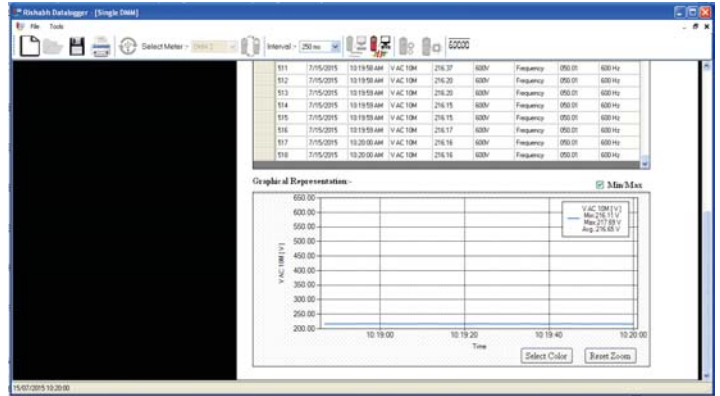


Fig 6.b Single DMM Analysis with Table and Graph

The Single DMM meter selection criteria is select the meter in Select Meter: and then click on New Form Icon and the Single DMM Analysis. The Analysis Log the data at time interval provided to it. The Table representation log data is as follows:

SrNo : Serial Number

Date : The Date at which meter send the frame (information)

Time : The Time at which meter send the frame (information)

Date and Time are taken from meter

Primary Function : Function which is selected in meter (knob position). The Detail is explained in Section 10.6 Online Communication start query response (Function Code & Function Counter)

Primary Readings : Main Display Reading


Primary Range : Current Range of the Readings. The Detail is explained in Section 10.6 Online Communication start query response (Range)

Secondary Function : This function is related to sub display function and is updated according to it

Secondary Readings : Sub Display Reading

Secondary Range : Current Range of the Readings. The Detail is explained in Section 10.6 Online Communication start query response (Range)

5.2 Multiple DMM Analysis

This Form is used to log data of one or more meter and meter can be added in this form dynamically. Dynamically means that at any time instant meter can be added into this form by pressing on  scan button. It's an extended version of Single DMM Analysis which can analyze multiple meter at same time.

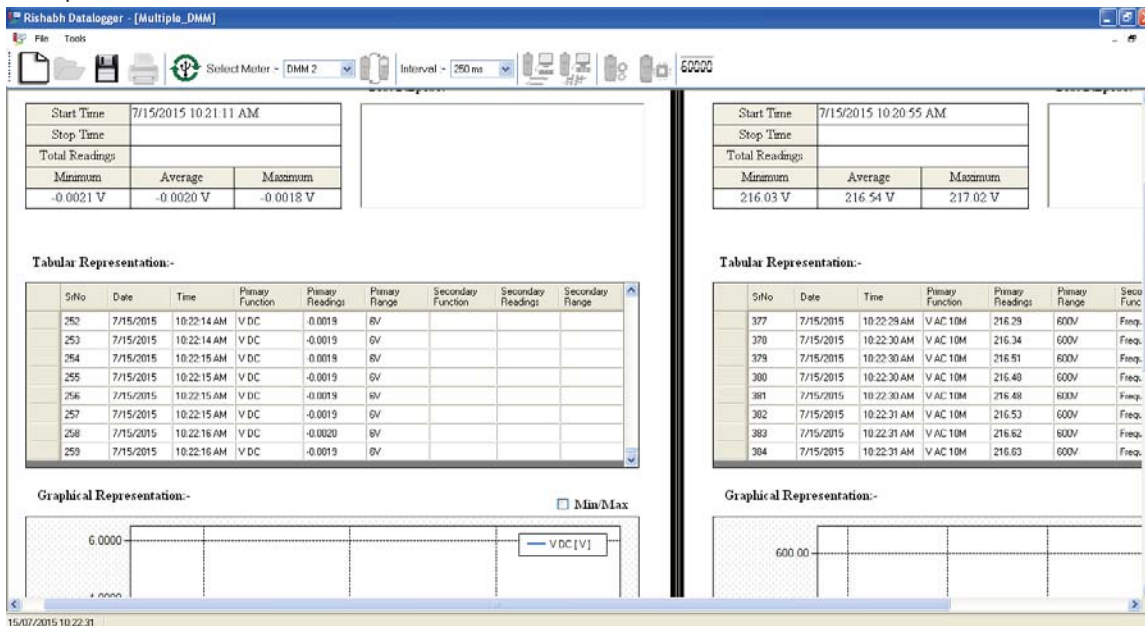


Fig 7. Multiple DMM Analysis

5.3 X-Y Recorder

The X-Y Recorder is used to analyze two different meter in X-Plane & Y-Plane instead with respect to time. Any desired channel (meter) is assigned to the X abscissa, and other channel to Y abscissa. The X-Y Recorder consider only to channel for its recording.

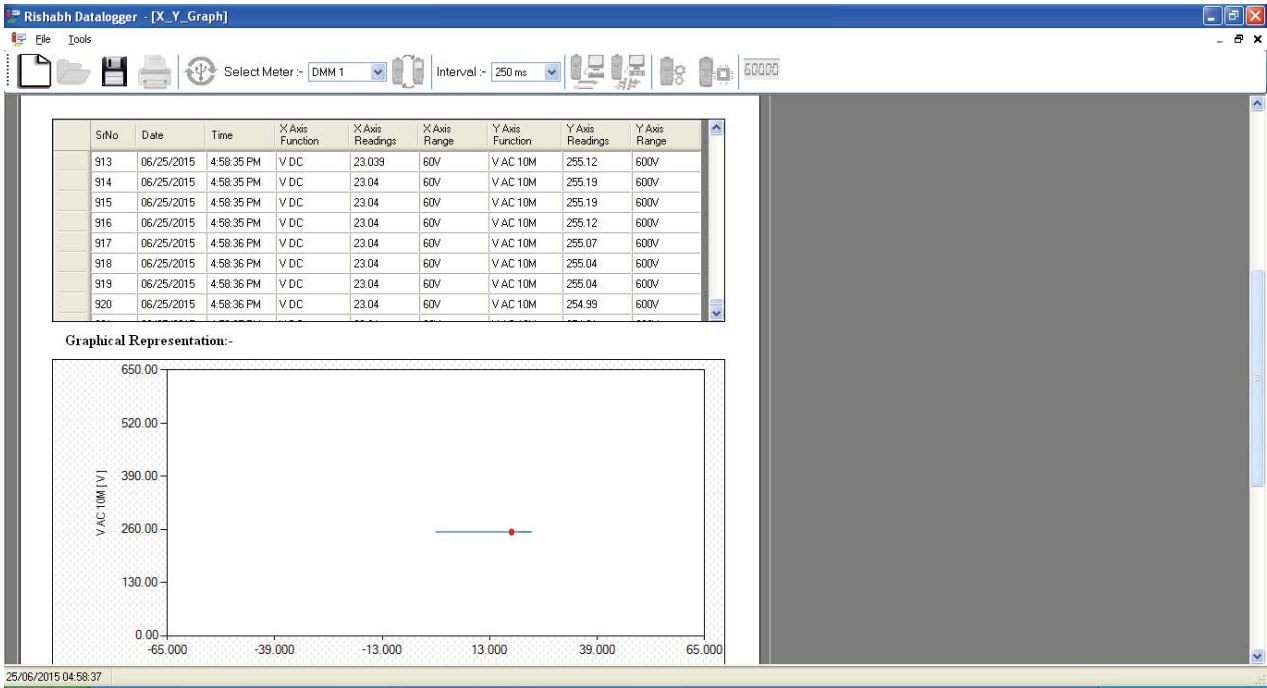


Fig 8. X-Y Recorder

When Software scan the 3 meter or more meter, then software ask for which meter should be considered for X abscissa & Y abscissa.

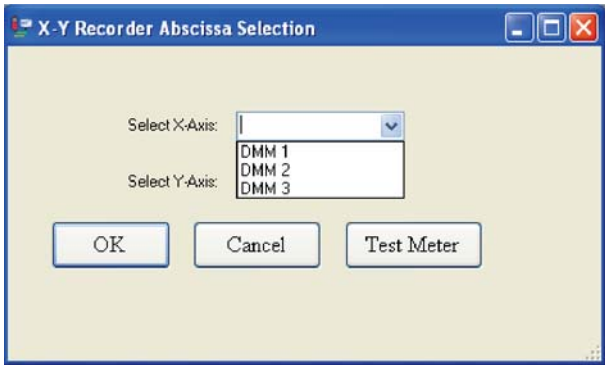


Fig 9.a Meter Selection



Fig 9.b Selected Meter for X-Y Recorder

Note: During X-Y Recorder, Prefer to use only "Two" Meter.

6. Virtual Display, Save & Open

6.1 Virtual Display

This is used to re-create multimeter display on PC/system.

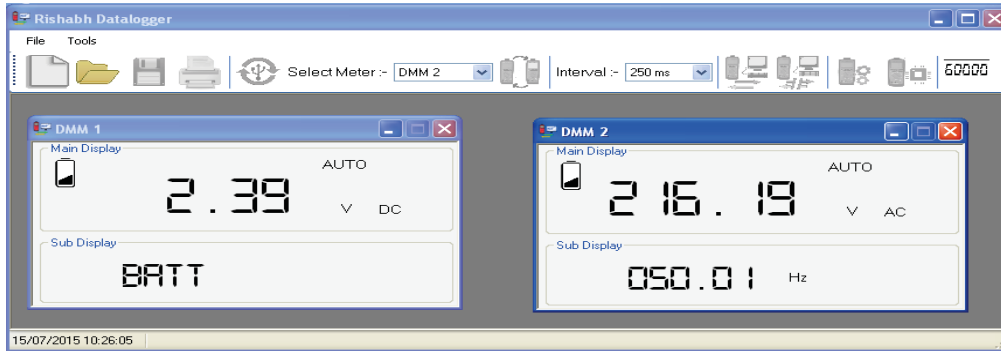


Fig 10. Virtual Display

6.2 Save

This is used to save all the file in File detail Table of Single DMM Analysis, Multiple DMM Analysis, X-Y Recorder and Offline Memory read.

The file saved using this button or **Section 3.3.3** option are not in excel or pdf format but in **‘.xml’** format. Currently in Xml Format only data from the tabular representation are saved.

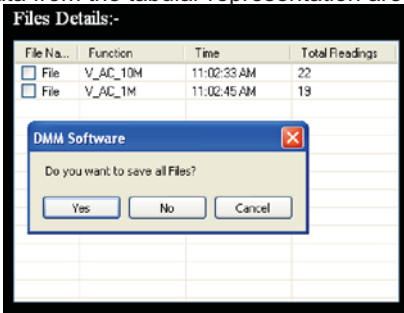


Fig 11.a File Save



Fig 11.b Save Location

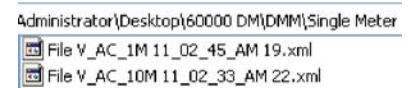


Fig 11.c File at Desire Location

Note: Prefer Section 3.1 to save in pdf or excel

Suppose that Selected Folder is D:\XYZ\, in that folder software will create a **“DMM”** and then for respective Analysis sub folder created. Single DMM Analysis: **D:\XYZ\DMM\Single Meter** Multiple DMM Analysis: **D:\XYZ\DMM\Multiple Meter**
X-Y Recorder: **D:\XYZ\DMM\X_Y_Recorder** Memory Data: **D:\XYZ\DMM\Memory Data**

6.3 Open

This is used to open the save data. This Open menu is to open saved ***.xml** file. The Step is as follows:

- Click on Open
- Goto file which is required to be reviewed

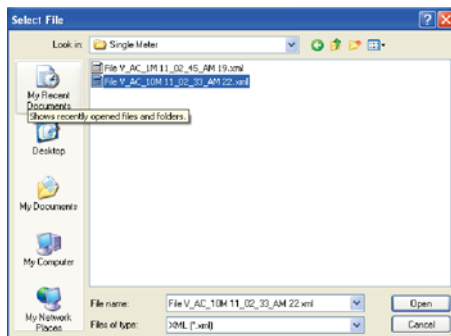


Fig 12. Open Saved File

- Click on open.

7. Tool Menu

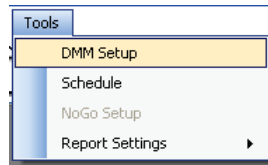


Fig 13. Tool Menu

7.1 DMM Setup

This is used to set the settable parameter in Multimeter. Parameter from meter can be read and then set again.

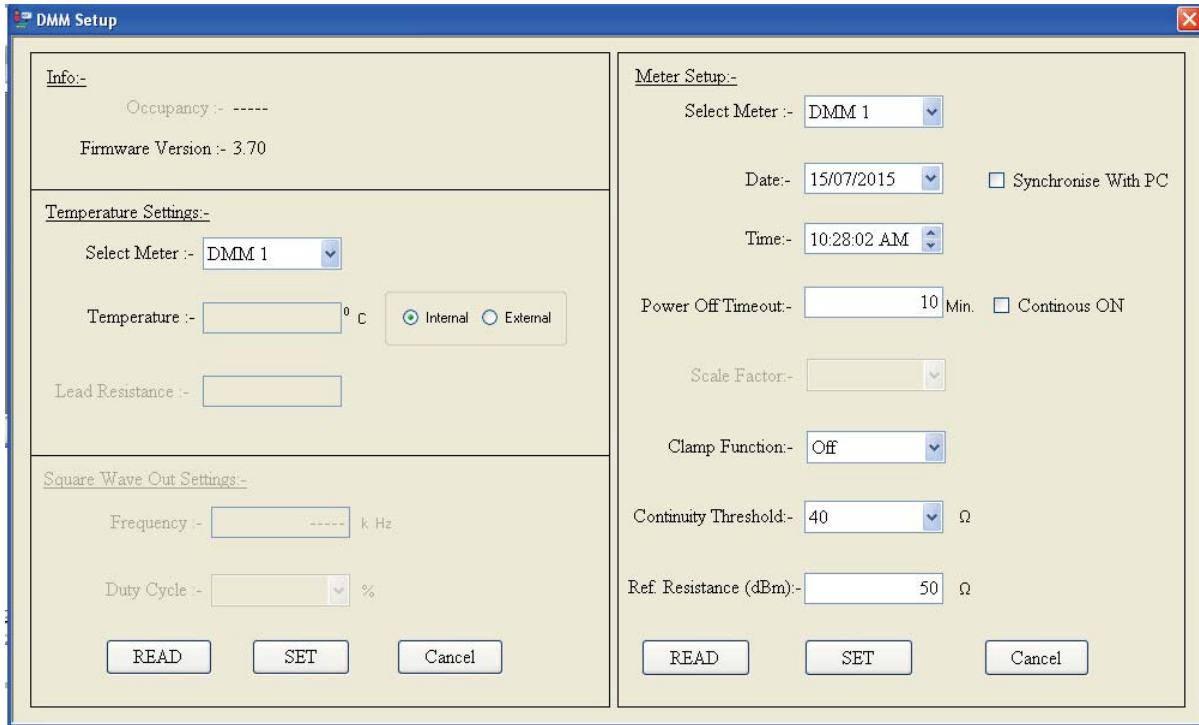


Fig 14. Setup Parameter (For Model 6013)

READ Button: Used to read the settable parameter from the meter.

SET Button: Used to set the unmodified, modified parameter

Cancel Button: Used to close the form

Note: Two Read / Set Button are used to read / set parameter part-wise.

7.2 Report Setting

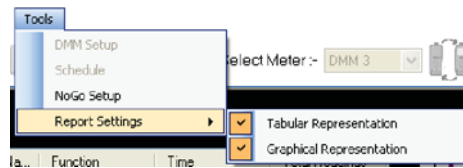


Fig 15. Report Setting

Report Setting is used to decide how the form look-like, how pdf and print will result in.

7.2.1 Tabular Representation

Removing the Tick will result in, no table will be shown in form, pdf and print.

7.2.2 Graphical Representation

Removing the Tick will result in, no graph will be shown in form, pdf and print.

7.3 Schedule

Schedule can be used to start the data-log at specific time or stop at specific time or start and stop at specific interval of time.

The 'Schedule' dialog box contains the following elements:

- Start Time:**
 - Manual
 - Scheduled
 - Date: 21/06/2015
 - Time: 2:18:27 PM
- Stop Time:**
 - Manual
 - Scheduled
 - Specific Time: 21/06/2015, 2:18:27 PM
 - Elapsed Time: 00 Hours, 18 Minutes
- Buttons:** Start, Cancel

Fig 16. Schedule

By clicking on start button, schedule will be enabled.

By clicking on cancel button, schedule form will be closed.

In ideal case when schedule is not enabled, then software is in manual start time and manual stop time.

7.4 NoGo Setup

The 'NoGo_Settings' dialog box contains the following elements:

- Select Meter :- DMM 1
- Function Code :- V AC 10M
- Condition :- Off
- Lower Limit :- [] V
- Upper Limit :- [] V
- Only NoGo Readings
- Buttons:** SET, Cancel

Fig 17. NoGo Setup Form

GO NO-GO feature for all measuring functions. This is very useful feature which gives changes in background color, if the measured value is outside the NO-GO band or inside the NO-GO band or Below the limit or Above the limit. All conditions are settable. Limits or band for GO NO-GO are also settable. Its very useful feature to give pass or fail signal in case of measurement is not in the desired band.

*Note: NoGo of Software and of meter are independent.
NoGo Setup is Enabled only when Datalogging is ON*

7.4.1 NoGo Conditions

7.4.1.1 Off

If this condition is selected and then clicked in *SET*, then NoGo Function is turned off.

7.4.1.2 Both

When primary reading of form is lower than the *Lower Limit* or higher than the *Upper Limit* then the color of reading is changed that mean either of the event has occurred.

7.4.1.3 OverFlow

When primary reading of form is higher than *Upper Limit* then the color of the reading changed. It means Overflow occurs.

7.4.1.4 UnderFlow

When primary reading of form is lower than *Lower Limit* then the color of the reading changed. It means Underflow occurs.

7.4.1.5 In-between

When primary reading of form is higher than the *Lower Limit* and also lower than the *Upper Limit* then the color of reading is changed. It means In-between event occurs.

7.4.2 Only NoGo Readings

When this is checked, it means reading should be logged in table and in graph only NoGo condition satisfied. Unchecking means log all the reading that are sent from the multimeter.

Note: NoGo Limit: Upper Limit > Lower Limit.

7.4.3 SET

It will be set the specified NoGo condition when all the basic information is provided.

7.4.4 Cancel

It will close the form.

8. Form Logo Change & Graph

8.1 Form Logo Change

To change default logo i.e. Rishabh Instrument Pvt. Ltd Logo to desire logo, following procedure to be followed

- * Double click default logo



Fig 18. Default logo

- * Select desire logo

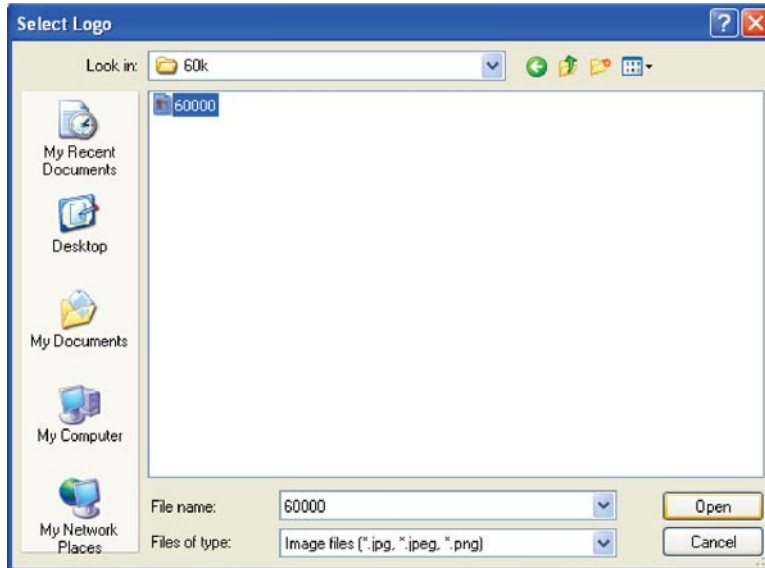


Fig 19. Select Desire logo Location

- * Click on open to select new logo.
- * New logo has been setted as default logo.
- * If you want to get back Rishabh logo then go to location as
*:\Program Files\Rishabh Instruments Pvt. Ltd\Rishabh Datalogger\logo\logo.jpg

8.2 Graph (Graphical Representation)

While data is logging in the form, to reduce system usage, graphical representation of the data will be showing only latest 2000 reading for Single DMM Analysis & Multiple DMM Analysis and 5000 reading for X-Y recorder.

When already logged data viewing is going on then all the reading which has been logged will be represented in graph.

Note: Maximize Graph Option: When Graph is maximized, new logged reading will not be updated but in normal size graph reading update will go on.

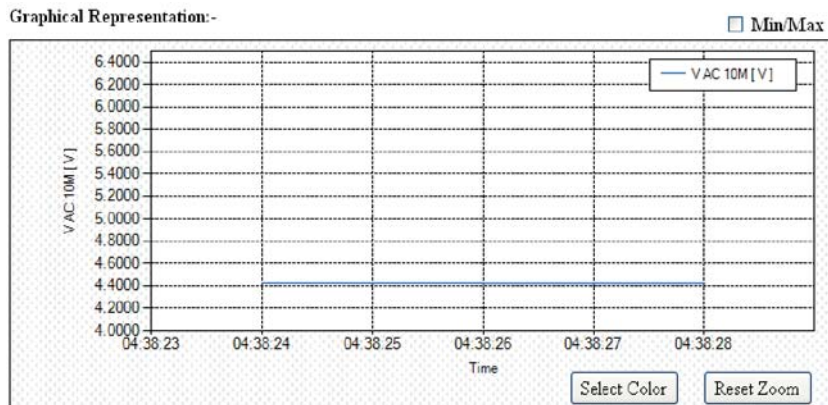


Fig 20. Graph Outlook

8.2.1 Select Color

This is used to change the graph reading representation color. Default Color is Blue

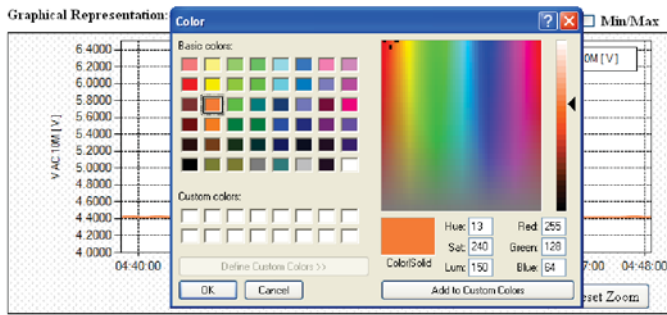


Fig 21. Color Palette

8.2.2 Zoom

With the help of the zoom function, the horizontal and vertical axis can be expanded in the graphic view, in order to recognize details or to gain an overview of particular area.

8.2.3 Reset Zoom

This is used to reset the zoom scale. The scale of the axis is returned to its previous (default) setting.

8.2.4 Min/Max

When Min/Max is checked then in graph information you will also be able to view minimum, maximum, and average value of the log data.

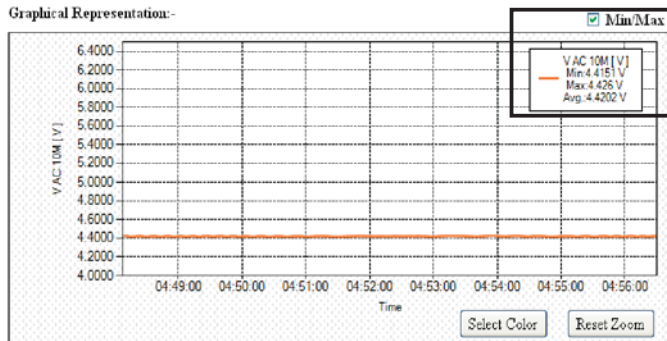



Fig 22. Min/Max/Avg Readings in Graph

9. Memory Offline Data

This is used to read the already logged data in memory of multimeter. The procedure to read data is as follows:

- * Click on memory button. 
- * After clicking, it will read file detail.
- * It takes approx. 17 sec to read complete file detail and show the screen.

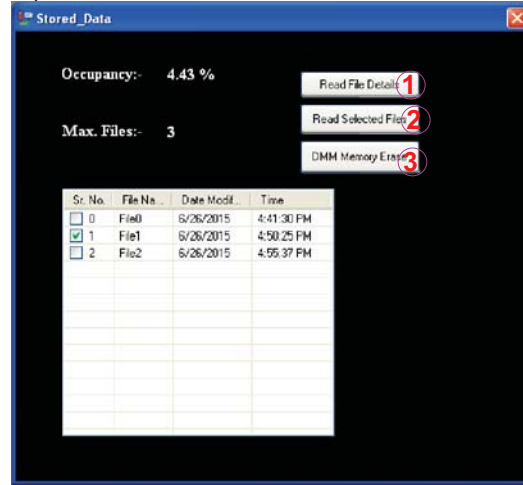


Fig 23. Memory File Detail Screen

- 1. Read File Detail : Will again read the file details from the meter.
- 2. Read Selected Files : Will read the file data which has been selected in the list. In above picture, File 1 selected.
- 3. DMM Memory Erase : Will the erase memory from the meter.

* After clicking on Read Selected File, following screen will be shown after reading data from the meter completes.

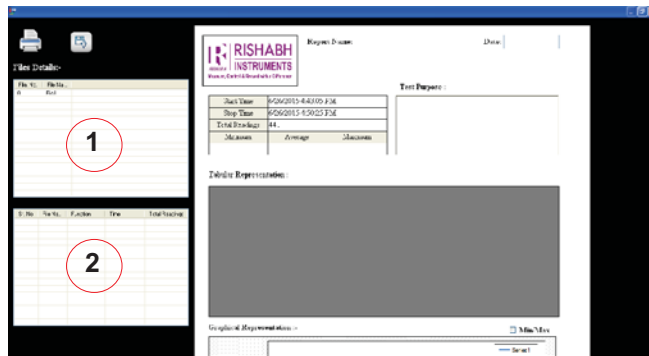


Fig 24. Memory Display Screen

* After Clicking on File 1 at (1), it will generate sub file at position (2), and then single click on any sub-File, will show the data contain in it.

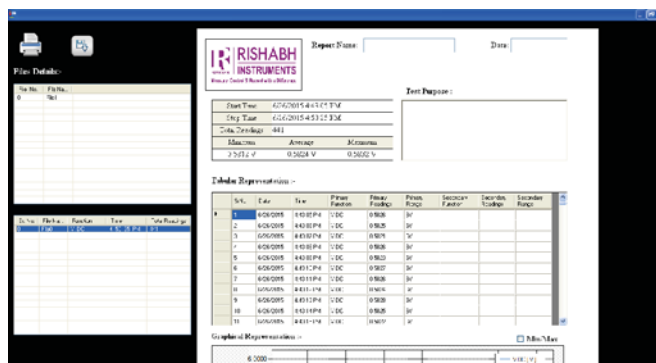


Fig. 25 Memory Data Display Screen

10. Tool for Automation, Protocol

10.1 Introduction

Note: All the value are in Hexadecimal Format ()_H

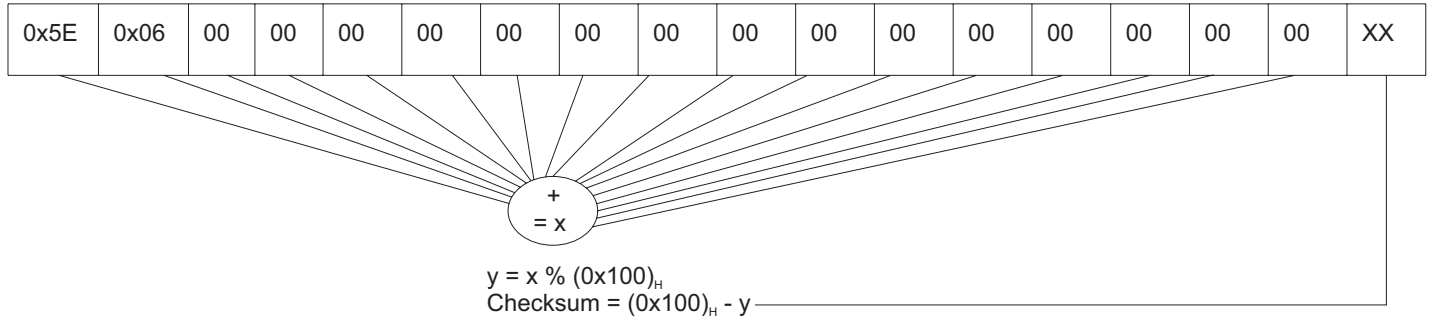
In Protocol, the frame length is of not same length, for offline Memory Communication Response is of 16 bytes and others 18 bytes.

1st Byte: is always Start of frame

Query From system contains : (0x5E)_H

Response from meter : (0x24)_H or (0x40)_H

18th Byte: is always Checksum. Formula for Checksum:



In case of checksum greater than $(0xFF)_{H}$, then checksum value = $(0x00)_{H}$

In case of total 16 Byte frame i.e. offline memory response, checksum is not included.

10.2 Query for Scan

Since Software start the communication then meter send information, it is necessary to find the total number meter connected to the USB.

To identify meter model number,

Meter Identification Query :

0x5E	0x06	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	XX
Start of Frame	Meter Model Information	Don't Care or Dummy Byte															CC	

- 18 byte frame Length
- CC stands for checksum
- XX not a fixed value

Response from meter (When data is correctly received at meter)

0x40	0x23	0x0D	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	XX
Start of frame	Special Character	Model Number	Dummy Byte														CC	

- 18 byte frame Length
- Model Number Varies
- (0x0C)_H - Model 6012
- (0x0D)_H - Model 6013
- (0x0F)_H - Model 6015
- (0x10)_H - Model 6016
- CC stands for checksum
- XX not a fixed value

Response from meter (When query is not correctly received at meter) (Stated: **Checksum Error Frame**)

0x24	0x23	0x0D	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	XX
Start of Frame	Special '#'	Model Number	Dummy Byte														CC	

- 18 byte frame Length
- CC stands for checksum
- XX not a fixed value

10.3 Setup Parameter Read Frame Format

The parameter like memory space(occupancy), Firmware Version, Temperature, Square Wave Output, Meter Date, Meter Time, Standard clamp ratio, Percentage scale function, beep level, dB reference resistor and others are read using '3' different Frames.

Setup parameter Query:

0x5E	0x03	XY	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	XX
Start Frame	Setup Parameter	Query	Dummy Byte														Checksum	

- 18 byte frame Length
- XX not a fixed value
- XY Data is as follows:

1. (0x01)_H - First set of Parameter query
2. (0x02)_H - Second set of Parameter query
3. (0x03)_H - Third set of Parameter query

After query of (0x01)_H is send then wait for response, it takes maximum of 0.5sec to provide response. After receiving response send frame containing (0x02)_H and so on.

Response for XY = (0x01)_H Query:

0x40	0x01	L1	T1	T2	T3	T4	F1	F2	F3	D1	XX	XX	XX	XX	XX	XX	XX
Start Frame	First Query	Lead Resistance	Thermocouple Temperature Detail				Square Wave Out Frequency			SquareWave Out Duty Cycle	Dummy Byte				Checksum		

- 18 byte frame Length
- XX not a fixed value
- Lead Resistance

Eg: L1 = (0x0A)_H = (10)_D

Lead Resistance = 10Ω (for: Lead Resistance - RTD Probe Resistance and Square Wave Out Duty Cycle, convert Hexadecimal Value to Decimal Value for End Result (Data))

- Thermocouple Temperature Detail

T1 - Internal or External Reference Temperature
Data (0x00)_H - External Reference Temperature
Data (0x01)_H - Internal Reference Temperature

T2 - Positive or Negative Temperature Value
Data (0x00)_H - Positive Sign '+'
Data (0x01)_H - Negative Sign '-'

T3 & T4 - Temperature Data
Temperature Data = T3.T4

Eg: T1 = (0x01)_H, T2 = (0x01)_H, T3 = (0x17)_H, T4 = (0x00)_H

Temperature = Internal - (0x17)_H, (0x00)_H

Decimal Equivalent = Internal -(23)_D, (0)_D => -23.0 Degree Centigrade

- Square Wave out Frequency

Frequency = ((F3 * (2710)_H) + (F2 * (0x64)_H) + F1) / (0x64)_H

Eg: F1 = (0x00)_H, F2 = (0x5B)_H, F3 = (0x00)_H

F4 = ((0x00)_H * (2710)_H) + ((0x5B)_H * (0x64)_H) + (0x00)_H => (0x238C)_H => (9100)_D

Frequency = F4 / (0x64)_H => (91.00)_D KHz

Response for XY = (0x02)_H Query:

0x40	0x02	hh	MM	ss	dd	mm	yy	S1	C1	R1	R2	R3	A1	A2	XX	XX	XX
Start Frame	2 nd Query	Hour	Minute	Second	Date	Month	Year	%age Scale	Continuity Threshold	Reference Resistor (dbm)			Auto Power OFF		Clamp Ratio	Dummy Byte	Checksum

- 18 byte frame Length
- XX not a fixed value
- %age Scale (S1)

S1 (0x00)_H - No Percentage Scale is selected
S1 (0x01)_H - 0-20mA Percentage Scale Selected
S1 (0x02)_H - 4-20mA Percentage Scale Selected

- Reference Resistor (dbm)

Reference Resistor = (R3 * (2710)_H) + (R2 * (0x64)_H) + R1

Eg: R1 = (0x63)_H, R2 = (0x09)_H, R3 = (0x00)_H

Reference Resistor = ((0x00)_H * (2710)_H) + ((0x09)_H * (0x64)_H) + (0x63)_H => (0x3E7)_H => (999)_D

- Auto Power OFF

A1 - Continuous On or Auto Power Off

Data (0x00)_H - Continuous On

Data (0x01)_H - Auto Power off Enable

A2 - Power off Timer Value

-Hour, Minute, Second, Date, Month & Year

Hour value is in 24-Hour Format

Eg: hh = (0x17)_H, MM = (0x30)_H, ss = (0x48)_H, dd = (0x28)_H, mm = (0x06)_H, yy = (0x15)_H

Time => 17:30:48

Date => 28/06/15

- Continuity Threshold = (C1)_H => (XX)_D

Eg: C1 = (0x28)_H => (40)_D => Continuity Threshold = (40)_D

- Clamp Ratio (CR)
- CR (0x00)_H- Normal Function
- CR (0x10)_H- 1:1 Clamp Ratio is Selected
- CR (0x20)_H- 1:10 Clamp Ratio is Selected
- CR (0x30)_H- 1:100 Clamp Ratio is Selected
- CR (0x40)_H- 1:1000 Clamp Ratio is Selected

Response for XY = (0x03)_H Query

0x40	0x03	XX	XX	M1	M2	V1	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
Start Frame	3 rd Query	Don't Care		Memory Space in %		Ver	Dummy Byte										Checksum	

- 18 byte frame Length
- XX not a fixed value
- Memory Space in %age (Occupancy)
- Occupancy = ((M1 * (0x64)_H) + M2) / (0x64)_H
- Ver (Firmware Version)
- Ver = (V1)_H * (0x0A)_H / (0x64)_H = > (XX)_D
- Eg: V1 = (0x25)_H, Ver = (0x25)_H * (0x0A)_H / (0x64)_H = > (3.70)_D

10.4 Meter Test Query

Test query is used to test whether Communication between PC and meter is broken or not. For this query, Meter Backlit will on-off momentarily (appx. 1Sec)

Query: (18 Byte Frame Length)

0x5E	0x05	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	XX
Start Frame	Test	Dummy Byte															Checksum		

Response: (18 Byte Frame Length)

Wait for maximum 1.5sec for response

0x40	0x23	0x0D	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	XX
Start frame	Special Character	Model Number	Dummy Byte															Checksum	

- Model Number Information

10.5 Set Setup Parameter

The parameter like Reference Temperature, Square Wave Output, Meter Date, Meter Time, Standard clamp ratio, Percentage scale function, beep level, dB reference resistor and others are setted using '2' different frames.

Frame 1:

0x5E	0x04	0x01	L1	T1	T2	T3	T4	F1	F2	F3	D1	FF	FF	FF	FF	FF	XX
Start frame	Parameter Write	Parameter	Lead Res.	Reference Temperature			Square Wave Out Frequency			SWO Duty	Dummy Byte					Checksum	

- 18 byte frame Length
- XX not a fixed value
- Lead Res. & SWO Duty: Convert the Decimal to Hexadecimal and Send the Hexadecimal Value

Eg: Lead Res. = (50)_D => (0x32)_H, L1 = (0x32)_H, Similar Calculation for D1.

Note: SWO Duty : Duty cycle should be set in step of 10 like (10)_D, (20)_D, (30)_D, (40)_D, (50)_D, (60)_D, (70)_D, (80)_D, (90)_D.

Lead Res. (Lead Resistance) value can be set from (00)_D to (99)_D

- Reference Temperature
- T1 - Internal or External Reference Temperature
 - T1 (0x00)_H - External Reference Temperature
 - T1 (0x01)_H - Internal Reference Temperature
 - During internal reference, the contains of T2, T3 & T4 is Don't Care
- T2 - Positive or Negative Temperature Value
 - T2 (0x00)_H - Positive Sign '+'
 - T2 (0x01)_H - Negative Sign '-'
- T3 & T4 - Temperature Data
 - Temperature Data = AB.C Degree Centigrade
 - T3 = AB, T4 = C

Eg. External -(0x17)_H, (0x01)_H => (-23.1)_D

T1 = (0x00)_H, T2 = (0x01)_H, T3 = (0x17)_H, T4 = (0x01)_H

Note: Reference Temperature Value can be set from (-99.9)_D to (99.9)_D

-Square Wave Out Frequency

Frequency = ABC.DE

$x = \text{Frequency} * (0x64)_H \Rightarrow \text{ABCDE}$

$F1 = x \% (0x64)_H$

$F2 = (x / (0x64)_H) \% (0x64)_H$

$F3 = (x / (0x2710)_H)$

Eg: Frequency = (100.30)_D

$x = \text{Frequency} * (0x64)_H \Rightarrow (10030)_D \Rightarrow (0x272E)_H$

$F1 = (0x272E)_H \% (0x64)_H \Rightarrow (0x1E)_H$

$F2 = ((0x272E)_H / (0x64)_H) \% (0x64)_H \Rightarrow (0x00)_H$

$F3 = ((0x272E)_H / (0x2710)_H) \Rightarrow (0x01)_H$

In meter, $((0x01)_H * (0x2710)_H) + ((0x00)_H * (0x64)_H) + (0x1E)_H \Rightarrow (0x272E)_H / (0x64)_H \Rightarrow (100.30)_D$

Note: Square Wave Out Frequency can be set from (0.03)_D to (500.00)_D

Frame 2:

0x5E	0x04	0x02	hh	mm	ss	dd	MM	yy	XX	C1	R1	R2	R3	A1	A2	FF	XX
Start frame	Parameter Write	Parameter	Hour	Minute	Second	Date	Month	Year	SC	Beep Level	Reference Resistor (dbm)			APO		Don't Care	Checksum

- 18 byte Frame Length

- XX value is not fixed

- SC stands for %age scale Function and standard clamp ratio

Lower Nibble of Data is %age scale Function

Upper Nibble of Data is standard clamp ration

%age Scale Function (SF)

SF (0x00)_H - No Percentage Scale is selected

SF (0x01)_H - 0-20mA Percentage Scale Selected

SF (0x02)_H - 4-20mA Percentage Scale Selected

Standard Clamp Ratio(CR)

CR (0x00)_H - Normal Function

CR (0x10)_H - 1:1 Clamp Ratio is Selected

CR (0x20)_H - 1:10 Clamp Ratio is Selected

CR (0x30)_H - 1:100 Clamp Ratio is Selected

CR (0x40)_H - 1:1000 Clamp Ratio is Selected

Eg: SF = (0x02)_H & CR = (0x40)_H

SC = (0x42)_H

-Beep Level stands for continuity threshold value

Eg: Beep Level = (70)_D, C1 = (70)_D => (0x46)_H, C1 = (0x46)_H

Note: Continuity Threshold (Beep Level) value can be set in step 10 like (10)_D, (20)_D, (30)_D, (40)_D, (50)_D, (60)_D, (70)_D, (80)_D, (90)_D.

-Reference Resistor (dbm)

Reference Resistor = ABCD

R1 = Reference Resistor % (0x64)_H

R2 = (Reference Resistor / (0x64)_H) % (0x64)_H

R3 = (Reference Resistor / (0x2710)_H)

Eg: Reference Resistor = (9999)_D => (0x270F)_H

R1 = (0x270F)_H % (0x64)_H => (0x63)_H

R2 = ((0x270F)_H / (0x64)_H) % (0x64)_H => (0x63)_H

R3 = ((0x270F)_H / (0x2710)_H) => (0x00)_H

In meter, $((0x00)_H * (0x2710)_H) + ((0x63)_H * (0x64)_H) + (0x63)_H \Rightarrow (0x270F)_H \Rightarrow (9999)_D$

Note: Reference Resistor (dbm) value can be set from (0001)_D to (9999)_D

-APO stands for auto power off function

A1 - (0x00)_H - Continuous On

A2 data should be (0x3C)_H => (60)_D

A1 - (0x01)_H - Auto power off

A2 data should be in range (0x05)_H to (0x3B)_H

-Date and Time : Time should be in 24 Hour Format

Eg: Date: 30/06/15 & Time: 09:42:10

hh = (0x09)_H, mm = (0x42)_H, ss = (0x10)_H, dd = (0x30)_H, MM = (0x06)_H, yy = (0x15)_H

Note: It is expected that valid date and time should be setted through the frame.

Response After Frame 1 or Frame 2 Query:

Wait for maximum 1sec to get response

0x40	0x23	0x0D	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	XX
Start frame	Special Character	Model Number	Dummy Byte														Check sum	

- 18 byte Frame Length

- Model Number Information

10.6 Online Communication

Online Communication means to get the data which are currently appearing on the meter screen. Multimeter Send data at the rate 250ms.

Online Communication Start Query:

0x5E	0x01	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	XX
Start frame	Online Com	Dummy Byte														Checksum		

- 18 byte Frame Length

To start communication send start query only once, response will be given until stop query is send.

Response:

0x24	XX	M1	M2	M3	S1	S2	S3	XX	R1	hh	mm	ss	dd	MM	XX	yy	XX
Start frame	Function Detail	Main Display Readings			Sub Display Readings			Standards key & data	Range	Hour	Min ute	Sec onds	Date	Mon th	Fla gs	Year	Checksum

- 18 byte Frame Length

- XX value is not fixed

- Function Details

BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
BATT		Function Code			Function Counter		

BATT- DATA (0b1)₂ means data which is send is of battery voltage

Note: Ignore other bits of this frame. In case of Battery, sub display readings are of no use.

Function Code -

Function Code (0x01)_h means VAC 10MΩ

Function Code (0x02)_h means VAC 1MΩ

For Data (0x01)_h & (0x02)_h Function Counter:

Function Counter (0x00)_h means Hz Function

Function Counter (0x01)_h means Low Pass Filter Enabled

Function Counter (0x02)_h means dB

Function Counter (0x03)_h means dBm

Function Counter (0x04)_h means dBμ

Function Code (0x03)_h means VDC

Function Counter:

Function Counter (0x00)_h means VDC

Function Counter (0x01)_h means VACDC

Function Code (0x05)_h means Resistance

Function Counter data is Don't Care

Function Code (0x06)_h means Diode

Function Counter:

Function Counter (0x00)_h means Diode

Function Counter (0x01)_h means Continuity

Function Code (0x07)_h means Temperature

Function Counter:

Function Counter (0x00)_h means Thermocouple K Degree Centigrade

Function Counter (0x01)_h means Thermocouple J Degree Centigrade

Function Counter (0x02)_h means PT100 Degree Centigrade

Function Counter (0x03)_h means PT100 Degree Centigrade

Function Code (0x08)_h means Capacitance

Function Counter:

Function Counter (0x00)_h means Capacitance

Function Code (0x09)_h means milli - Ampere

Function Counter:

Function Counter (0x00)_h means mA DC

Function Counter (0x01)_h means mA AC

Function Counter (0x02)_h means mA ACDC

Function Code (0x0A)_h means Ampere

Function Counter:

Function Counter (0x00)_h means A DC

Function Counter (0x01)_h means A AC

Function Counter (0x02)_h means A ACDC

Function Code (0x0B)_H means mVDC

Function Counter:

Function Counter (0x00)_H means mVDC

Function Counter (0x01)_H means mVACDC

Function Counter (0x02)_H means Hz

Function Counter (0x03)_H means Duty Cycle

Function Code (0x0F)_H means No Function

Function Counter Don't Care. Display Shows -----

-Main Display Readings

M1=>

BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
Sign		Data					

Sign: Sign (0b0)₂ means Positive Value

Sign (0b1)₂ means Negative Value

It is necessary to make sign data (0b0)₂ for getting proper Data value of digits

Main Readings = (M1 * (0x10000)_H) + (M2 * (0x100)_H) + M3

Eg: Data Send for meter = (60000)D => (0xEA60)_H

M1 = (0x00)_H, M2 = (0xEA)_H, M3 = (0x60)_H

Main Readings = ((0x00)_H * (0x10000)_H) + ((0xEA)_H * (0x100)_H) + (0x60)_H => (0xEA60)_H

- Sub Display Readings

Calculation is Similar to Main Display Readings instead of M1, M2 & M3 it is S1, S2, S3

- Standards keys & Data

BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
Standard Clamp Ratio		Flag Sub display	HOLD key	Relative key	Min/Max/Avg key		

Standard Clamp ratio (SCR)

SCR (0b000)₂- Normal Function

SCR (0b001)₂- 1:1 Clamp Ratio is Selected

SCR (0b010)₂- 1:10 Clamp Ratio is Selected

SCR (0b011)₂- 1:100 Clamp Ratio is Selected

SCR (0b100)₂- 1:1000 Clamp Ratio is Selected

Flag Sub Display (FSD)

FSD (0b0)₂- Sub Display Readings Don't Care

FSD (0b1)₂- Sub Display Readings is valid and can be used/shown

HOLD key

Hold key (0b1)₂ is pressed (Sub display Reading is Hold Value)

Relative key

Relative key (0b1)₂ is pressed (Sub display Reading is Relative Value)

Min/Max/Avg key (MMA)

MMA (0b00)₂- Normal Function

MMA (0b01)₂- Min key Pressed (Sub display Reading is Minimum Value)

MMA (0b10)₂- Max key Pressed (Sub display Reading is Maximum Value)

MMA (0b11)₂- Average key pressed (Sub display Reading is Average Value)

-Range

Range contain Main Display Range and Sub Display Range.

Main Display Range = (R1)_H / (0x0A)_H

Sub Display Range = (R1)_H % (0x0A)_H

Milli-Volt (mV)		Milli-Ampere(mA)		Resistance (Ω)		Frequency (Hz)		Capacitance (F)		Temperature	
60.000	(0x00) _H	600.00	(0x00) _H	600.00 Ω	(0x00) _H	600.00 Hz	(0x00) _H	10.00 nF	(0x00) _H	1372.0	(0x00) _H
600.00	(0x01) _H	6.0000	(0x01) _H	6.0000 kΩ	(0x01) _H	6.0000 kHz	(0x01) _H	100.0 nF	(0x01) _H	Conductance / Time (S)	
Voltage (V)		60.000	(0x02) _H	60.000 KΩ	(0x02) _H	60.000 KHz	(0x02) _H	1.000 μF	(0x02) _H	1.0000 S	(0x00) _H
6.0000	(0x00) _H	600.00	(0x03) _H	600.00 KΩ	(0x03) _H	600.00 KHz	(0x03) _H	10.00 μF	(0x03) _H	100.00 mS	(0x01) _H
60.000	(0x01) _H	Ampere (A)		6.0000 MΩ	(0x04) _H	1.0000 MHz	(0x04) _H	100.0 μF	(0x04) _H	100.00 μS	(0x02) _H
600.00	(0x02) _H	6.0000	(0x00) _H	40.00 MΩ	(0x05) _H	dB, dBm, dBμ		100.0 μF	(0x05) _H	1.0000 μS	(0x03) _H
1000.0	(0x03) _H	10.000/16.000	(0x01) _H			40.000	(0x00) _H			Temperature	
										Deg. C	(0x00) _H
										Deg. F	(0x01) _H
										Kelvin	(0x02) _H

Note: Main Display Range & Sub Display Range is used to determine Decimal point for Main Display Reading and sub Display Reading

For Min/Max/Avg/Rel Data Decimal point position for Main Display Readings and Sub Display Reading is same

Eg: VAC R1= (0x0B)_H

Main Display Range = (0x0B)_H / (0x0A)_H = (0x01)_H => VAC 60.000V Main Display Range

Sub Display Range = (0x0B)_H % (0x0A)_H = (0x01)_H => 6.0000KHz Sub Display Range

The Function like Duty Cycle, Diode & Continuity Main Display Range & Sub Display Range (0x00)_H
 -Hour, Minute, Second, Date, Month & Year

Hour value is in 24-Hour Format

Eg: hh = (0x17)_H, MM = (0x30)_H, ss = (0x48)_H, dd = (0x28)_H, mm = (0x06)_H, yy = (0x15)_H

Time => 17:30:48
 Date => 28/06/15

-Flags

BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
'OL' Sub Display	REL 'OL'	AUTO MAN	%age Scale Function	FUSE BLOW	Danger Voltage	Low Battery	

'OL' sub Display

OL (0b0)₂ - Sub Display Readings is not overloaded

OL (0b1)₂ - Sub Display Readings is Overloaded

Rel 'OL'

Rel 'OL'(0b0)₂ - Main Display Data For Relative Function is not Overloaded

Rel 'OL' (0b1)₂ - Main Display Data For Relative Function is loaded

For DC Functions, Main Display Value can goes to '99999' counts

AUTO MAN (AM)

AM (0b0)₂ - Meter is in Manual Mode

AM (0b1)₂ - Meter is in Auto Mode

%age Scale Function (PSF)

PSF (0b00)₂ - Normal Function

PSF (0b01)₂ - 0-20 mA %age scale is setted

PSF (0b10)₂ - 4-20 mA %age scale is setted

FUSE BLOW(FB)

FB (0b0)₂ - Fuse is proper

FB (0b1)₂ - Fuse is damaged

Danger Voltage(DV)

DV (0b0)₂ - No Danger/ Hazardous Voltage

DV (0b1)₂ - Danger Voltage Detected

Low Battery (LB)

LB (0b0)₂ - Battery voltage is ok

LB (0b1)₂ - Battery voltage has fallen below 2.4V (low battery detected)

Note: For Memory Offline Data Read :

In Function Detail, BATT data is always (0b0)₂, since BATT, Square Wave Output Function value are not logged in meter.

Year and Checksum, Byte are not sent.

Decoding Method of offline frame is same as of online communication frame.

Online Communication Stop Query:

0x5E	0x00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	XX
Start frame	Stop Com	Dummy Byte														Checksum		

-18 byte Frame length

Response:

wait for nearly 250ms to get response

0x40	0x23	0x0D	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	XX
Start frame	Special Character	Model Number	Dummy Byte														Check sum		

-18 byte Frame Length

- Model Number Information

10.7 Memory Data

Memory Data Initialization Query:

0x5E	0x02	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	XX
Start frame	Offline Init	Dummy Byte															Checksum	

-18 Byte Frame Length

Response (16 Byte Frame Length)

P1	P2	F1	F2	00	00	00	00	00	00	00	00	00	00	00	00	00
Max. Page Number	Max. File Number	Dummy Byte														

-Max. Page Number (Max Page Number Can be $(7FF)_H$)

$Pg.No. = (P1 * (0x100)_H) + P2$

Eg: $P1 = (0x01)_H, P2 = (0x23)_H$ $Pg.No = ((0x01)_H * (0x100)_H) + (0x23)_H \Rightarrow (0x123)_H \Rightarrow (291)_D$

Memory Used Space in % = $((Pg.No)_D - (39)_D) / (2009)_D * (100)_D$

Pg. No. = $(291)_D$ Memory Used Space in % = $((291)_D - (39)_D) / (2009)_D * (100)_D \Rightarrow 12.54\%$

$P1 = P2 = (0xFF)_H$ then there is no data in the memory, memory is empty.

-Max. File Number

$File = (F1 * (0x100)_H) + F2$

Eg: Suppose Max File Number = $(0x02)_H$ means there is total 3 file \Rightarrow File0, File 1, & File 2

Memory Erase Query:

0x5E	0x02	0x04	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	XX
Start frame	Offline Init	Erase	Dummy Byte														Checksum	

-18 Byte Frame Length

Response:

wait for maximum 10s to get response

0x40	0x23	0x0D	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	XX
Start frame	Special Character	Model Number	Dummy Byte																Checksum	

-18 byte Frame Length

- Model Number Information

Note: Continuous ON symbol glows after Memory Erase query

Memory File Details Query:

0x5E	0x02	0x02	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	XX
Start frame	Offline Init	File Detail	Dummy Byte																Checksum	

-18 byte Frame length

Response:

The Response is of total byte $(2800)_H \Rightarrow (10240)_D$

Out of $(10240)_D$ First 256 byte of data is of no use because its information is already sent in Memory Initialization Query

After 256 byte of data, data is in following format:

P1	P2	XX	XX	XX	XX	XX	XX
File End Page Address	Hour	Minute	Second	Date	Month	Year	

-8 Byte Frame Length

-File End Page Address (Max Page Address Can be $(7FF)_H$)

$File\ End\ Page\ Address = (P1 * (0x100)_H) + P2$

Eg: $P1 = (0x01)_H, P2 = (0x23)_H$

$File\ End\ Page\ Address = ((0x01)_H * (0x100)_H) + (0x23)_H \Rightarrow (0x123)_H \Rightarrow (291)_D$

$P1 = P2 = (0xFF)_H$ then memory is empty.

-If there is continuously $(0xFF)_H$ for minimum of 8 Byte then Data is of no need (Don't Care)

-Above frame is repeated for maximum file number present in memory

Memory Page Data Read Query:

0x5E	0x02	0x03	S1	S2	E1	E2	00	00	00	00	00	00	00	00	00	00	00	XX
Start frame	Offline Init	Data Read	Start Page	End Page	Dummy Byte												Checksum	

-18 Byte Frame Length

- Start Page

S2 = Start Page % (0x64)_H

S1 = (Start Page / (0x64)_H) % (0x64)_H

-End Page

E2 = End Page % (0x64)_H

E1 = (End Page / (0x64)_H) % (0x64)_H

Eg: If you want to read certain file, Check which of the file detail should be read, in that file detail there is File End Page Number which should be used as End Page in case of data read.

If you are reading File 0 data then start page will always be (0x28)_H

If you are reading other than File 0 data the Start will be Previous File End page Number + 1.

Eg: There are total 3 File Details

File 0, File 1, File 2

File 0, P1 = File End Page Address

File 1, P2 = File End Page Address

File 2, P3 = File End Page Address

Now Suppose we want to read File 0

Then, Start Page = (0x28)_H, End Page = P1

Now suppose we want to read File 1

Then, Start Page = P1 + (0x01)_H, End Page = P2

Response:

The response from meter of ((End Page Number)_D - (Start Page Number)_D * (256)_D) Byte.

The response time may varies according the number of byte being sent from meter.

The Start of frame is always (0x24)_H

From start of frame total byte length of data is 16 byte.

If Continuous (0xFF)_H arrives for 16 byte means that data is not valid data move until next 16 byte of data, start frame contains (0x24)_H

0x24	XX	M1	M2	M3	S1	S2	S3	XX	R1	hh	mm	ss	dd	MM	XX
Start frame	Function Detail	Main Display Readings			Sub Display Readings			Standards key & data	Range	Hour	Minute	Seconds	Date	Month	Flags

***Refer to Section 10.6 Online Communication Start Query Response Frame, Only difference is that in memory data year and checksum is not sent from the meter.

-16 Byte Frame Length

-XX means value is not fixed

-At Each frame

-Above frame is repeated for maximum number data byte read.

10.8 Memory Distribution:

Page Number	Information	(Byte Length) _D
0	Basic Data	256
1 - 39	File Details	9984
40 - 2047	Data	513792

A Single Page consist of 256byte of information.

10.9 Communication Detail

Baud Rate: 9600

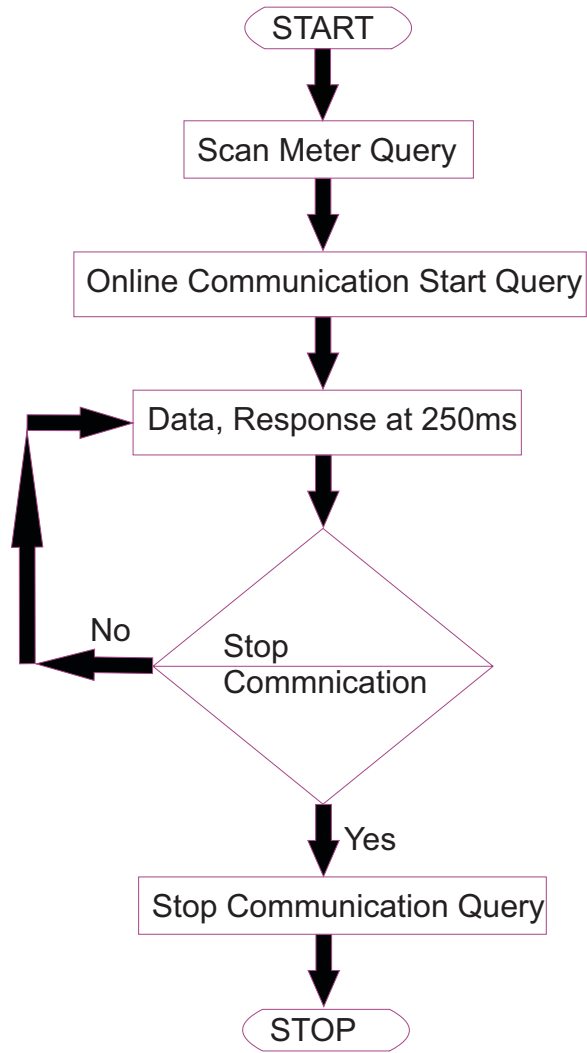
Parity: None

Data bits: 8

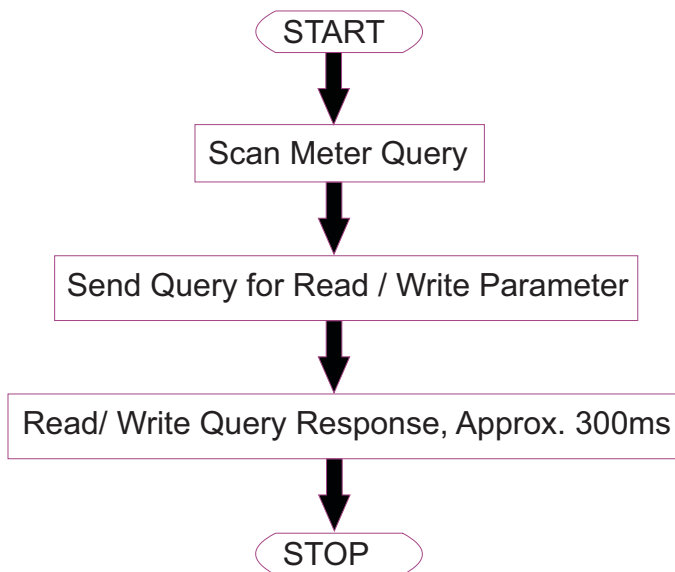
Stop bits: 1

Flow Control: None

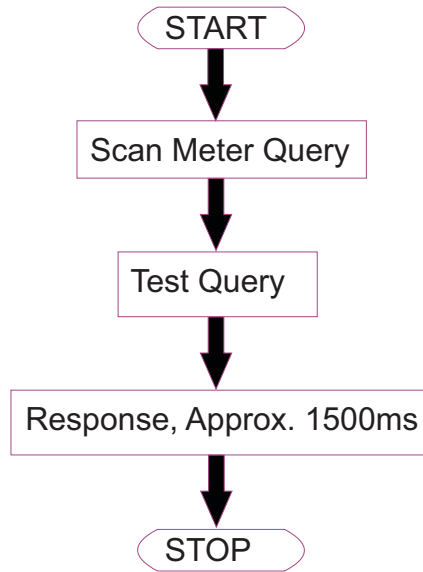
10.10 Online Communication Flow Chart



10.11 Setup Read/Write Parameter FlowChart



10.12 Test Query FlowChart



10.13 Memory Read FlowChart

