



**Solartron  
Metrology**

**SCIENCE  
GATE**  
Your Automation Partner



**SCIGATE AUTOMATION (S) PTE LTD**

No. 1 Bukit Batok Street 22 #01-01 Singapore 659592

Tel: (65) 6561 0488

Fax: (65) 6562 0588

Email: [sales@scigate.com.sg](mailto:sales@scigate.com.sg)

Web: [www.scigate.com.sg](http://www.scigate.com.sg)

Business Hours: Monday - Friday 8.30am - 6.15pm

# MODIM Manual



**AMETEK**<sup>®</sup>  
ULTRA PRECISION TECHNOLOGIES

## 1.1 DOCUMENTATION CROSS REFERENCE

502990	Orbit3 System manual	Details on installation and electrical requirements for the OrbitLibrary compatible products
502990	Orbit3 System manual	Details on installation and electrical requirements for the Orbit Library compatible products
502914	Orbit Module manual	Details on installation and electrical requirements for Orbit Modules
503094	Digital Probe, Orbit ACS and Linear Encoder User Leaflet	Detailing the specific requirements for using the Digital Probe (DP), Orbit ACS and Linear Encoder such as mounting details
503184	Strain Gauge Input Module (SGIM)	User leaflet covers the specific requirements such as product handling & configuration
503145	Orbit Laser Triangulation Probe (LT)	User leaflet covers the specific requirements such as product handling & configuration
503158	Orbit high performance Laser Triangulation Probe (LTH)	User leaflet covers the specific requirements such as product handling & configuration
	Orbit3 Catalogue	Describes the Orbit system and provides details of the products including specifications and dimensions.
Modbus_Application_Protocol_V1_1b.pdf	MODBUS protocol specification	<a href="http://www.modbus.org/docs/Modbus_Application_Protocol_V1_1b.pdf">http://www.modbus.org/docs/Modbus_Application_Protocol_V1_1b.pdf</a>

For module connecting details see the relevant section of this manual.

For updated information, troubleshooting guide and to see our full range of products, visit our website: <http://www.solartronmetrology.com>

## 1.2 TRADEMARKS AND COPYRIGHTS

Microsoft®, Windows®XP, Windows®Vista, Windows®7, Windows®8, Windows®10, Excel®, VBA, VB and the .NET Framework are registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries.

Orbit® is a registered trademark of Solartron Metrology Ltd

### 1.3 CONTACT INFORMATION

For updated information, troubleshooting guide and to see our full range of products, visit our website:

<http://www.solartronmetrology.com>

<b>2</b>	<b>TABLE OF CONTENTS</b>	
1.1	DOCUMENTATION CROSS REFERENCE.....	<a href="#">2</a>
1.2	TRADEMARKS AND COPYRIGHTS.....	<a href="#">2</a>
1.3	CONTACT INFORMATION.....	<a href="#">3</a>
<b>2</b>	<b>TABLE OF CONTENTS.....</b>	<a href="#">4</a>
<b>3</b>	<b>INTRODUCTION.....</b>	<a href="#">6</a>
3.1	SCOPE.....	<a href="#">6</a>
3.2	NAVIGATE THIS DOCUMENT.....	<a href="#">7</a>
<b>4</b>	<b>SAFETY SUMMARY.....</b>	<a href="#">7</a>
<b>5</b>	<b>GLOSSARY.....</b>	<a href="#">8</a>
5.1	Terms associated with MODIM.....	<a href="#">8</a>
5.2	Overview of Orbit modules.....	<a href="#">9</a>
<b>6</b>	<b>CONFIGURATION OF MODIM NETWORK.....</b>	<a href="#">10</a>
6.1	Installing Orbit3 Support Pack for Windows.....	<a href="#">10</a>
6.2	Orbit3 Gateway Configurator - Installation & Operation.....	<a href="#">11</a>
6.2.1	Connecting the Network.....	<a href="#">11</a>
6.2.2	Configuring the Network.....	<a href="#">12</a>
6.2.3	Adjusting the Module Address (as required).....	<a href="#">13</a>
6.2.4	Advanced Set Up Commands.....	<a href="#">13</a>
<b>7</b>	<b>MODBUS INTERFACE FUNCTIONALITY.....</b>	<a href="#">14</a>
7.1	MODBUS Function Codes Supported.....	<a href="#">14</a>
7.2	Modbus Address.....	<a href="#">15</a>
7.3	Baud rate, Stop/Parity bits Configuration.....	<a href="#">15</a>
7.4	Modbus Parameter Map.....	<a href="#">15</a>
7.5	Conversion of readings into decimal format.....	<a href="#">16</a>
7.6	Procedure for reading measurements from all sensors synchronously.....	<a href="#">17</a>
7.6.1	TriggerSync mode.....	<a href="#">17</a>
7.6.2	UpdateOnReq mode.....	<a href="#">18</a>
7.7	Procedure for reading measurement from a single sensor.....	<a href="#">19</a>

<b>8</b>	<b>DIAGNOSTICS</b>	<b><a href="#">20</a></b>
<b>8.1</b>	<b>MODIM Status register codes</b>	<b><a href="#">21</a></b>
<b>8.2</b>	<b>Modbus Exception Codes</b>	<b><a href="#">21</a></b>
<b>9</b>	<b>FIRMWARE UPGRADE</b>	<b><a href="#">22</a></b>
<b>10</b>	<b>REVISION HISTORY</b>	<b><a href="#">23</a></b>

## 3 INTRODUCTION

### 3.1 SCOPE

The Orbit®3 Measurement System is a modular measurement system that can be put together quickly, easily and is cost effective. It allows different types of sensors to be easily mixed and integrated on a single network independent of sensor technology

The Orbit network can consist of any of the following Orbit3 modules: Digital Probes (DP), Analogue Interface Modules (AIM), Laser Triangulation Sensors (LT/LTH), Encoder Input Module (EIM). The MODIM does not support Linear Encoder (LE), Digital Input Output module (DIOM), Digimatic Input (DIM) type of Orbit modules on the network. MODIM supports communicating up to a maximum of 150 Orbit3 modules on the network.

The network was originally designed to interface to a PC and the network protocol designed around this. Typical PC controllers being for USB, RS232 and Ethernet. Interfacing the ORBIT network to a PLC has always proven more difficult and so a new range of controllers has been developed specifically for PLC interfacing.

This manual provides technical information about the PLC MODBUS product called the MODIM (Modbus Interface Module) which provides a gateway between a MODBUS network and the ORBIT network.

This allows a PLC/MODBUS system to use the Orbit Network using standard MODBUS commands without the need to understand the Orbit Protocol.

#### Examples

Combine an Encoder Module with a rotary encoder to give angular position and then use this to take readings from Digital Probes to profile a round part.

Add an AIM with a PT100 to monitor the temperature during the measurement cycle

Add an AIM with a load cell to weigh the part.

Several Aim can be used with PT100 to monitor and record clean room temperatures for audit trails.

Use the Digital Input Output Module to trigger a PLC to advise a measured part is Ok or not OK.

Use a DIOM to monition interlock relays



## 3.2 NAVIGATE THIS DOCUMENT

Hyperlinks are included to aid navigation.



To return to the point where you have jumped from, most pdf readers have a 'Previous Page View' button, alternatively use the keyboard shortcut 'ALT' + left arrow key.

## 4 SAFETY SUMMARY

<p><b>WARNING</b> statements identify conditions or practices that could result in personal injury or loss of life.</p> <p><b>CAUTION</b> statements identify conditions or practices that could result in damage to the equipment or other property</p> <p><b>Symbols in this manual</b></p> <p> Indicates cautionary or other information</p>	<p><b>Warnings and Cautions</b></p> <p><b>Warning:</b> Do not operate in an explosive atmosphere.</p> <p><b>Warning:</b> this equipment is not intended for safety critical applications</p> <p><b>Warning:</b> do not exceed maximum ratings as specified in this document under individual modules.</p> <p><b>Caution: Low Voltage</b> This equipment operates below the SELV and is therefore outside the scope of the Low Voltage Directive</p> <p><b>Service and Repair</b></p> <p> <b>CAUTION:</b> This equipment contains no user serviceable parts. Return to supplier for all service and repair</p>
--	--

All of the products are **CE** marked and comply with EN61000-6-3 Electrical Emissions and EN61000-6-2 Electrical Immunity and EN61326-1

## 5 GLOSSARY

### 5.1 TERMS ASSOCIATED WITH MODIM

#### PLC (Programmable Logic Controllers)

A real-time computer built/configured to perform certain specific tasks. These are real-time systems, generally used for automation of an electromechanical process.

#### Abbreviations

AIM	Analogue Input Module
DP	Digital Probe (e.g. DP10)
DIOM	Digital Input Output Module
EIM	Encoder Input Module
LE	Linear Encoder
LT	Laser Triangulation Probe
LTH	High performance Laser Triangulation Probe
DIM	Digimatic Interface Module
M	(Orbit) Module
PIE	Probe Interface Electronics
USBIM	USB Interface Module
RS232IM	RS232 Interface Controller
RS485IM	RS485 Interface Controller
ETHIM	Ethernet Interface Controller
ORBIT®	Orbit communication protocol
OSPW	Orbit Support Pack for Windows
PSIM	Power Supply Interface Module required to provide power for the MODIM and the Orbit Network
UOM	Unit of measure
Master	MODBUS master controller



## 5.2 OVERVIEW OF ORBIT MODULES

MODULE	DESCRIPTION
Digital Probe (DP)	A Linear Measurement Probe hard wired to an Orbit <sup>®</sup> 3 Conditioning Module, which provides improved accuracy and a simple method of constructing a Gauging System. The conditioning module that is fitted to the DP is called a PIE module.
Linear Encoder (LE)	An incremental encoder hard wired to an Orbit <sup>®</sup> 3 Conditioning Module which provides improved accuracy.
Laser Triangulation (LT & LTH)	A Laser Triangulation Sensor hard wired to an Orbit <sup>®</sup> 3 Conditioning Module allowing a Laser non contacting sensor to be integrated into the Orbit Network
Analogue Input Module (AIM)	A module that can take in 3 <sup>rd</sup> party sensors with either voltage or current outputs (E.g. pressure, load cells). A Special variant is available for a PT100 temperature sensor
Encoder Input Module (EIM)	A module that can take in a square wave signal from a rotary encoder or line scale. This allows angular position to be easily brought into the Orbit3 measurement system for profiling.
Digital Input Output Module (DIOM)	This module can read discrete inputs and set discrete outputs for control functions.
Digimatic Interface Module	This module reads equipment with a Digimatic interface such as a Vernier Calliper.
Digital Displacement	A displacement sensor hard wired to an Orbit3 Conditioning Module, allowing Displacement sensors to be easily networked and data collected from them.
PSIM	Power Supply Interface Module used to power the Orbit3 Network.

NOTE. The MODIM does not work with DIOM, DIM or LE Products

For further information of the Orbit Modules refer to the Orbit Modules Manual supplied as part of the OSPW installation.

Also, for updated information, troubleshooting guide and to see our full range of products, visit our website: <http://www.solartronmetrology.com>

## 6 CONFIGURATION OF MODIM NETWORK

Before using the MODIM product, the MODIM and the attached Orbit Modules must be configured. The Orbit3 Gateway Configurator is provided for this purpose.

It allows the user to perform the following key functions:

- Set up the MODIM Gateway.
- Set up the Modules on the Orbit Network
- Store the MODIM Setup file for future use
- Maintain the Network by adding, removing or replacing modules

A PC running the latest Orbit3 Support Pack for Windows is required to run the Orbit 3 Gateway Configurator along with an Orbit3 Gateway Interface 1 (Part No. 806748) which is supplied as part of the MODIM Pack.

Note. The Gateway Interface is only used during the configuration step and is not required for normal Modbus operation.

### 6.1 INSTALLING ORBIT3 SUPPORT PACK FOR WINDOWS

**Important!** Please ensure that you have Administrative access rights for installing this software.

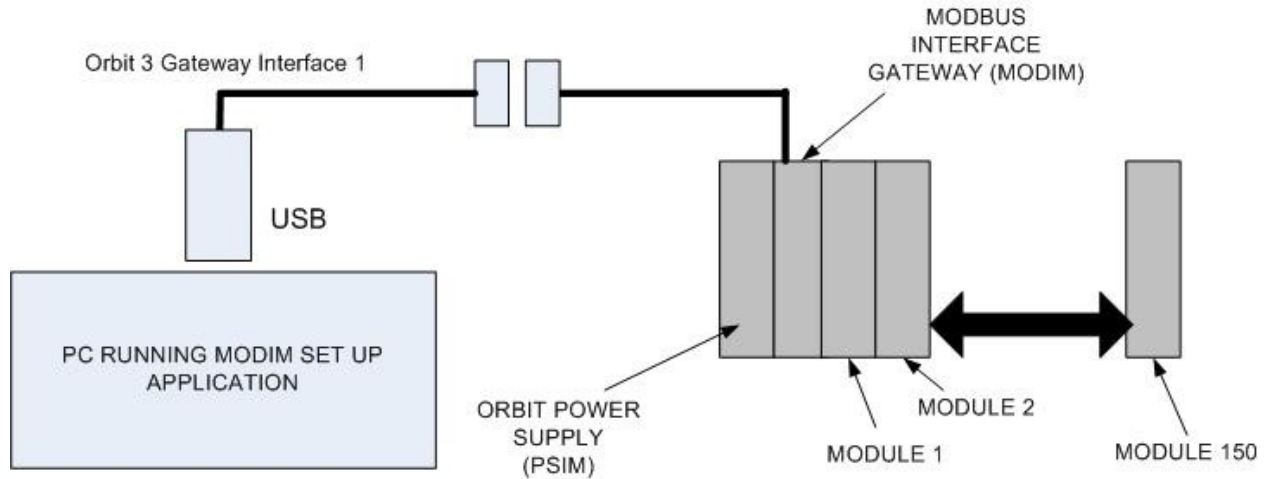
Before you can use the Orbit3 Gateway Configurator you must have the Orbit3 Support Pack for Windows® software installed on your computer; this is freely available from the Solartron website.

This will install the latest version of this manual, the Orbit3 Gateway Configurator and Orbit3 Updater that are required for using the MODIM product.

## 6.2 ORBIT3 GATEWAY CONFIGURATOR - INSTALLATION & OPERATION

### 6.2.1 Connecting the Network

Connect the network as shown in the connection diagram below.



#### NOTES

The PSIM is always the first module on the Network, (a standard PSIM provides 5V DC power to the network). Depending on the number and types of Orbit modules on the Network, more than one PSIM may be required. Typically a PSIM will power between 10 and 30 Modules (depending on module type); use the "Orbit3 Network Power Calculator" spreadsheet (supplied as part of the Orbit3 Support Pack) as a guide.

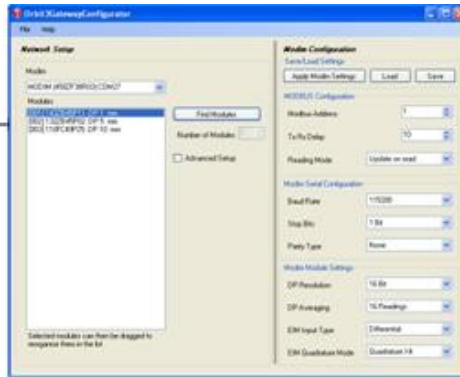
If Laser products are used on the network, a PSIM that provides +24V DC to the network is required.

For guidance in connecting the Orbit modules together in a network, grounding considerations, cabling and power supplies please see the ORBIT SYSTEM MANUAL. For additional information on the ORBIT modules please see the relevant datasheets, product manuals and the ORBIT MODULE MANUAL.

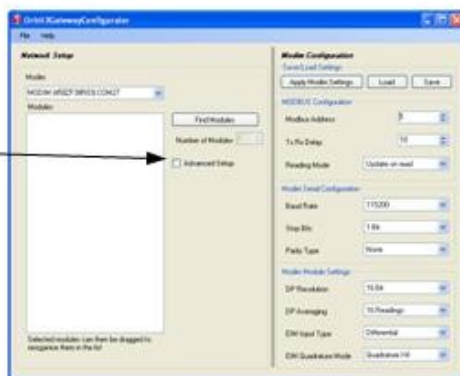
Once the Orbit system is connected, connect the PC using the Orbit Gateway Interface 1 cable, apply power to the system and run the ORBIT3 Gateway Configurator application software.

## 6.2.2 Configuring the Network

Orbit Modules appear here When the Orbit3 Gateway Application is Run



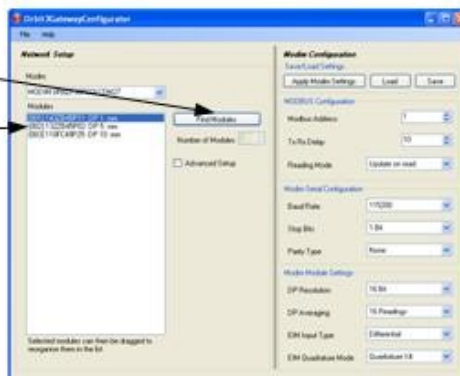
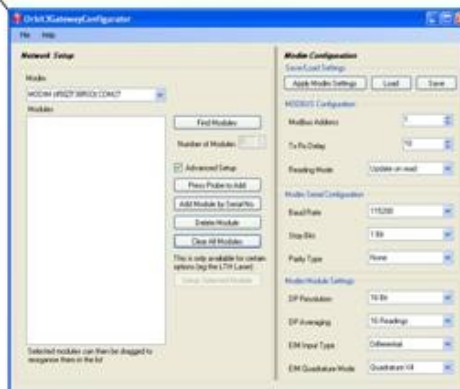
If No Orbit Modules appear select the advance setup and Clear Modules



Clear "ADVANCED SETTINGS" and use

"FIND MODULES"

To find and identify the Orbit Modules

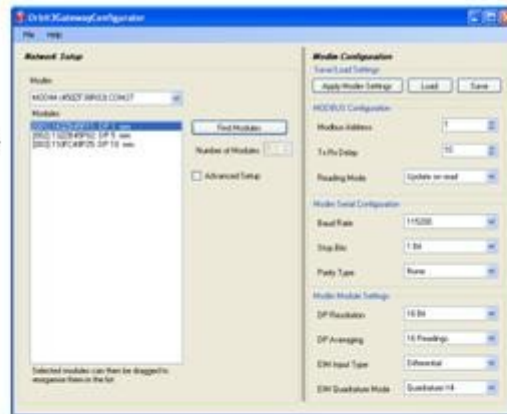


On running the application the initial screen (shown below) will be displayed. The right hand panel shows the MODIM settings.

### 6.2.3 Adjusting the Module Address (as required)

The Orbit Module addresses are initially set at random (although they can be selected in Order using the Advanced Settings in the Orbit3 Gateway Configurator).

Orbit Modules on the Network with address, ID code (also printed on the module) and description



Click on a Module to Select It and then Drag it to where required in list. This will automatically change its address

[001]143ZB45P11 :DP 1 mm  
 [002]132ZB45P02 :DP 5 mm  
 [003]110FC49P25 :DP 10 mm

[001]110FC49P25 :DP 10 mm  
 [002]143ZB45P11 :DP 1 mm  
 [003]132ZB45P02 :DP 5 mm

Once the Orbit Modules have been moved to their desired address, then the MODIM settings such as address and Serial Configurations can then be adjusted.

At this point, global setting of the Orbit Module resolution and averaging (for DP and AIM modules only) can be set (Bottom right of screen).

Once this is done click “Apply Modim Settings” and if required, click 'Save' to save the configuration to a backup file on the PC for future use.

### 6.2.4 Advanced Set Up Commands

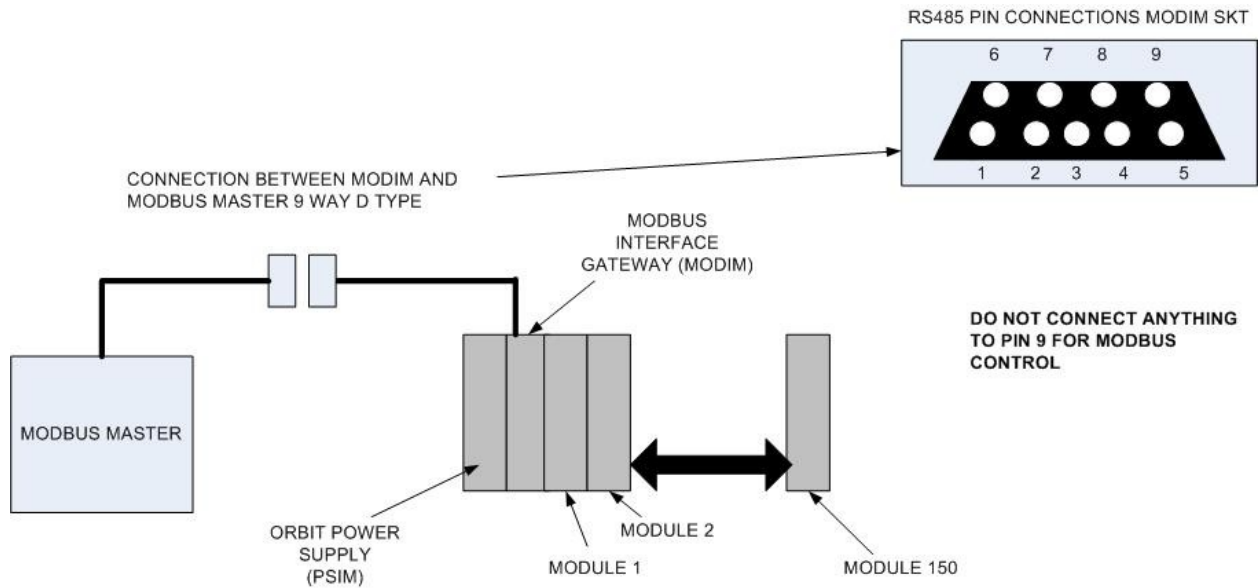
These commands enable a manual set up of the Orbit Module Addresses.

Available commands are:

- Clear All Modules: removes all sorted addresses from the Orbit Network
- Add Module by Serial Number: allows the ID to be set against the next available address.
- Press Probe Tip to Add: allows the user to set the module to the next available address by simply changing its input (for a probe this means moving the tip).

## 7 MODBUS INTERFACE FUNCTIONALITY

Make the installation and RS485 pin connections as detailed below.



### NOTES

The PSIM is always the first module on the Network, (a standard PSIM provides 5V DC power to the network). Depending on the number and types of Orbit modules on the Network, more than one PSIM may be required. Typically a PSIM will power between 10 and 30 Modules (depending on module type); use the “Orbit3 Network Power Calculator” spreadsheet (supplied as part of the Orbit3 Support Pack) as a guide.

If Laser products are used on the network, a PSIM that provides +24V DC to the network is required.

For guidance in connecting the Orbit modules together in a network, grounding considerations, cabling and power supplies please see the ORBIT SYSTEM MANUAL. For additional information on the ORBIT modules please see the relevant datasheets, product manuals and the ORBIT MODULE MANUAL.

An overview on Modbus protocol can be found under:

[http://www.modbus.org/docs/Modbus\\_Application\\_Protocol\\_V1\\_1b.pdf](http://www.modbus.org/docs/Modbus_Application_Protocol_V1_1b.pdf)

### 7.1 MODBUS FUNCTION CODES SUPPORTED

The Modbus request function codes supported are as below:

Function Code	Description
0x03	Read Multiple Holding Registers
0x04	Read Multiple Input Registers
0x06	Write Single Register

## References

See [Modbus Parameter Map](#) section for Modbus parameter register addresses.

See [Procedure for reading measurements from all sensors synchronously](#) and [Procedure for reading measurement from a single sensor](#) section for steps required to read the measurements from Orbit sensors synchronously or individually.

## 7.2 MODBUS ADDRESS

MODIM will communicate with the node-id (Modbus Address) as configured through Configuration PC application.

## 7.3 BAUD RATE, STOP/PARITY BITS CONFIGURATION

MODIM will communicate according to the baud rate and no. of stop/parity bits configured through Configuration PC application

## 7.4 MODBUS PARAMETER MAP

Below is the Modbus registers parameter map:

Register Address	Access Type	Description
0	Write Only	Trigger Sync Read request. A non-zero data write onto this register will trigger a read from all the Orbit sensors on the network and copies the readings from sensors onto corresponding Modbus reading registers
1	Read Only	MODIM status register - Contains the current status/error code for MODIM unit. Refer to <a href="#">MODIM Status register codes</a> section for possible status codes and its description.
2	Read Only	Upper Reading word for sensor 1
3	Read Only	Lower Reading word for sensor 1
4	Read Only	Upper Reading word for sensor 2
5	Read Only	Lower Reading word for sensor 2
6	Read Only	Upper Reading word for sensor 3
7	Read Only	Lower Reading word for sensor 3
8	Read Only	Upper Reading word for sensor 4
9	Read Only	Lower Reading word for sensor 4
10	Read Only	Upper Reading word for sensor 5
11	Read Only	Lower Reading word for sensor 5
		.
		.
		.
498	Read Only	Upper Reading word for sensor 249
499	Read Only	Lower Reading word for sensor 249
500	Read Only	Upper Reading word for sensor 250
501	Read Only	Lower Reading word for sensor 250
502	Read Only	Error code status for sensor 1
503	Read Only	Error code status for sensor 2

504	Read Only	Error code status for sensor 3
505	Read Only	Error code status for sensor 4
506	Read Only	Error code status for sensor 5
	Read Only	.
		.
		.
750	Read Only	Error code status for sensor 249
751	Read Only	Error code status for sensor 250
752	Write Only	Trigger Single Read request. A write onto this register with sensor address will internally trigger a read command to that particular sensor address. The reading and error code status is updated onto Single Data Register and Single Read Error code registers respectively. The sensor address ranges from 1 to 250.
753	Read Only	Single Read Data Register - Upper word
754	Read Only	Single Read Data Register - Lower word
755	Read Only	Single Read Error Code status
756	Read Only	MODIM Firmware Version
757	Read/Write	Modbus protocol Request-To-Response delay in ms. MODIM will send response to Modbus requests only after this configured time delay. A write onto this register through Modbus "Write Single Register" command will change the configuration temporarily and will not be available at next power-on. To save the configuration data permanently, configure the parameter through configuration PC application.
758	Read Only	Number of Orbit modules notified/configured through configuration PC application
759	Read/Write	Network Read Mode. When set to 0=> MODIM will read the measurement data synchronously from Orbit sensors through non-zero data write on TriggerSyncRead MODBUS parameter register. When set to 1=> MODIM will read the measurement data from Orbit sensors when a "Read multiple Holding Registers" or "Read multiple Input Registers" MODBUS command for reading single/multiple Reading registers or ErrorCode registers is received. Refer to section <u>Procedure for reading measurements from all sensors synchronously</u> for procedure to read the data from Orbit sensors. A write onto this register through Modbus "Write Single Register" command will change the configuration temporarily and will not be available at next power-on. To save the configuration data permanently, configure the parameter through the Gateway Configurator PC application.

Modbus registers are 16-bits and hence the Module readings use two registers ganged together to form 32-bits. The reading is stored in Big-endian format with the upper word stored at the lower address and the lower word stored at the higher address. The reading has to be read from both the registers together in a single request. MODIM internally takes care of rejecting the Modbus requests, which tries to read individual reading registers.

## 7.5 CONVERSION OF READINGS INTO DECIMAL FORMAT

The reading values read from the Orbit network are converted into their corresponding measurements in decimal format in two steps. Firstly, the MODIM internally converts raw readings read from the Orbit network into its corresponding UOM format and stores



in Modbus parameter registers in Signed Integer format (Negative readings are stored in 2's complement format).

The Master Modbus controller reads the values from the MODIM's Modbus registers and has to convert them into decimal format according to the decimal point resolution associated with the corresponding module type. The steps for conversion of raw reading read from the Orbit network into UOM format internally by MODIM are explained below.

<b>MODULE</b>	<b>METHOD</b>
DP/LTH	Raw reading is converted into UOM format with units set as mm. The resolution is 6 decimal point places.
AIM	Raw reading is converted into UOM format with units according to AIM type (V, mA, degC, g). The resolution is 3 decimal point places.
EIM	Raw reading is converted into UOM format with units set to counts. The resolution is '0' decimal places.

On reading the values from "Reading registers", the Master has to convert it back into corresponding decimal format.

i.e.

For DP/LTH sensor: Measurement in decimal format = (Reading read from Modbus registers/1000000)

For AIM sensor: Measurement in decimal format = (Reading read from Modbus registers/1000)

For EIM sensor: Measurement in decimal format = (Reading read from Modbus registers)

## 7.6 PROCEDURE FOR READING MEASUREMENTS FROM ALL SENSORS SYNCHRONOUSLY

A synchronous reading of measurements is a way to read measurements from all the sensors through a single command to keep the delay between readings from sensors as small as possible. The procedure for reading the measurement data from Orbit sensors synchronously depends on the value configured in "Network Read Mode" MODBUS parameter register (address=759).

### 7.6.1 TriggerSync mode

Network Read Mode = 0 (referred to as TriggerSync mode)

1. Send "Read Multiple Holding Register" or "Read Multiple Input Registers" command with address=0x0001 (MODIM status register) and no. of registers=0x0001. If the status read is zero (No Error), then proceed further. Else STOP, an internal error has occurred during Orbit network setup at power-on and readings cannot be read from Orbit sensors.
2. Send "Write Single Register" Modbus command with parameter address=0x0000 and non-zero data value. MODIM will receive this request and in-turn send an

Orbit command requesting all Orbit sensors in the network to send out the current measurement readings along with their error code. The readings are then converted into UOM format and updated onto Reading registers. The error codes received are updated onto corresponding Modbus registers. If the response from Orbit network is valid, MODIM will send out a positive response to the master. If there is no/incorrect response from the Orbit network, MODIM sends a Modbus exception response with an appropriate exception code to the Master. Refer to [Modbus Exception Codes](#) section for possible exception codes.

3. Master after receiving positive response, should read data from “Reading Registers” and “Error Code Status Registers” through “Read Multiple Input Registers” or “Read Multiple Holding Registers” Modbus command.
4. If the Error Code status register contains zero, then there is no error and the readings read are valid. A non-zero value indicates an error in the sensor and the readings read are not valid.

The most common error codes are:

- 0x12 – Under range error. The reading is less than the minimum possible value for this sensor. In this case, the reading register for the corresponding sensor will contain 0.
  - 0x13 – Over range error. The reading is greater than the maximum possible value for this sensor. In this case, the reading register will contain the maximum measurement range value for that sensor.
5. The readings received have to be converted by the Master into decimal format as explained in [Conversion of readings into decimal format](#) section.

### 7.6.2 UpdateOnReq mode

Network Read Mode = 1 (referred to as UpdateOnReq mode)

1. Send “Read Multiple Holding Register” or “Read Multiple Input Registers” command with address=0x0001 (MODIM status register) and no. of registers=0x0001. If the status read is zero (No Error), then proceed further. Else STOP, an internal error has occurred during Orbit network setup at power-on and readings cannot be read from the Orbit sensors.
2. Send “Read multiple Holding Registers” or “Read multiple Input Registers” Modbus command to read the required number of reading registers (address range 2 to 501). MODIM will receive this request and in-turn send an Orbit command requesting all Orbit sensors in the network to send out the current measurement readings along with error code. The readings are then converted into UOM format and updated onto reading registers. The error codes received are updated onto corresponding Modbus registers. If the response from the Orbit network is valid, MODIM will send out a positive response with the updated readings received from the network to the Master. If there is no/incorrect response from Orbit network, MODIM sends a Modbus exception response with an appropriate exception code to the Master. Refer to [Modbus Exception Codes](#) section for possible exception codes.
3. Send “Read Multiple Holding Registers” or “Read Multiple Input Registers” command to read the error code registers. If the Error Code status register

contains zero, then there is no error and the readings read are valid. If it contains a non-zero value, then there is an error in the sensor and the readings read are not proper.

The most common error codes are:

- 0x12 – Under range error. The reading is less than the minimum possible value for this sensor. In this case, the reading register for the corresponding sensor will contain 0.
  - 0x13 – Over range error. The reading is greater than the maximum possible value for this sensor. In this case, the reading register will contain the maximum measurement range value for that sensor.
4. The readings received have to be converted by the Master into decimal format as explained in [Conversion of readings into decimal format](#) section.

**NOTE:** In UpdateOnReq mode:

- The measurements from Orbit sensors are read only if the address in Modbus read command in step 2 falls in the Reading Registers' range (address range 2 to 501). Any read request outside this range will not perform a read from Orbit sensors.
- A synchronous read can be performed only for a maximum of 62 sensors on the Orbit network. If the Orbit network contains more than 62 sensors, then use TriggerOnSync mode to perform a synchronous measurement read from the Orbit network.

Refer to “502915 - Orbit3 Software Manual – Section 19.4” for more information on the possible error codes from Orbit sensors.

## 7.7 PROCEDURE FOR READING MEASUREMENT FROM A SINGLE SENSOR

This procedure is used when the reading from a single sensor has to be read individually.

1. Send “Read Multiple Register” command to read MODIM status register address=0x0001. If the status read is zero, then proceed further. Else STOP since there is an internal error occurred during Orbit network setup at power-on and readings cannot be read from Orbit sensors.
2. Send “Write Single Register” Modbus command with address=0x02F0 and sensor address as data value. NOTE THAT the sensor address ranges from 1 to 250 (0 is not a valid sensor address). MODIM will receive this request and in-turn send an Orbit command addressing the sensor to send out current measurement reading along with error code status. The reading is then converted into UOM format and updated onto “Single Read Data registers”. The error codes received are updated onto “Single Read Error Code register”. If the response from the Orbit network is valid, MODIM will send out a positive response to the Master. If there is no/incorrect response from the Orbit network, MODIM sends a Modbus exception response with an appropriate exception code to the Master. Refer to [Modbus Exception Codes](#) section for possible exception codes.

3. Master after receiving positive response, should read data from “Single Read Data Register” and “Single Read Error Code Status Register” through “Read Multiple Input Registers” or “Read Multiple Holding Registers” Modbus command.
4. The readings received are converted into decimal format as explained in [Conversion of readings into decimal format](#) section.
5. If the Error Code status register contains zero, then there is no error and the readings read are valid. A non-zero value indicates there is an error in the sensor and the reading read is not valid.

The most common error codes are:

- 0x12 – Under range error. The reading is less than the minimum possible value for this sensor. In this case, the reading register for the corresponding sensor will contain 0.
- 0x13 – Over range error. The reading is greater than the maximum possible value for this sensor. In this case, the reading register will contain the maximum measurement range value for that sensor.

Refer to “502915 - Orbit3 Software Manual – Section 19.4” for more information on the possible error codes from Orbit sensors.

## 8 DIAGNOSTICS

The MODIM unit contains two LEDs (BLUE and RED) to indicate any errors and current status.

- BLUE LED blinks when there is a communication with the MODIM, either from the Modbus Master or the Orbit Gateway PC application.
- RED LED is used to indicate any hardware/voltage error status. The table below describes the behaviour of RED LED:

LED Status	Description
OFF	No error.
ON	MODIM unit Internal Hardware error.
Blink – Medium Flash (200ms ON, 800ms OFF)	Supply voltage is less than 4.7 V or Supply voltage is greater than 5.2 V. Modbus/Orbit network communication will continue to happen correctly in this condition.
Blink – Slow Flash (800ms ON, 200ms OFF)	Supply voltage is less than 4.5 V or Supply voltage is greater than 5.5 V. Modbus/Orbit network communication does not happen in this condition.

## 8.1 MODIM STATUS REGISTER CODES

Status Code YY=Module Address	Description
0x0000	No Error.
0x0010	Wrong module present error – An incompatible Orbit sensor is connected
0xYY11 to 0xYY17	Error Codes that refer to problems with Orbit Modules Codes 11 to 17. For further details see the Orbit manuals
0xYYFD	Sync Read Command timeout error – Occurs when there is a timeout for the synchronous read command from Orbit network. All the sensors below this sensor address have responded to the synchronous read request.
0xYYFE	Single Read Command timeout error – Occurs if there is a timeout for the Orbit read command to get the measurement from a particular Orbit sensor.

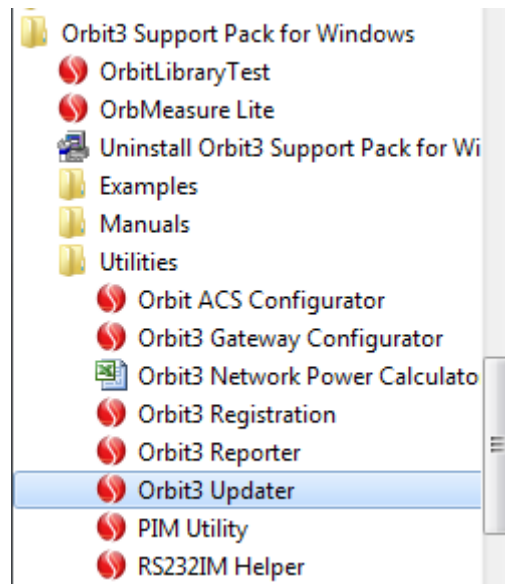
## 8.2 MODBUS EXCEPTION CODES

Status Code	Description
0x01	Illegal function code in the received request.
0x02	Incorrect Modbus register address detected in the received request. This error can occur when: <ul style="list-style-type: none"> <li>- Address exceeds the maximum supported range.</li> <li>- Wrong access level. Trying to read a write-only register or trying to write to a read-only register.</li> <li>- Does not fall on valid register address boundary i.e. (Start Reg. Addr + Number of Registers) do not fall under complete parameter boundary – For e.g: trying to read only one word of measurement reading.</li> </ul>
0x03	Incorrect data value/number of registers in the request. This error can occur when: <ul style="list-style-type: none"> <li>- Number of registers in a read request exceeds the maximum supported range. Or the calculated last register address (Start Addr + Num of Regs) exceeds the maximum supported range.</li> <li>- A '0' data value is sent in "Write Single Register" command during synchronous read procedure.</li> <li>- Incorrect sensor address is sent in "Write Single Register" command during single read procedure.</li> </ul>
0x0B	Timeout error. This error can occur when: <ul style="list-style-type: none"> <li>- There is an error in supply voltage (too low/too high).</li> <li>- Trying to trigger synchronous read/single read when the Orbit network is not initialized with the configured settings (MODIM status register contains an error code).</li> <li>- There is a timeout for the Synchronous Read Orbit command from the network. <ul style="list-style-type: none"> <li>- There is a timeout for the Single Read Orbit command from the network.</li> </ul> </li> </ul>

## 9 FIRMWARE UPGRADE

MODIM firmware can be upgraded using the Orbit3 Updater PC application which is part of the “Orbit3 Support Pack for Windows”. It can be downloaded from the Solartron Metrology website.

Once installed, it is located here:



Follow the on screen instructions to perform the upgrade. Perform power-on reset after successful firmware upgrade to start the newly upgraded firmware.

## 10 REVISION HISTORY

REVISION	DATE	COMMENTS
1		Initial Issue
2	03/08/15	Added <a href="#">Installing Orbit3 Support Pack for Windows</a>