MM-IM

Remote Telemetry Unit

User Guide

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Contents

About this manual

This manual explains how to install, configure and program the Micro Medina Intelligent Modem RTU.

It is assumed that the reader has a basic understanding of telemetry, Remote Telemetry Units and configuration of central telemetry systems. The reader may from time to time need to make reference to other manuals in the Master Control set.

Text conventions

This user guide uses different text types.

- *Note: Notes provide extra information to help improve understanding of the text, or to introduce other related topics.*

WARNING

Warnings are deliberately conspicuous as they only convey critical information. They should never be ignored.

The remaining text types are shown below:

This	Represents
bold	Words that require extra emphasis
italics	Referenced chapter or section headings

Numerical conventions

This user guide refers to decimal values unless otherwise stated. In some cases, binary and hexadecimal notation may be used, as indicated below:

This	Represents
2#00010	Binary
0x24 or 16#24	Hexadecimal

Other Master Control manuals

Master Control Getting Started

Provides an overview of Master Control: its structure and uses, appearance and terminology. There are basic instructions for using its graphical displays and for navigating the menu structure.

Master Control User Guide

Instructions for general users of Master Control: how to create and use Summaries and Reports, Trends, Alarms and Events and use additional Commands.

More detailed information for system operators and administrators is available in the following manuals.

Master Control Database Editor

How to access database information and use Master Control's Database Editor.

Master Control Picture Editor

How to create and edit Master Control's picture pages and symbols using Picture Editor.

Master Control Sequences

Describes the Master Control Sequences Languages and how they can be used to control RTU's and data gatherers.

Master Control Sequences Reference

Detailed information for sequence programmers including sample listings and details of the DG Sequence runtime library.

Master Control OMI

How to use the Operations Management Interface (OMI) to write interfaces from external systems into the Master Control telemetry system.

Master Control MicroMC

Describes MicroMC, an RTU configuration application, and how it can be used to configure and manage a Telemetry system.

Master Control RTU's

How to install, commission and use other Master Control Remote Telemetry Units such as the MM3X, MM3D and MM4A.

Master Control DMS

How to set up and use Master Control's District Metering System (DMS) to identify leaks in the water network.

Master Control Tools

How to use the commissioning and debugging tools such as COMTOOL and MagicEye.

The MM-IM

Introduction

The Intelligent Modem is one of the MM4 family of RTU's based on the Micro Medina kernel, a proven solution providing feature-rich telemetry functionality including standard I/O monitoring and control, monitoring of events and alarms, rate of change monitoring and local data logging and trending. Additional features such as the provision of independent lower and upper alarm thresholds and time deadbands can be used to reduce the false alarm rate. The MM-IM has been designed to take advantage of mainstream PC technology to reduce costs and allow for easy expansion.

MM-IM functionality

The MM-IM is fully functional when supplied, with software (the 'firmware') pre-installed. This functionality includes:

- Storing of historic values ('trending')
- Alarm and event generation
- Support for distributed IO protocols such as DF1 Master, Modbus master & slave and EtherNet/IP
- IEC61131-3 compliant program language for specific control and automation tasks
- Support for over 4,000 IO points
- A range of communication options: Serial, Radio, PSTN, GSM, GPRS and IP

The MM-IM may be upgraded to take advantage of new releases of firmware. The firmware is downloaded to the MM-IM over its Ethernet interface using a PC.

The RTU's configuration is maintained during firmware upgrade (although of course the user can change the configuration if required). Note that it may sometimes be necessary to also load the device configuration – either because the existing configuration has been corrupted during the firmware upgrade procedure or because the existing configuration is

no longer compatible with the new firmware (the corresponding individual release notes will tell you if this is necessary).

Similarly, configuration of alarm and event checking and trending are all downloaded by Master Control (otherwise known as the Data Gatherer (DG) or Master Station) when it first contacts an RTU after RTU power-up or reset.

The following sections describe the functionality provided by the firmware.

Points

General

Plant inputs and outputs are recorded by the MM-IM and their values stored in *points* which can be read remotely by Master Control. Points are numbered to ease identification and are classified as one of the following two types:

- Real - Values measured by the RTU at the inputs or Values at the outputs.
- Derived - Values calculated by the MM-IM internally or used to store data collected from sources other than real I/O (e.g. data from slave RTU's using the Data Sharing Manager (DSM)).

Points are of the following sub-types:

- Digital: digital inputs and outputs; single and double points are supported, giving four possible states 0, 1, 2, 3
- Analogue: analogue inputs and outputs; Inputs are 0-32767, normal, under- or over-range.
- Pulse counter.

Real points are obtained from:

- I/O Devices: from hardware supporting DF1, EtherNet/IP and Modbus protocols.
- Other Medina modules or RTU's supporting the Medina Local Subsidiary Interface (LSI)
- Master Control: output points and derived points can be set from Master Control as well as within the MM-IM.

Derived points are obtained from:

- Variables within the IEC61131-3 user program
- Points read from slave RTU's
- Points written to by a master RTU

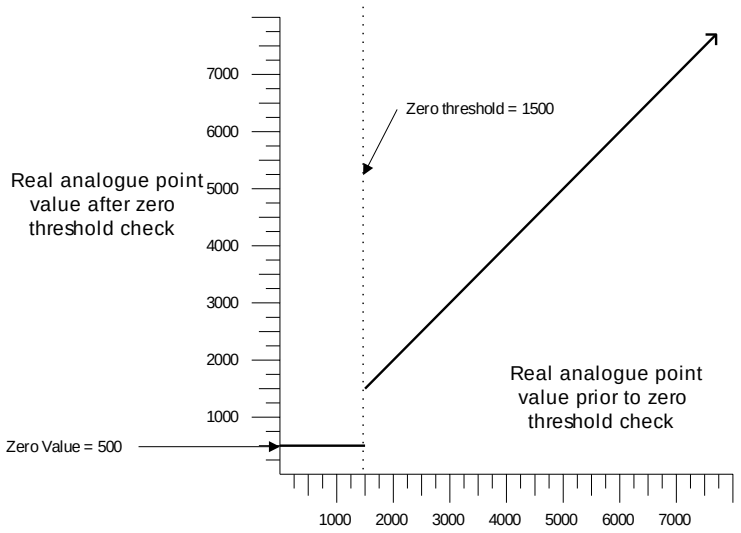
The following abbreviations are used throughout this manual and throughout the Master Control system to define the various point types:

Abbreviation	Point type	Maximum number of points
AI	Analogue Input, Real	512
DI	Digital Input, Real	2048
PI or CI	Pulse (or Counter) Input, Real	512
AID	Analogue Input, Derived	512
DID	Digital Input, Derived	2048
PID	Pulse (counter) Input, Derived	512

Analogue Inputs

Each real analogue point value can be subjected to zero threshold checking that can modify the value. If the value falls below a configurable zero threshold, then the point is considered to have reached its minimum value. The value is then set to the configured zero value.

The operation of the zero threshold and zero value parameters is illustrated below:



Here, the zero threshold is set to 1500 and the zero value to 500. If the real analogue value is 1500 or above, it is not changed. If the real analogue value is below 1500, it is set to 500.

Each real analogue value can also be compared against a configurable over-range limit and under-range limit configured for that point. If the value is greater than the over-range limit, then the "over-range" flag on the point in Master Control is set. If the value is less than the under-range limit, then the "under-range" flag on the point in Master Control is set.

Each real analogue value is then scaled into a floating-point engineering value when it is received by Master Control. The value has scaling factors *m* and *c* applied, such that the engineering value = (*m* * raw value) + *c*.

Pulse Inputs

Pulse or counter (also referred to as Integrated) inputs count pulses. These counts can be used to determine the frequency of change of an input.

Pulse inputs are 32-bit counters. Once a pulse counter reaches its maximum value it resets to zero and begins counting upwards again towards its maximum value.

Historic Data

The MM-IM will store (trend) points in its memory, providing a history of the site which can be read out remotely by Master Control.

Any real or derived analogue input or pulse counter point may be trended. For analogue values, the firmware supports trending of:

- Current values: the point value at the time the data is written to memory.
- Average values: the average value calculated over the last trend interval.
- Maximum values: the maximum value measured over the last trend interval.
- Minimum values: the minimum value measured over the last trend interval.

For a pulse counter point, only current value trending is supported. The data recorded is the instantaneous value at the end of the trending period.

The average, minimum and maximum statistical trend types are derived from a sample of all of the valid readings taken within the trend interval. Thus if the inputs were being scanned and updated once per second the statistical data (average, minimum or maximum) for a 1 minute trend would be derived from the 60 samples taken within each minute. The statistics would then be reset and recalculated for the next minute etc.

Points can be trended at any interval supported by Master Control in the range 1 to 65,535 minutes. A given point may be trended in any of the above types.

Configuration of trending is normally from Master Control and is automatic when the MM-IM powers-up on contact with Master Control. Trending may also be configured from a PC running MicroMC.

Trend streams on the MM-IM are identified by a unique combination of point derivation, type, number, statistic and interval. When a trend stream is created, the message configures the trend period along with alignment time and day. The alignment is used to ensure that recording starts at a particular time.

The number of trend streams that an outstation can maintain is governed by the amount of memory available for storing trend data, and the length of time that the data is retained there. The trend memory is gradually filled up as time progresses. When the data is read by Master Control the read data is deleted. The user can also view the data and/or delete it using a PC running MicroMC. The MM-IM has 512 MB solid-state memory for local storage of trend and alert data, equivalent to in excess of 10 million samples (for example, approx. 1 year's storage at a sampling rate of 30 analogue values per minute). When the memory is 87.5% full or above, an alarm is raised to notify the operators.

A secure two-way protocol ensures that memory is released only when the trend and alert data has been properly read out of the RTU. This helps to ensure that important alarm or trend data will not be lost.

Alarms and Events

In addition to plant monitoring, the MM-IM can also be configured to raise or clear an alarm or event should certain pre-defined conditions occur, either within the firmware (i.e. configuration change) or within the monitored plant.

Alarms and events (collectively called alerts), are actually very similar to one another, and differ only in the way the alert is handled once it has been detected. Events are time-stamped and recorded by the MM-IM for later retrieval by Master Control at some point in the future. Alarms are handled in exactly the same way as events but with one important difference - the presence of one or more alarm records in the alert queue can be used to initiate a call to the Data Gatherer using one or more pre-configured dial-back addresses (IP addresses and/or telephone numbers) held in the configuration.

- *Note: The call to Master Control is effectively just an 'interrupt', it is not a data transfer call[1]. Typically, to acknowledge the interrupt and find out the cause for the alarm, Master Control would pre-empt its normal polling schedule and poll the calling device immediately. It would then be able to retrieve the alert queue and forward any alarms or events to the operators' consoles in the normal way. Remember, without this mechanism for pre-empting the poll schedule, it could be hours or even days before the next scheduled poll goes out to the MM-IM – too long to wait if an alarm condition has occurred.*

Now the plant is monitored using plant inputs mapped to a combination of Medina points of type AI, DI and PI. It follows that alarms and events must be supported on these points and clearly the point type will determine the exact nature of the alarm or event. The following alarms and events can be configured:

AI/AID	Each input of type AI can be configured with two pairs of high and low alert setpoint levels - Hi, Lo and HiHi, LoLo, plus two Rate of Change (RoC) alert setpoint levels - RoC Positive and RoC Negative.
DI/DID	Each input of type DI can be configured with one alert setpoint level
PI/PID	Each input of type CI can be configured with a Hi setpoint level

Any Medina input point (any AI/AID, any DI/DID or any PI/PID) can be independently configured to raise either an Alarm or an Event against each of its configured setpoint levels, or to ignore the setpoints (alerts disabled).

In addition to the alert setpoint levels so far discussed, measures such as level and time deadbands can also be configured in many cases to reduce the incidences of false alarms and hence reduce the overall alarm rate. This is an important factor in large installations which can otherwise become flooded with very large numbers of duplicate alerts.

Full details of the various alerting functions supported by the MM-IM are presented below.

Analogue Inputs

HiHi, Hi, Lo and LoLo Level Alerts

Illustrated in Figure 1, each Medina AI point can be configured with two pairs of high and low alert setpoint levels:

[1] Historically, all transactions on a telemetry network must always be initiated by a single master (i.e. the Data Gatherer) and addressed to a particular slave (using an address field embedded in the protocol). The master then waits for the polled slave to recognise its own address and respond. Since only one poll goes out from the master at a time, and given that only the addressed slave is allowed to respond to that poll, any possibility of conflict on the network is avoided.

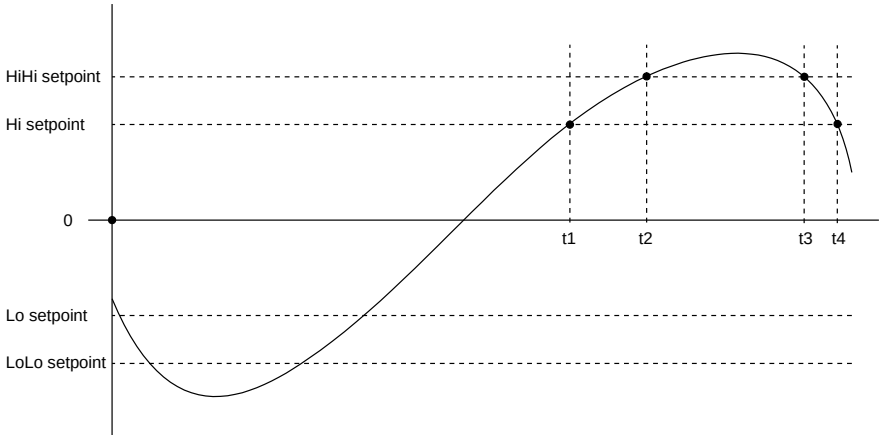


Figure 1: Alert Level Example

The configuration shown here is a typical one, with the HiHi and LoLo setpoints configured slightly outside the corresponding Hi and Lo setpoints. Technically all four setpoints are completely independent but Master Control will normally enforce the order LOLO<LO<HI<HIHI.

During AI alert processing, the current value of each AI is compared with each of the four alert setpoint levels for that AI. Ignoring level and time deadbands for the moment, if the current value is equal to or greater than either of the Hi or HiHi setpoints, then the corresponding *Hi Level* or *HiHi Level* alert is raised. Similarly, if the level is equal to or less than either of the Lo or LoLo setpoints, then the corresponding *Lo Level* or *LoLo Level* alert is raised. Again ignoring level and time deadbands, if the current value goes back within the setpoint then the corresponding alert is immediately cleared.

Hence in the example illustrated in Figure 1, the *Hi Level* alert is raised at time t1 and cleared at time t4, whilst the *HiHi Level* alert is raised at time t2 and cleared at time t3.

Now all measured analogue signals will exhibit minor variations about a nominal value. This means that as an analogue value approaches one of the setpoints the MM-IM is likely to see a very large number of duplicate alerts being raised and cleared as the value fluctuates about the setpoint level. To minimise this problem, each AI can be independently configured with a level deadband and a time deadband.

With just level deadband values in place, the current value must still equal or exceed the setpoint value before the alert is actually raised. To clear the alert the current value must fall back below the setpoint value *minus* the alert level deadband value. This situation is illustrated by Figure 2:

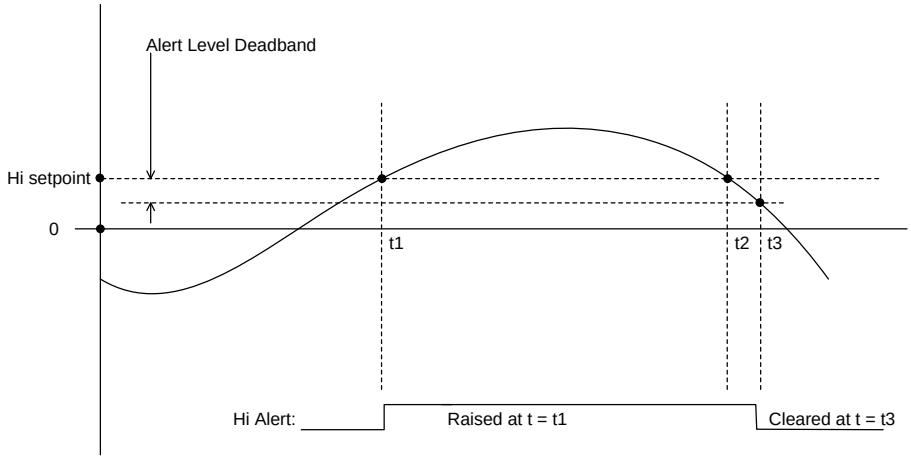


Figure 2: Alert Level Deadband Example

With just time deadband values in place, the current value must now equal or exceed the setpoint value continuously for at least the configured alert time deadband value before the alert is actually raised. Should the current value fall back below the setpoint value at any time before the alert time deadband has expired, then the timer will be reset without an alert ever being raised. Once an alert has been raised, the alert is cleared as soon as the current value falls back below the setpoint value (there is no clear time deadband value). This situation is illustrated in Figure 3:

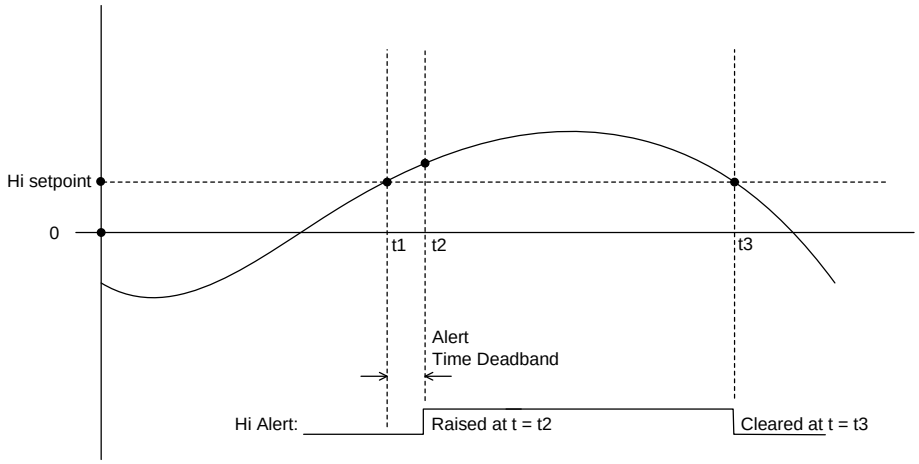


Figure 3: Alert Time Deadband Example

An alert setpoint can be configured with both level and time deadband values simultaneously, as shown in Figure 4:

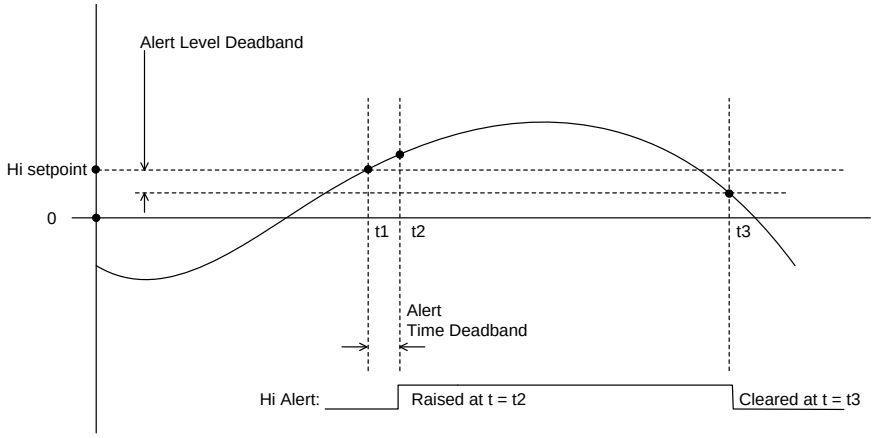


Figure 4: Alert Level and Time Deadband Example

Each AI is independently configurable and has its own HiHi, Hi, Lo and LoLo setpoints and its own level and time deadband values.

Digital Inputs

Each Medina DI/DID point can be configured with an alert setpoint level.

During DI alert processing, the current value of each DI is compared with the corresponding alert setpoint value for this DI. Ignoring time deadbands for the moment, if the current value matches the alert setpoint value, then the *DI Level* alert is raised. If the current value later changes and no longer matches the alert setpoint value then the *DI Level* alert is immediately cleared.

As with the AI alerts, the DI alerts can be configured with alert time deadbands. Level deadbands are, of course, not applicable to digital values.

Counter Inputs

Each Medina PI/PID point can be configured with a Hi Level alert setpoint.

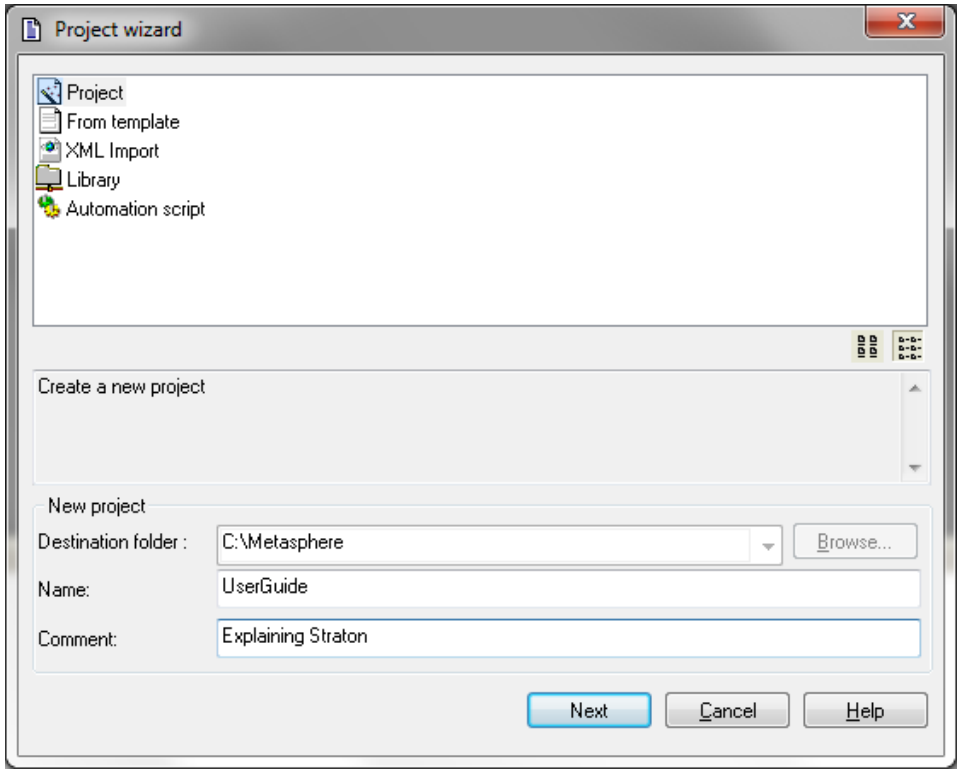
The alerts themselves are handled in exactly the same way as their AI counterparts except that they do not have level and time deadbands. Level alerts will not be cleared except when the counter rolls over or is explicitly cleared by a user action.

Straton

Straton provides the sequence language on the MM-IM, as well as the Modbus & Ethernet/IP drivers. Tutorials and help are provided with Straton, so only Medina MM-IM specific issues will be covered in this section

The Medina MM-IM makes use of a set of extensions to Straton that must be present in the installation. They are distributed with each Medina MM-IM firmware release, or are available on request. If you are not using the Straton Medina Enhancements ensure that the "Destination folder" is the same as the MicroMC configuration directory for that RTU. By default, this will exist in `C:\Isawin\Apl\<RTU NAME>`.

To create a new project for the new MM-IM configuration, click "Create an empty project" and click OK.



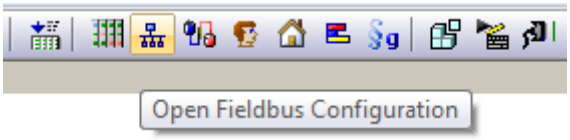
Choose a Name for the project – for example, the same name as the MicroMC configuration.

The Wizard will request Medina and some other configuration options, to which defaults can be used.

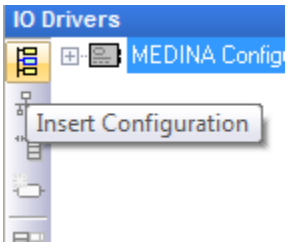
Fieldbus Configuration

Straton provides the drivers for a number of field bus protocols, including the Modbus and Ethernet/IP protocols supported by the MM-IM.

To configure a field bus driver, first you must open the Fieldbus Configuration in Straton. Click on the toolbar icon:

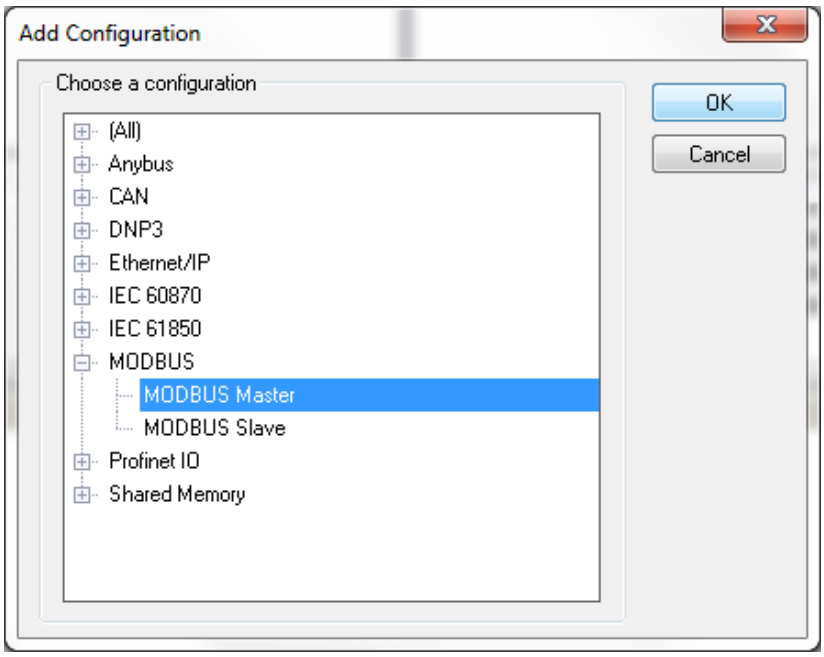


Then click the Insert Configuration icon from the top left corner of the IO Driver pane to add a filed bus driver.

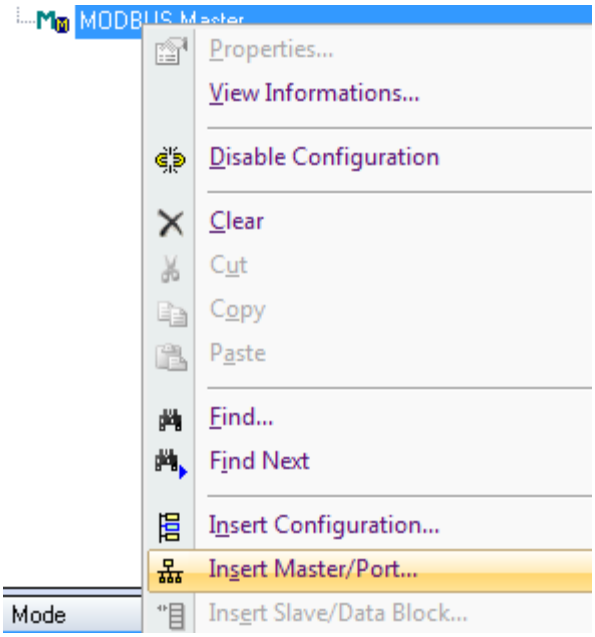


Modbus

To add a Modbus master configuration to the MM-IM, select MODBUS Master protocol from the Add Configuration window.

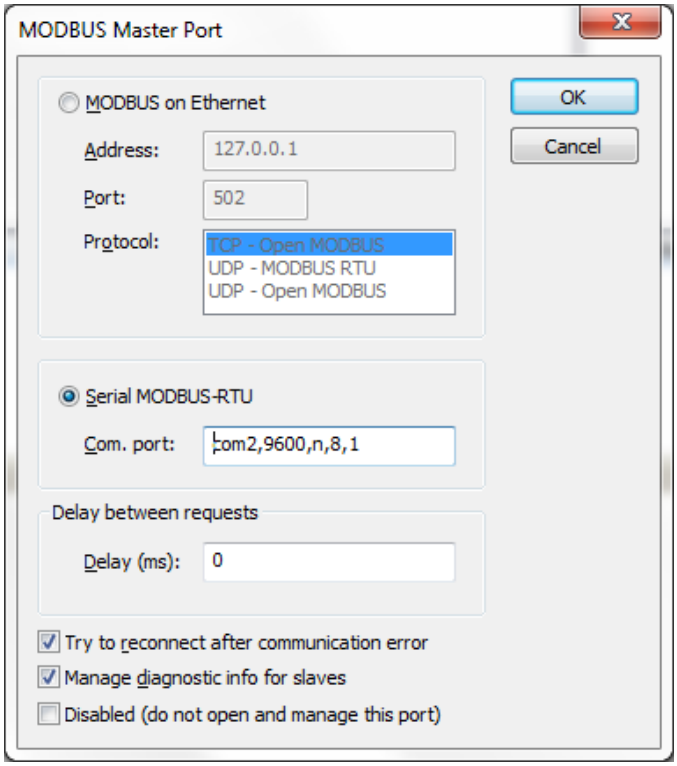


Then right click on the Modbus Master and select “Insert Master/Port”.



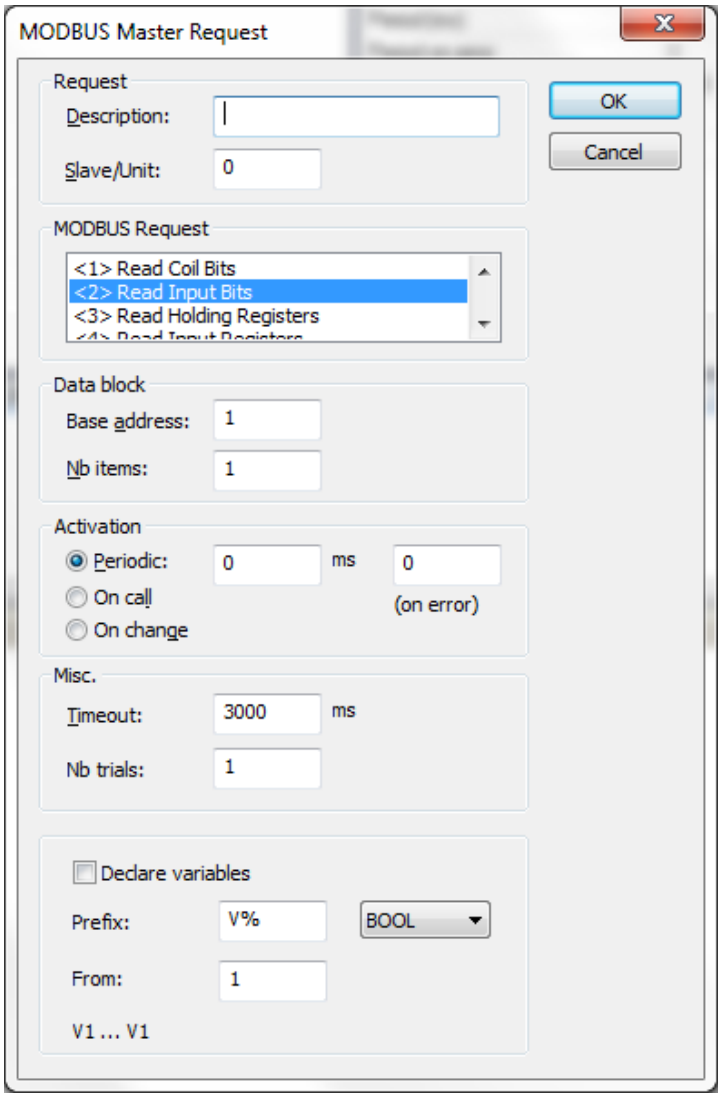
You can choose either Modbus on Ethernet, or Serial Modbus-RTU. The format of the "Com port" string must be in **lower case** as shown in the example below. It comprises:

<COM port>, <Baud rate>, <parity>, <Data bits>, <Stop bits>



- *Note: If configuring Modbus for COM4 (RS485), you must add an extra item to the "Com port" string: rs485. E.g. com4,19200,n,8,1,rs485. This must be in lower case.*

Once you have inserted the port, you can then right click on it and choose "Insert Slave/Data Block. Fill in the details as required. An example is shown below.

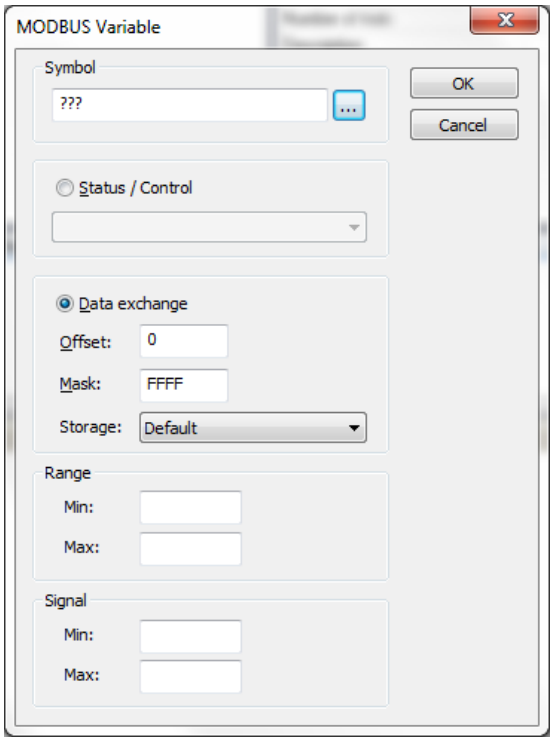


➢ *Note: For more information on configuring Modbus, please see the Straton help file.*

The item selected in the "MODBUS Request" section in the above diagram (Read Input Bits, Read Coil Bits, Write Coil Bits etc.) determines the address that will be added on to the "Base address" specified to obtain the Modbus address for that block. In the above diagram, "Read Input Registers" is selected so this will add 30,000 to the base address, therefore making a point with zero offset in that block read Modbus address 31,216.

MODBUS Request Item	Address that is added to the Base address
Coil Bits	0
Input Bits	10,000
Input Registers	30,000
Holding Registers	40,000

Once you have created a Slave/Data block, you can map variables to the block by dragging them from the global variable list. You will be prompted to enter an offset for each variable. This is the offset from the base address for that block.



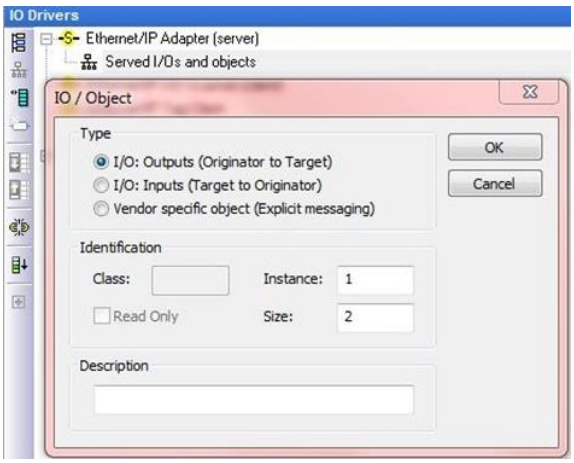
You can optionally map a variable as an "error status" variable by selecting the "Error report" option under "Status/Control". This is an analogue value that indicates the state of the link to the Modbus polling block. Any non-zero value indicates a problem.

Ethernet/IP

Four different Ethernet/IP configurations are supported, these are:

Ethernet/IP Adapter (server)

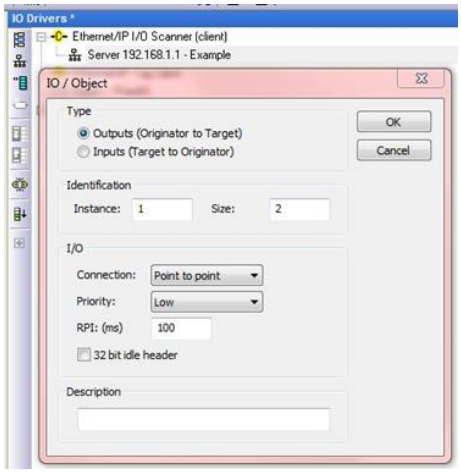
This is used to configure the MM-IM as an Ethernet/IP IO device, to provide data to an Ethernet/IP scanner. IO data is usually grouped into input and output assemblies and read by the scanner at a periodic interval (set by the scanner). Data may also be arranged as vendor specific objects that may be read and written to by the Ethernet/IP scanner.



Ethernet/IP I/O Scanner (client)

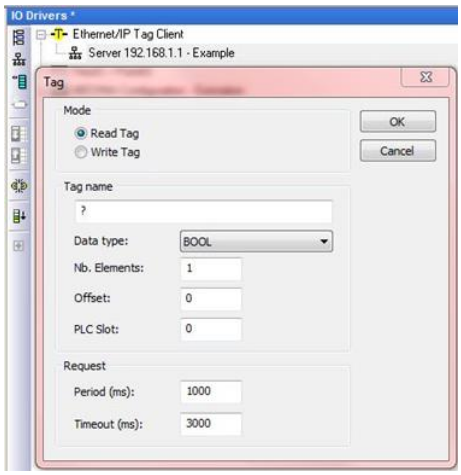
This is used to configure the MM-IM as an Ethernet/IP (IO data) scanner to read input assemblies and write output assemblies from/to an Ethernet/IP IO device. This configuration cannot read or write vendor specific objects from other Ethernet/IP devices

N.B. Instance and Class values for input and output assemblies and vendor specific objects should always be in the range 100 to 199.



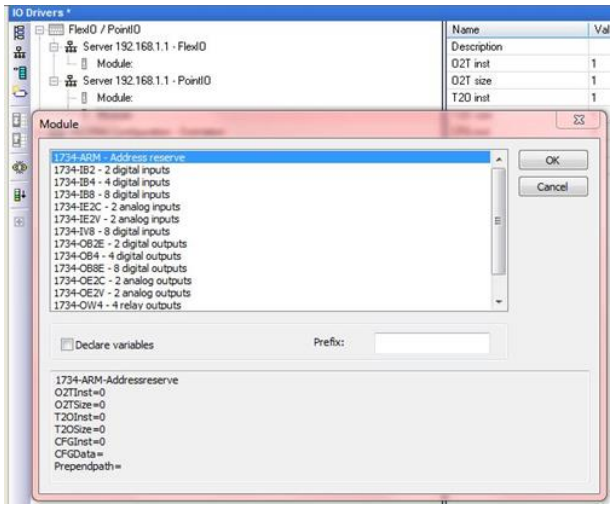
Ethernet/IP Tag Client

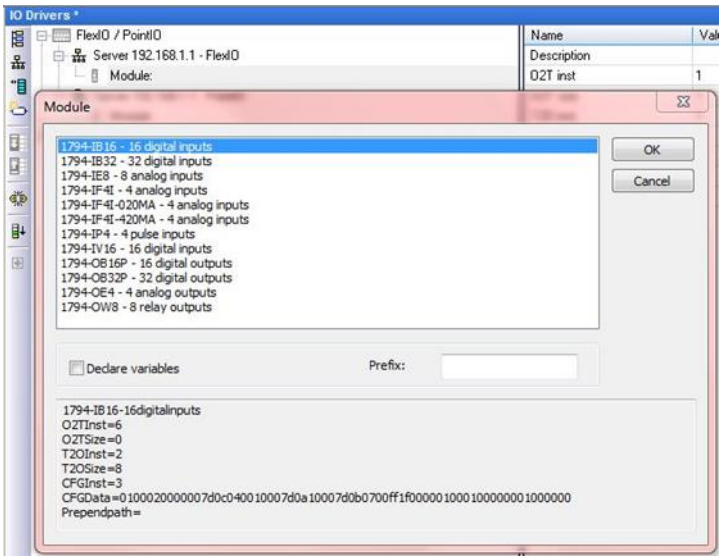
This is used to configure the MM-IM to read or write tags in a Rockwell Logix5000 series PLC using Ethernet/IP.



Ethernet/IP Flex & Point IO

This is used to configure the MMIM to be able to communicate with external modular I/O.





Further details for the configuring the Ethernet/IP driver can be found in the Straton help files.

Sequence Monitoring

Timing of the Straton application is monitored and if each cycle starts to take longer, then the Sequence Running Halted error bit will be set.

It achieves this by learning the cycle time during the first 10 minutes of operation. A following 50 minute period allows limited internal adjustment of the maximum cycle time. After this period then a cycle time above the learned maximum will set the Sequence Running Halted error bit.

If at any point there is a cycle time that is long enough to be deemed to be an infinite loop, the Sequence Running Halted error bit will be set. The learning phase is restarted whenever the Straton application is changed.

Sequence Limit

To avoid spurious setting of the Sequence Running Halted error bit the cycle time can be reported and an upper limit set by using the CFG_SEQ_LIMIT point. When the CFG_SEQ_LIMIT point is added to a Straton application, its value will be used as a

maximum allowed cycle time. The MM-IM will still learn the expected cycle time, but by using a suitable value in the CFG_SWG_LIMIT point, Sequence Running halted errors can be overridden.

The common use for this is within applications that have some processing that takes longer only some of the time. When the learning phase does not coincide with this longer processing, Sequence Running Halted errors are seen.

As the limit in CFG_SEQ_LIMIT is a Straton point, its value can be updated dynamically if desired. An example of dynamic updating would be increasing the value when the application knows it will take longer, and decreasing when it will take a standard time.

The Sequence Running Halted error will only be set when the cycle time is greater than both the learned value and the manually set sequence limit CFG_SEQ_LIMIT.

Highest Cycle Time

The highest cycle time is reported in the RES_SEQ_HIGH point within Straton, with an embedded profile as a Medina analogue output. This can be used to determine if CFG_SEQ_LIMIT has been set appropriately.

Name	Straton Type	Embed Profile
CFG_SEQ_LIMIT	REAL	MEDINA_AI
RES_SEQ_HIGH	REAL	MEDINA_AO

Configuration

The MM-IM configuration can be done in one of two ways — either with or without the Straton-Medina enhancements. With the Straton-Medina enhancements, the entire configuration and file download can be done within Straton. Without the enhancements, both Straton and MicroMC are required. Most of the RTU configuration is performed in MicroMC, while Straton is largely used to write and compile the IEC61131-3 user program. Straton is also required to configure the Modbus driver on the MM-IM. For simple configurations that do not use Modbus, DSM or a user program, only MicroMC is required.

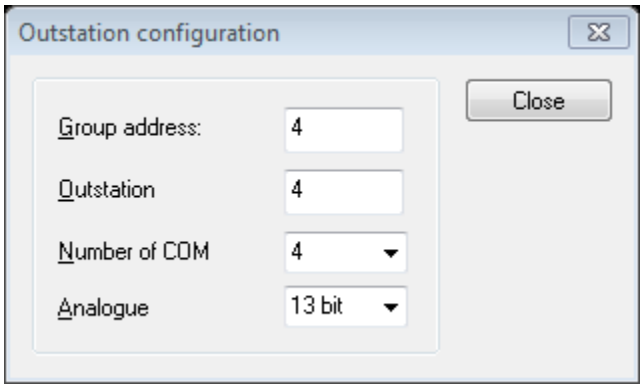
Configuring the MM-IM with the Straton-Medina Enhancements

This section explains how to configure the MM-IM with the Straton-Medina enhancements.

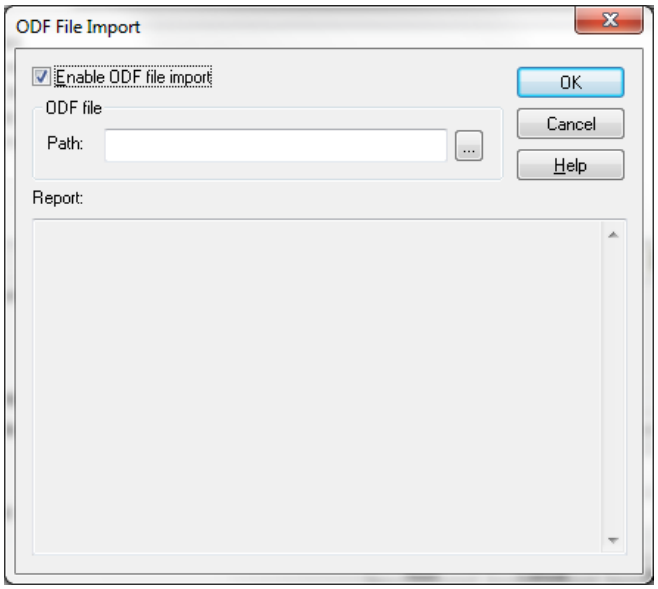
Creating a new project

After installing the latest version of Straton, the Medina add-ons need to be installed to provide the extra MM-IM functionality. The add-ons can be downloaded from the Metasphere website as a separate Installshield program.

When creating a new Straton project, you will be prompted for an outstation address, number of COM ports and analogue format. You do not need to specify the correct address if you plan to import an Outstation Descriptor File (ODF) in the next step. For the analogue format, the options are 13 bit (AWS/DCC) or 14 bit (YWS/FDWS), and this is only used when the MM-IM is communicating with remote RTU's.

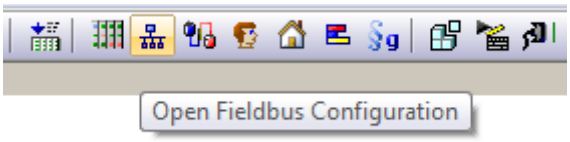


Next, you will be prompted to import an ODF. This file contains details (such as analogue scaling factors for analogue points) of all points (real and derived) configured on the RTU. It can be generated by Master Control once the RTU and all points have been configured on the system. Therefore, it is normal to create all points on Master Control first, and then import the ODF in to Straton, which will automatically populate the global variable list with the points defined in the ODF.

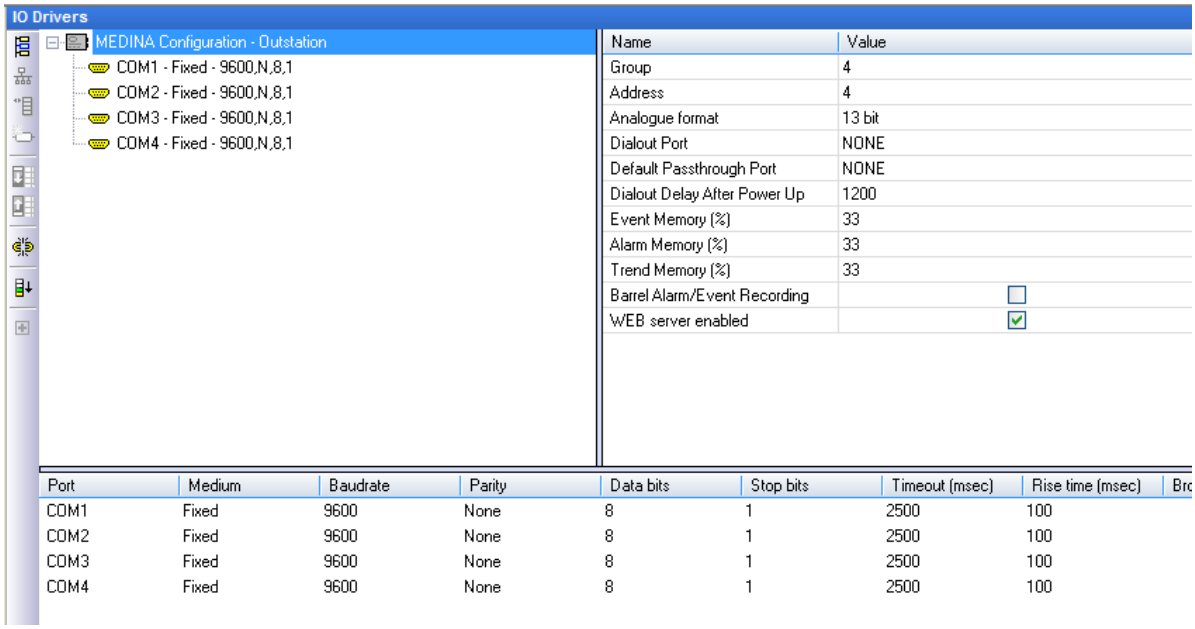


Outstation Parameters

All the MM-IM configuration revolves around the Fieldbus Configuration screen, a tree-like format. Click on the toolbar icon shown below or use the "File / Open / Fieldbus Configuration" command from the menu.



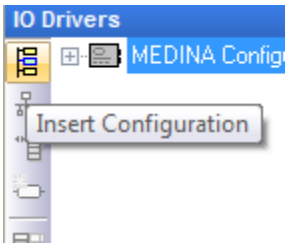
The "MEDINA Configuration – Outstation" view will be present. In this screen, you define each of the Com port settings, along with other general settings for the MM-IM.



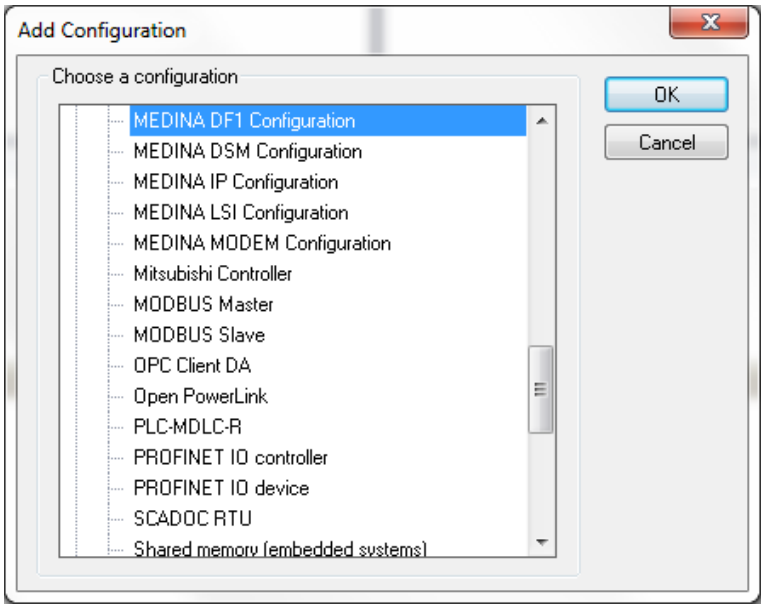
Parameter	Description
Group and Address	Outstation address on the Master Control system (imported from ODF).
Analogue Format	Analogue format for communicating with remote RTU's (using LSI or DSM). 13 bit (AWS/DCC) or 14 bit (YWS/FDWS).
Dialout Port	COM port to be used for PSTN Dial-out.
Default Passthrough Port	Default port to pass through any polls for other RTU's.
Dialout Delay After Power Up	The number of seconds the MM-IM will wait before attempting to contact the DG after it has been powered on.
Memory (%)	What proportion of the memory is allocated to Trend, Event and Alarm data. Due to the large amount of memory, it is rare that you will need to change these settings from the default.
Barrel Alarm/Event Recording	Select this box to record over the oldest data if the memory becomes full.
Web server enabled	Select this to enable the Web server on the MM-IM (See the "Web Server" section).
Broadcast enabled	Select this if the serial port is used to pass polls to a remote RTU so that the broadcast time poll is forwarded.

DF1 Configuration

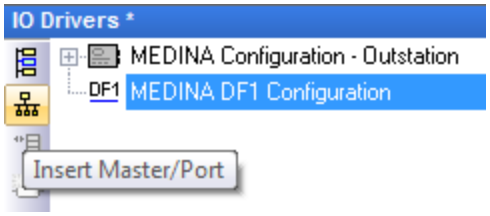
To add the DF1 configuration, click on this icon or right click in a blank space and choose "Insert Configuration".



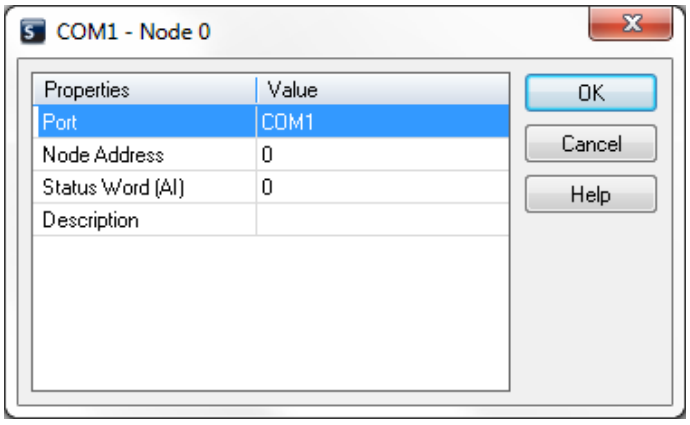
From the list, select "MEDINA DF1 Configuration".



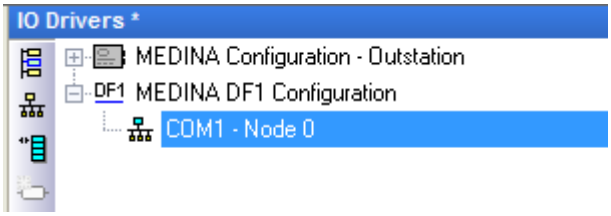
You must now define the details of the PLC you are connecting to, by clicking on this icon or right-clicking on the "MEDINA DF1 Configuration" and choosing "Insert Master/Port":



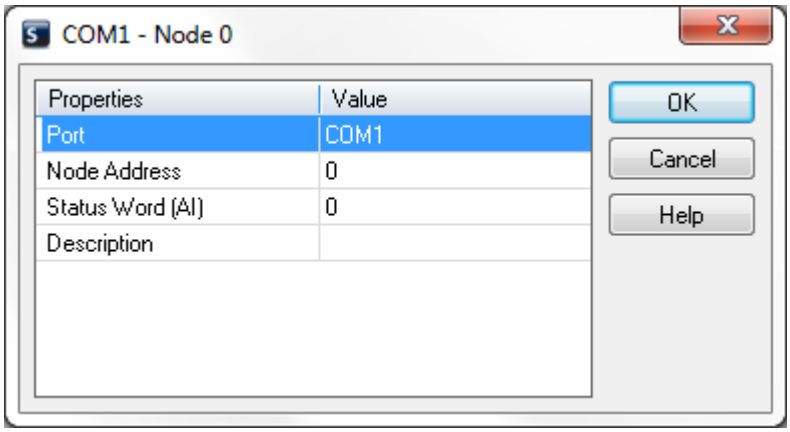
In here, select the serial port connected to the PLC, the PLC Node address, and a status word. The status word is an analogue value that indicates the health of the link to the PLC. Any non-zero value indicates a problem (1=STS Error, 3=NAK Error, 5=Timeout, 9=CRC Error).



Next, you can create polling blocks of data for the PLC. Click on this icon, or right click and choose "Insert Slave/Data Block":



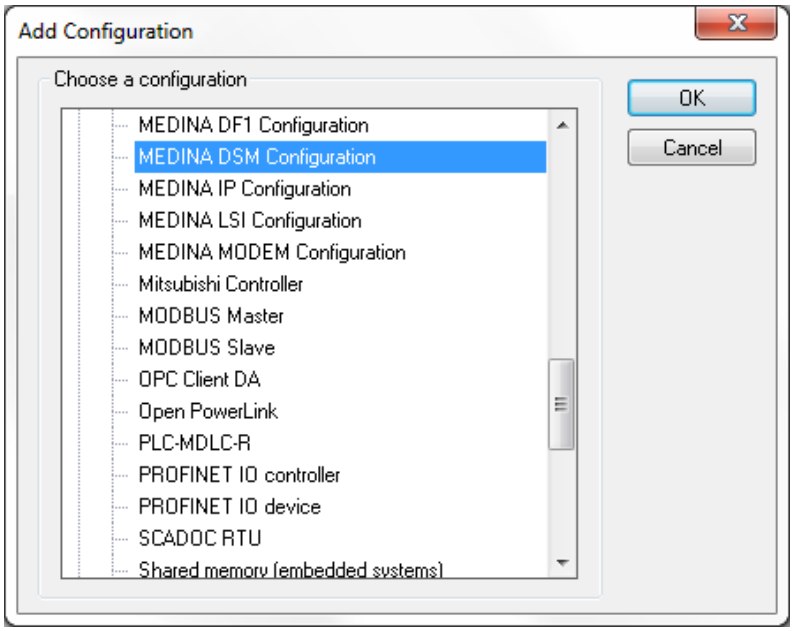
In here, you can define the details of the polling block:



Parameter	Description
Type	Type of point – Analogue inputs/outputs, Digital inputs/outputs or counters.
Starting Point Number	The point number of the first point to be retrieved. E.g. if "Analogue inputs" is chosen with a starting point of 16, the first word in the polling block will be stored in AI16.
File Number	The DF1 File Number (N-register) of the block
Base Address	The offset in to the file
Nb Words	Number of words to read or write. For Digital Inputs/Outputs, a size of "1" indicates 1 word, which is 16 digital values.

DSM Configuration

To configure DSM, insert the configuration in the same way as for DF1, then select "MEDINA DSM Configuration":



The configuration is shown as a 4 level tree, with the following form:

-Medina DSM Configuration (root)

-Remote Outstation

-Group of exchanged points

-Exchanged Straton variable

Defining a Remote Outstation

First right-click on the root of the DSM configuration tree and choose the "Insert Master / Port" menu command to declare a new remote outstation. For each outstation you must enter the following properties:

Parameter	Description
Address	Address of the remote outstation (between 4 and 255)
Port	Serial Port used for communication (COM1 to COM8[2])
Slave Failure Point (DI)	Straton Name of a Digital Input to be used for the slave failure point for this slave. The point will become "1" when any poll fails to this slave, and will change back to "0" when all read/writes are successful.

- *Note: Defining just a remote outstation and no shared points will configure the passthrough port on the MM-IM for that outstation. You should NOT select a slave failure point in this situation, as it is only applicable if Data Sharing is being performed with the remote outstation as well.*

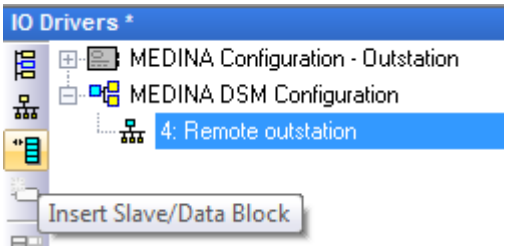
[2] As standard the MM-IM has COM1 to COM4, however up to 4 additional ports can be added using USB adaptors. See USB Serial Adapters for details.

Defining groups of exchanged points

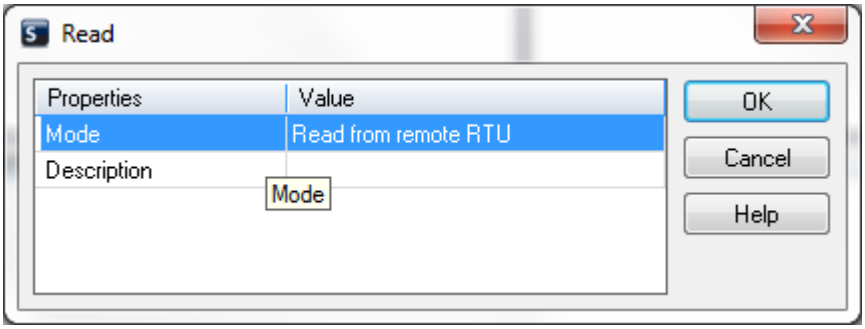
After defining a remote outstation a new group of exchanged points needs to be created. This can be done by clicking on the "Insert Slave / Data Block" icon or right clicking on the remote outstation and selecting the "Insert Slave / Data Block" menu entry. For each group you have to specify the following properties:

Parameter	Description
Mode	Indicates whether the points in this group are read from the remote outstation or written to the remote outstation

You can freely create as many groups as you need. This will allow you to design a clear configuration according to the classification of exchanged points.

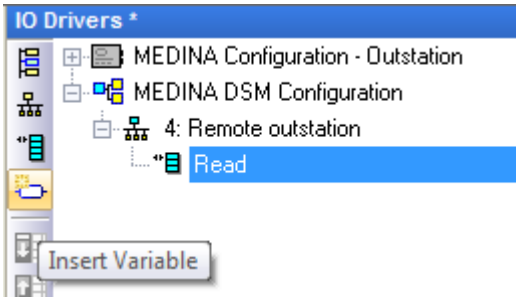


➢ *Note: Double-click on the "Mode" to toggle it between "Read" or "Write".*



Defining points

To define points, you can either click the icon as shown, right-click on the group and select the "Insert Variable" menu command, or you can drag variables straight on to the group.

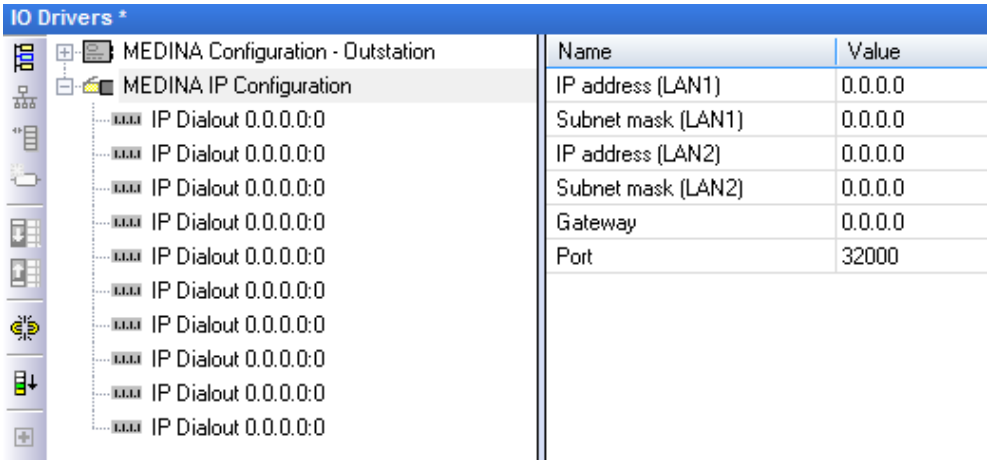


For each point you need to specify the following properties:

Parameter	Description
Symbol	Name of the local point linked to the remote point
Remote Point	Name of the point on the remote outstation (e.g. "DID1")
Time between updates	Frequency of the exchange expressed in seconds between 0 and 65,535. 0 seconds will make the point update as fast as possible.

IP Configuration

If you wish to enable the MM-IM for IP communication, you need to insert the "MEDINA IP Configuration". In here, you can configure the IP address and subnet mask of both of the on-board Ethernet adaptors. Leaving the IP address and subnet mask as zeros will not configure that device.



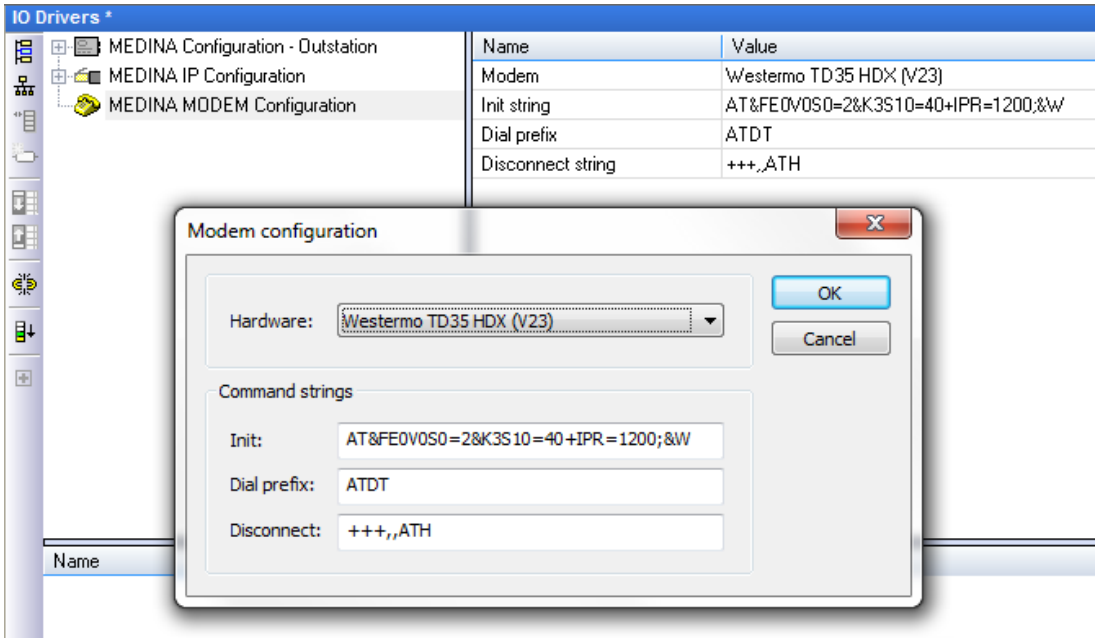
Parameter	Description
IP Address (LAN1)	IP Address for the on-board Ethernet adaptor
Subnet mask (LAN1)	Subnet mask for the on-board Ethernet adaptor.
IP Address (LAN2)	IP Address for the second Ethernet adaptor
Subnet mask (LAN2)	Subnet mask for the second Ethernet adaptor
Gateway	An optional gateway address
Port	The port number that the MM-IM listens on for incoming Medina connections. This does not normally need to be changed.

Underneath the IP configuration, there is the option to specify up to ten IP Dialout addresses. If configured, these should be the IP addresses and port numbers of the Master Control servers (DGs) that the MM-IM's set is present on. However, the addresses are over-written during the power-up sequence with the address(es) of the DG(s) on which the RTU is configured. You can omit this part of the configuration, and the RTU will automatically be configured for IP Dial in once it has been in communication with Master Control. The RTU must, of course, have "IP" media set up on Master Control for this to work.

➢ *Note: Where an MM-IM is configured with both IP and a modem, it will contact the master dependant on the Test Frequency as detailed in the Dynamic Configuration and Reporting section. By default it will always try IP first to contact Master Control, followed by the modem if IP fails.*

Modem Configuration

To configure a modem that is connected to the MM-IM, you need to insert the "MEDINA MODEM Configuration". Double clicking on the item in the tree-view brings up the following window:

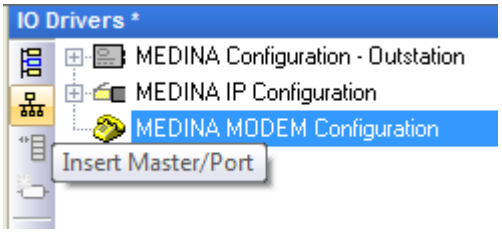


In here, you can select a type of modem from the drop-down list, which will automatically populate the command strings for that type.

➢ *Note: The types of modem and command strings are held in the "MODEM.INI" file, located in the "IOD" directory in the Straton installation.*

You can optionally configure up to eight telephone numbers which the MM-IM will use to contact the Master Control Servers. These phone numbers will be loaded to the MM-IM, but will be over-written by the DG with the phone numbers that the DG is configured with for the MM-IM's PSTN type. The MM-IM will then store the DG numbers in non-volatile memory and will use them until a new configuration is loaded. The DG numbers stored in non-volatile memory will be remembered and used after any subsequent restart.

To add a phone number click the icon as shown, or right-click on the modem and choose "Insert Master/Port":



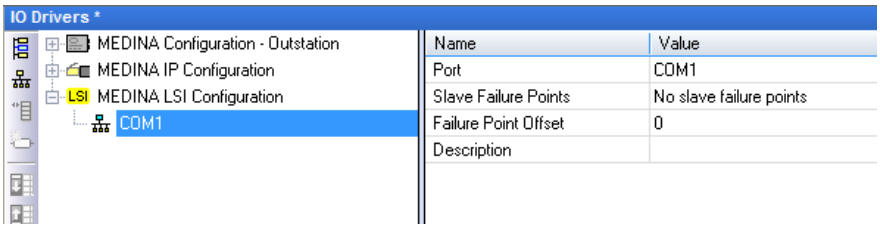
You can specify the phone number, and an optional name to identify the number, e.g. "DG1".

LSI Configuration

The Local Subsidiary Interface (LSI, sometimes called Local Slave Interface) can be used to retrieve points from either other Medina RTU's configured as LSI slaves, or from proprietary Medina Bus Master modules.

The MM-IM scans the selected serial port when it starts up, to detect any connected slave devices and automatically begins polling. After each polling cycle, it checks for the presence of a new slave device that hasn't yet been found, in order to achieve "plug and play" functionality

Insert the MEDINA LSI Configuration, and then insert the "Master/Port", much like any other MEDINA configuration element within Straton.

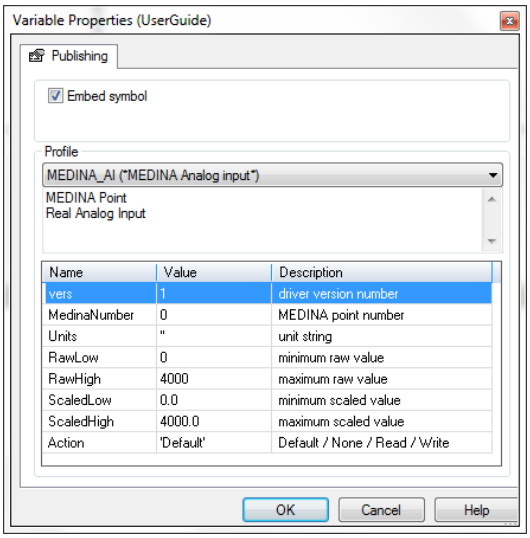


The following parameters are configurable:

Parameter	Description
Port	The COM port to be used for LSI
Slave Failure Points	The slave failure points provide digital inputs that indicate the state of the LSI slave devices.
Failure Point Offset	For "Distributed" failure points, one Digital Input (at the offset configured) in each slave's DI range is used as the failure status for that slave. For "Grouped" failure points, all the failure points appear in one group, at the offset configured.

Straton point properties

Each variable in Straton has a set of properties associated with it. For each variable that is linked to a telemetry point, it must have the correct type of "MEDINA" profile assigned to it. These profiles are automatically assigned when importing an ODF. Here is an example of the properties for an analogue point.



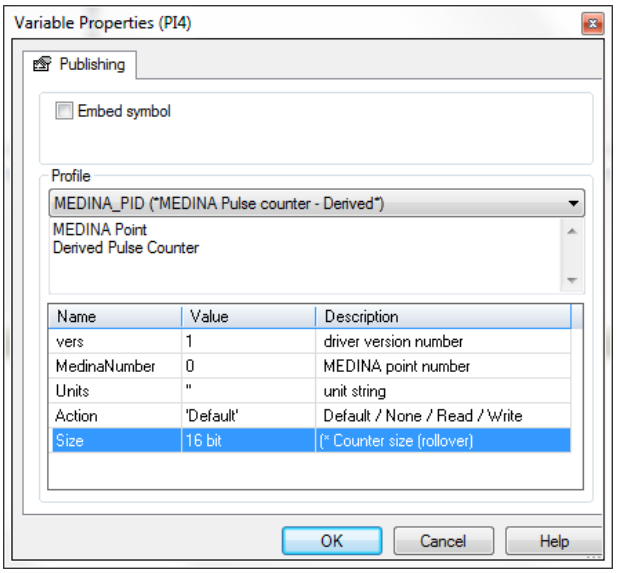
- *Note: For analogue points, the scaling defined in the properties is used to evaluate a scaled value which is used within the Straton program.*

The following table lists the available profiles for each variable and the available options in each profile.

Profile Name	Description	Available options
MEDINA_AI	Analogue Input	Medina Point Number, units, scaling factors, Action
MEDINA_AID	Derived Analogue Input	Medina Point Number, units, scaling factors, Action
MEDINA_AO	Analogue Output	Medina Point Number, units, scaling factors, Action
MEDINA_DI	Digital Input	Medina Point Number, Mnemonics (on and off state), Action
MEDINA_DID	Derived Digital Input	Medina Point Number, Mnemonics (on and off state), Action
MEDINA_DO	Digital Output	Medina Point Number, Mnemonics (on and off state), Action
MEDINA_PI	Integrated Input	Medina Point Number, units, Action, Size
MEDINA_PID	Derived Integrated Input	Medina Point Number, units, Action, Size

For integrated inputs, the "size" option can be used to specify a rollover value for the input. This way, the MM-IM works out the increment each time an integrated input changes, and can detect when it rolls over to zero, making use of the full range of the MM-IM's counter inputs.

For example, if an integrated input is being read from DF1, the maximum value will be 32,767 as the DF1 driver uses the N registers, which are 16-bit signed numbers. Therefore, in the properties for the point, choose "16 bit" for the size:

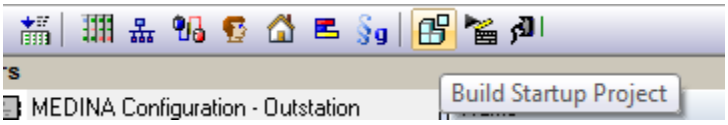


When the DF1 input rolls over to zero, the MM-IM's integrated value will increase to 32,768, and continue increasing following further roll-overs.

- *Note: This means that the integrated value presented to the DG will often be different from the current value being read from the I/O. Similarly, the value that Straton has for an integrated input is likely to be the value read in from the I/O, and may not be identical to the value that the DG has for the same point. This is because the value presented to the DG will take in to account any roll-overs that may occur, to make full use of the 32-bit range of the point.*

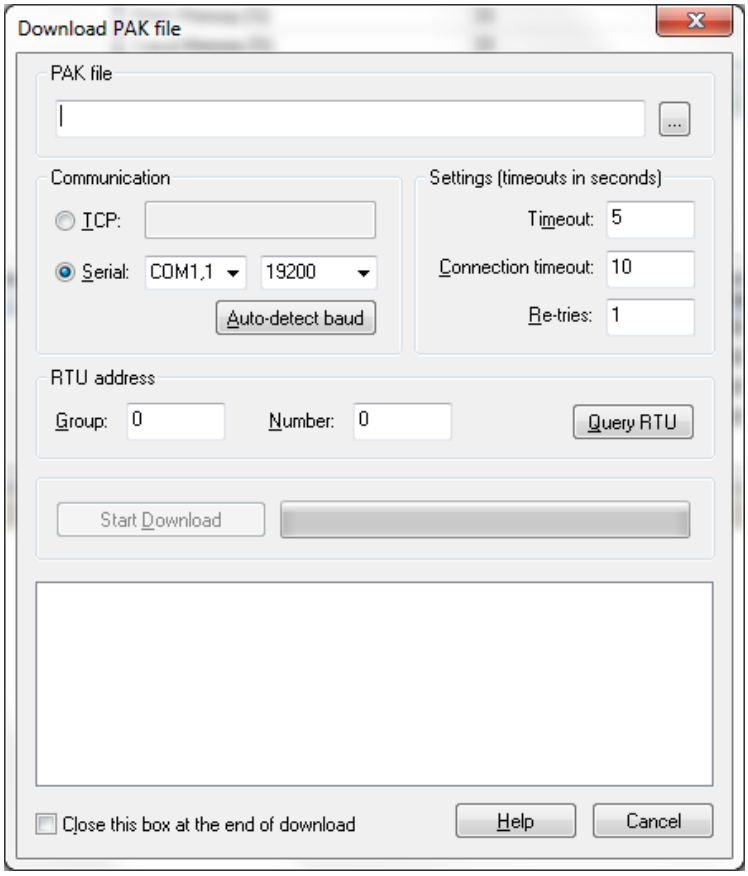
Downloading an MM-IM configuration

Once you've made your changes to the configuration, the configuration file can be generated by selecting the "Build Project" option from the Project menu, or by clicking on this icon:



Any build errors are shown in the "Build" window at the bottom of the Straton Workbench. When the project has been successfully built, Straton will create a "PAK" file (please see the section on *PAK files* for more information).

To download the configuration, select "Tools / Download PAK configuration File".



By default the configuration file you've just created will be ready for download. You can navigate to a different file if you want.

You must first establish the communication link between your PC and the RTU. The "Communication" section of this window will be set to the current connection settings for the Straton Workbench. You can select either to connect over IP or serial. For IP, enter the IP address of the MM-IM. For serial, select the serial port of your PC and the baud rate. Then click "Query RTU".

If successful, the current address will appear in the "RTU address" section.

You can then click "Start Download" to perform the configuration download.

Once the download is complete, the MM-IM will automatically restart and adopt the new configuration.

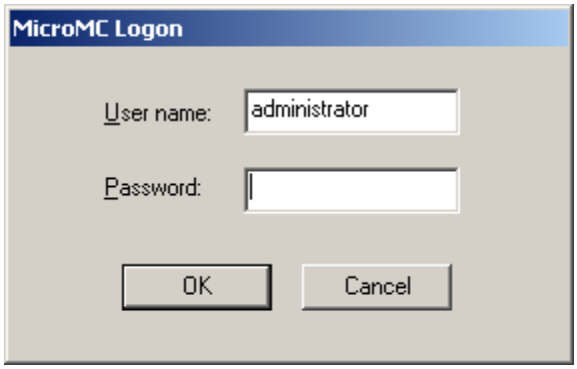
Configuring the MM-IM without the Straton-Medina Enhancements

This section explains how to configure the MM-IM without the Straton-Medina enhancements.

MicroMC

Full details of how to use MicroMC are contained in the Master Control MicroMC user guide, a copy which is available from the Metasphere website at http://www.metasphere.co.uk. You can also download an installable version of MicroMC from the Metasphere website.

When you start MicroMC, a login box is displayed. Enter a valid username and password (both case sensitive) and click OK.

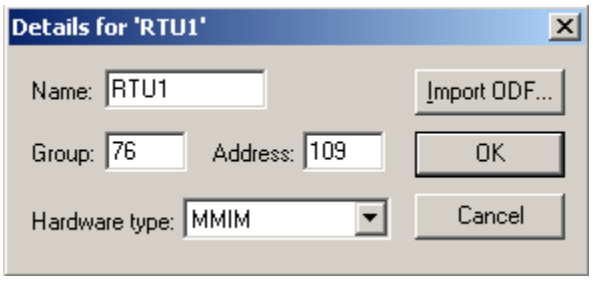


If you can't remember your password, please contact your system administrator.

- *Note: The default administrator password is "metasphere".*

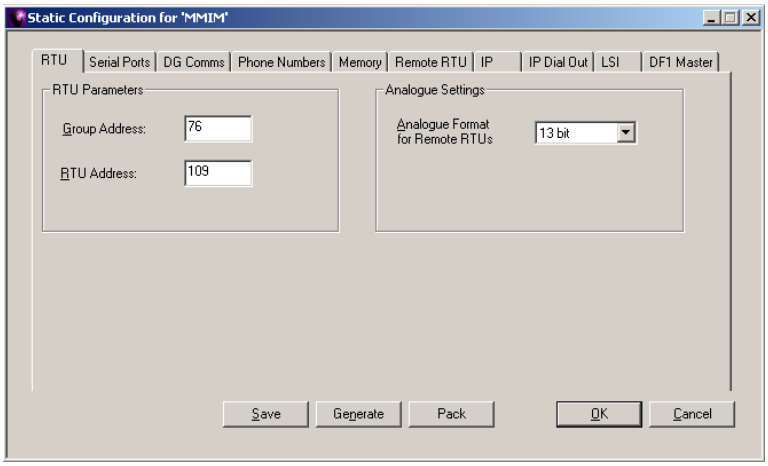
Creating an MM-IM configuration

Create a new RTU by selecting "RTU" and "New" from the main menu. Then select "MM4" and click OK. In the box that is displayed, enter a name and telemetry address for the RTU. Select "MMIM" for the hardware type.



RTU

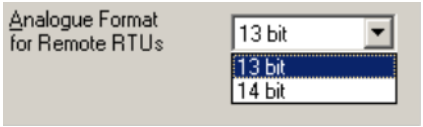
The MM-IM configuration revolves around a main screen as shown below. This is accessed by selecting "Configure" and "Configuration" from the main menu.



As a minimum the MM-IM needs:

- A valid **address**, i.e. in the range 4-255, default 4,4
- A suitably configured **serial port** or **IP address**
- The RTU section contains the basic information about the RTU; the address (eg 76,109 in this case)
- The analogue format for remote RTU's.

To change the analogue format select the pull down list. The options are 13 bit (AWS/DCC) or 14 bit (YWS/FDWS).

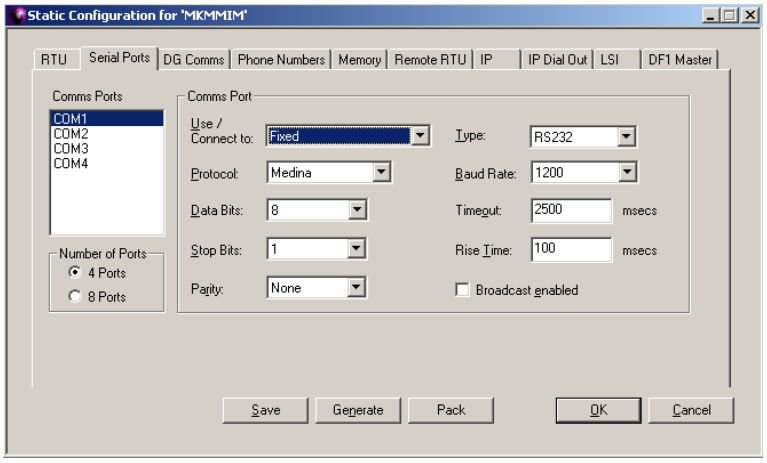


➢ *Note: The analogue format setting only matters if the MM-IM will communicate with remote RTU's or other Medina devices using LSI or DSM*

Serial ports

Each serial port needs to be configured according to what it is used for or connected to. Most common options are Fixed, Radio, PSTN, Modbus Slave, DF1 Slave, LSI and Data Sharing.

- *Note: Selecting "Modbus Slave" or "DF1 Slave" indicates that the selected port will be connected to a slave, i.e. that the MM-IM will act as the master.*



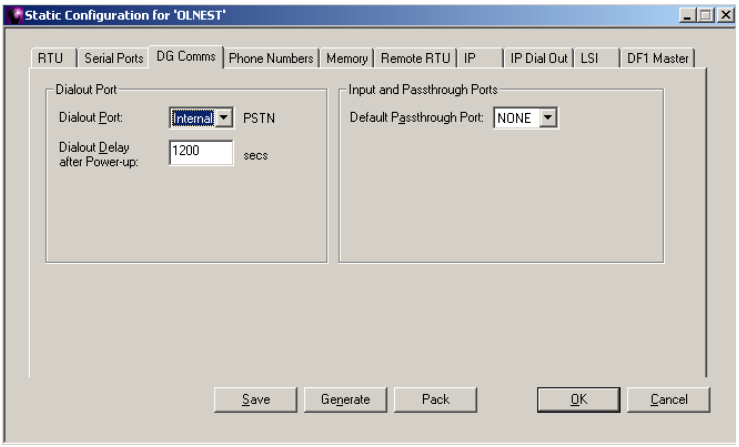
Early versions of the MM-IM were available with 8 serial ports. While subsequent versions have 4 serial ports, there is support for up to 4 additional ports connected using USB. If no USB ports are to be used, the default of "4 Ports" should remain selected.

Select "Broadcast Enabled" if this serial port is used to pass polls to a remote RTU so that the broadcast time poll is forwarded.

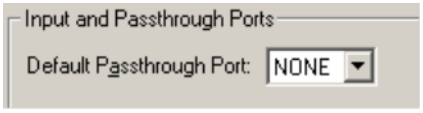
- *Note: COM4 is either RS485 or RS422, configured with a DIL switch on the MM-IM. Please ignore the "RS232" setting for the "Type" for COM4.*
- *Note: The specific settings (baud rate, data bits, stop bits etc) for a port that is connected to a Modbus Slave are not important, as these are configured within the Fieldbus configuration in Straton. It is important, however, to ensure that the port is set up to connect to a Modbus Slave.*

DG Comms

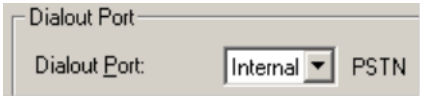
The MM-IM is capable of passing polls through to locally-connected RTU's over one or many of its serial ports. Whereas this is configured in the "Remote RTU" screen, there is an option here to set up a default passthrough port, which will forward polls to the specified port if the destination group address is the same as the MM-IM's group address and if the RTU address does not match the MM-IM's RTU address or the address of one of the Remote RTU's.



This screen allows you to set up the options for the dialout port and passthrough ports. Select a default passthrough port if required.



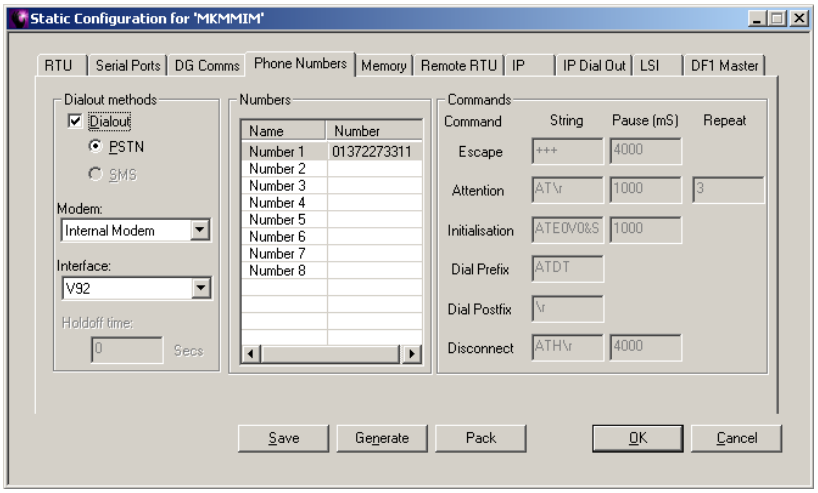
Select the dialout port from the list of available ports. This is the serial port that will be used to initiate an outgoing call following an alarm condition or power-up event.



This is the delay after the MM-IM is switched on before it will try to contact Master Control using the phone numbers or IP addresses defined in the configuration.

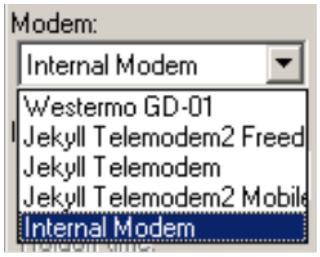
Phone Numbers

The MM-IM can hold up to eight telephone numbers which it will try and dial out to in sequence in the event of an alarm.

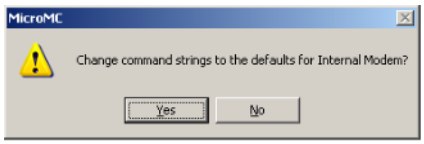


This screen allows you to set up the telephone numbers and also optionally the details of the modem used.

Select the modem type being used from the list of supported types. The available interface options and what you can change will vary depending on your selection. The "Internal Modem" refers to the optional PCMCIA modem on early versions of the MM-IM.



When you change your selection you will be prompted to confirm the change.



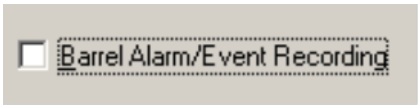
Select your interface type from the list of those supported for the chosen modem type. For the internal modem, V92 is the only option. This is compatible with V22bis/V34 etc.

- *Note: All phone numbers configured in the static configuration are over-written during a power up sequence with the phone numbers that the DG is configured with for that PSTN type. The MM-IM will store the phone numbers from the DG in non-volatile memory and will use them until a new configuration is loaded. The numbers stored in non-volatile memory will be used after any subsequent restart.*

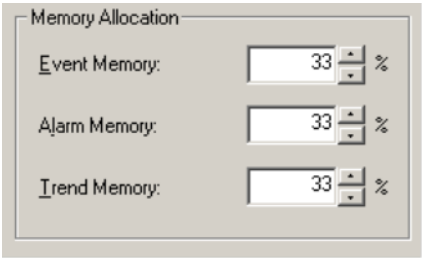
Memory

Use this screen to configure what proportion of the MM-IM's memory is allocated to storing event, alarm and trend data. Due to the large amount of memory, it is rare that you will need to change these settings from the default.

Select this box to record over the oldest data if the memory becomes full.

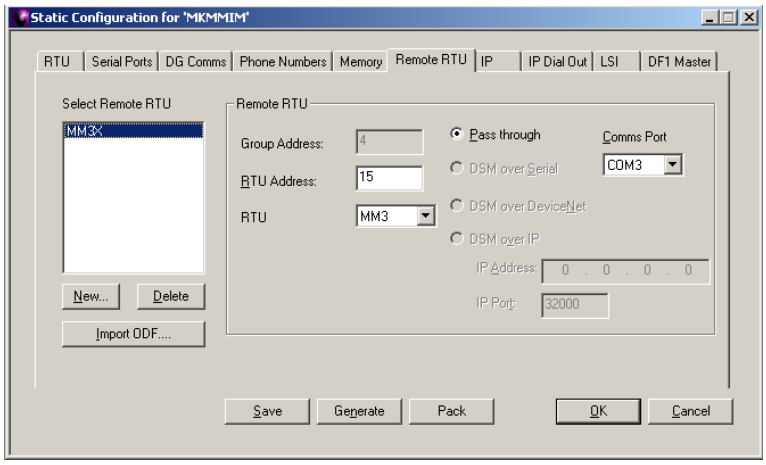


Allocate a percentage to each type of memory.



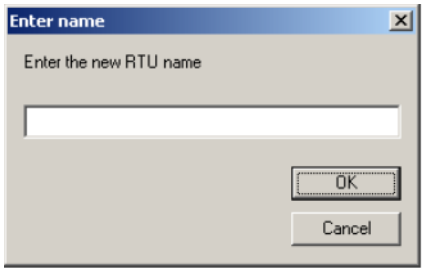
Remote RTU

This screen is used to set up any specific remote RTU's that are connected to the MM-IM, so that polls from the Master Control system can be forwarded over the correct serial port.

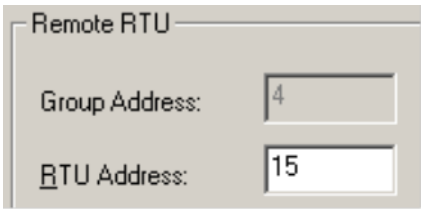


Click "New" to add a remote RTU.

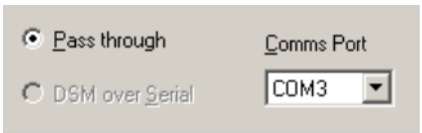
You will be prompted to enter a name for the new RTU. This is only a label and does not affect communication to the RTU.



Enter the address of the remote RTU. The group address is not editable as the remote RTU must have the same group address as the MM-IM.



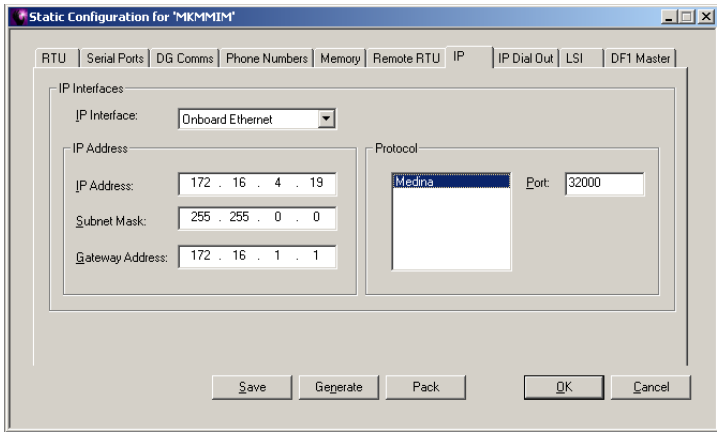
Select the serial port over which this RTU will be polled. The port must have been set up as "Fixed" in the "serial ports" screen.



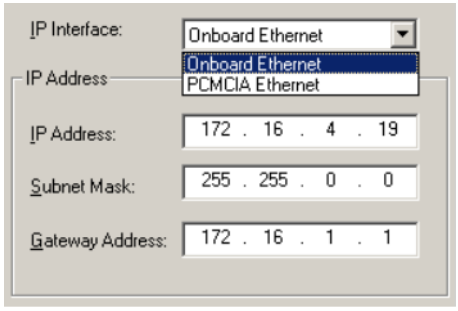
- *Note: The "RTU" field is obsolete so it does not matter what is selected (MM3/MM4A/MM4M etc).*

IP Address

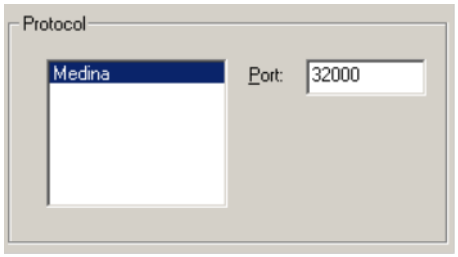
If you wish to use IP communications between the MM-IM and Master Control, use this screen to configure the IP address.



Enter a valid IP address, subnet mask and gateway address. The PCMCIA adaptor refers to the second on-board Ethernet port



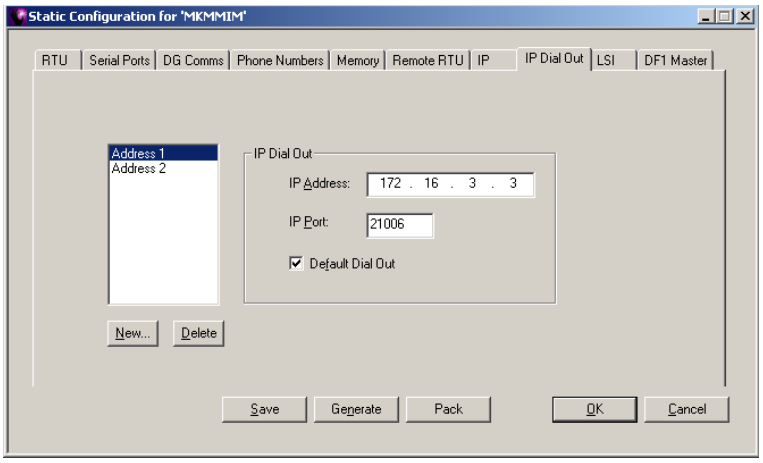
You can change the port number that the MM-IM listens on for incoming connections from Master Control. All Medina RTU's on a Master Control system will listen on the same port. Usually this default value does not need to be changed



- *Note: Entering an IP address and subnet mask as 0.0.0.0 will result in leaving the MM-IM configured with its default IP address (LAN1: 192.168.1.1, subnet mask 255.255.255.0, LAN2: 192.168.2.1, subnet mask 255.255.255.0).*

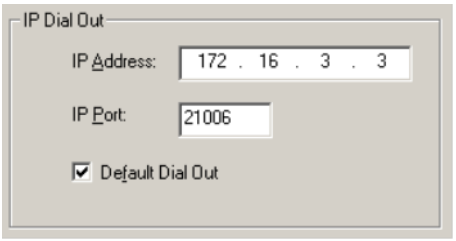
IP Dial Out

The MM-IM can use IP communication to contact Master Control. This screen is used to set up the IP addresses and port numbers of the Master Control servers.



- *Note: The information on this screen is similar to that on the "phone numbers" screen – the addresses are over-written during the power-up sequence with the address(es) of the DG(s) on which the RTU is configured. You can omit this part of the configuration, and the RTU will automatically be configured for IP Dial out once it has powered up with Master Control. The RTU must, of course, have "IP" media set up on Master Control for this to work.*
- *Note: MicroMC can only configure up to two IP addresses. If a greater number need to be configured, then Straton configuration must be used, which supports up to 10 IP addresses.*

Enter the IP addresses and port numbers of the Master Control servers (DGs). Tick "Default Dial Out" to make this address the first one the MM-IM tries.

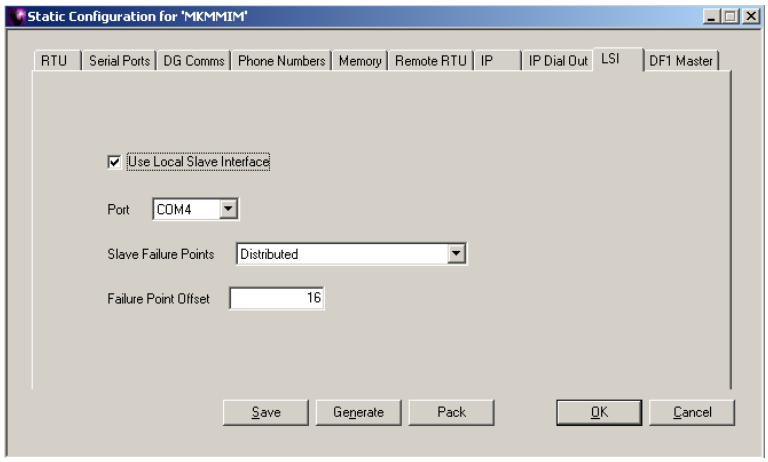


- *Note: Where an MM-IM is configured with both IP and a modem, it will always try IP first to contact Master Control, followed by the modem if IP fails.*

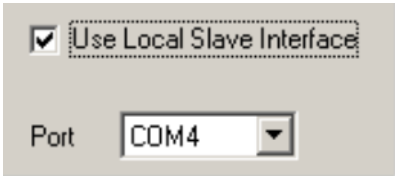
LSI

The Local Subsidiary Interface (LSI, sometimes called Local Slave Interface) can be used to retrieve points from either other Medina RTU's configured as LSI slaves, or from proprietary Medina Bus Master modules.

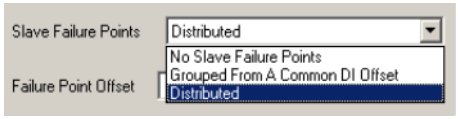
The MM-IM scans the selected serial port when it starts up, to detect any connected slave devices and automatically begins polling. After each polling cycle, it checks for the presence of a new slave device that hasn't yet been found, in order to achieve "plug and play" functionality.



Tick "Use Local Slave Interface" to activate the MM-IM's LSI driver. Select a COM port that was set up for LSI in the "serial ports" screen.



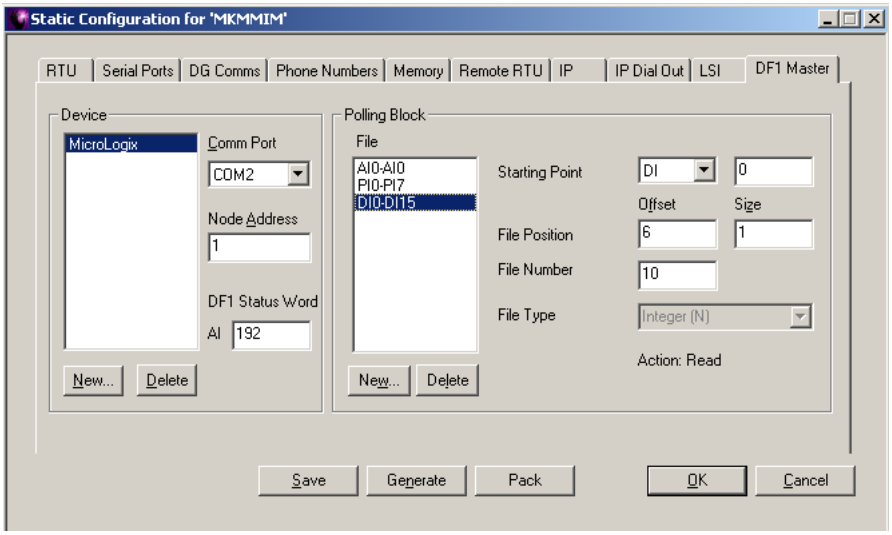
The slave failure points provide digital inputs that indicate the state of the LSI slave devices. "Distributed" is a common option, where one Digital Input (at the offset configured) in each slave's DI range is used as the failure status for that slave.



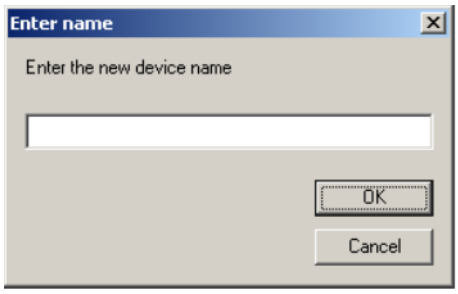
- *Note: If using LSI and Straton (and you have the Straton-Medina enhancements), remember to enable it in Straton as well. See the Straton configuration section for more details.*

DF1

Use this screen to configure the MM-IM as a DF1 Master.

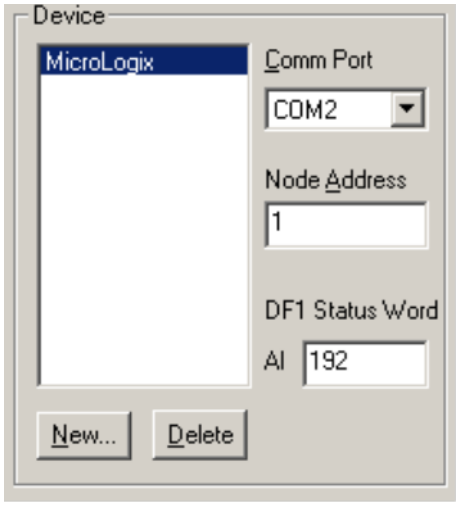


Click "New" to create a new device. You are prompted for a name to identify the device. The name chosen is merely an identifier and is not important, but it must not be blank.



Allocate the device a serial port that has been set up to connect to "DF1 Slave" in the "Serial Ports" screen. Enter the Node Address of the DF1 Slave.

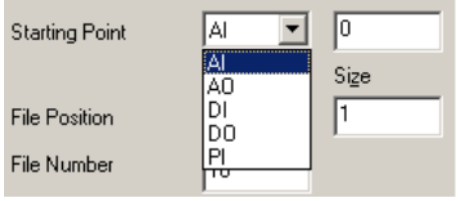
An optional analogue input can be configured as the DF1 Status Word. This is an analogue value that indicates the health of the link to the DF1 device. Any non-zero value indicates a problem



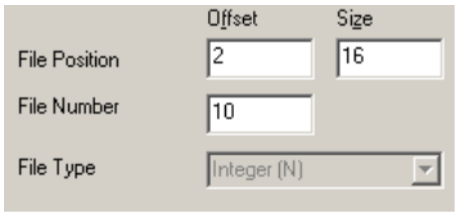
Error code	Error
1	STS Error
3	NAK Error
5	Message timeout
9	CRC Error

Create "polling blocks" of data you wish to retrieve from the DF1 Slave.

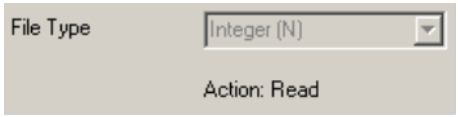
Click "New", then select a starting point number. This can be any one of the available options. Analogue outputs (AO) or Digital outputs (DO) will be written to the DF1 Slave.



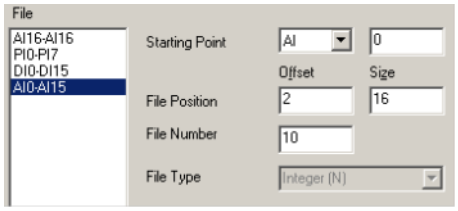
Enter the offset in to the file this block is to start from, and the size (in words) of the block. Enter the file number for this block on the DF1 Slave. Only integer (N) registers are supported.



The "Action" serves as an indication whether the data in the polling block will be read from the DF1 device or written to it.



As you enter the information, the range of points updates dynamically on the left. In this example, the last block in the list will populate points AI0 – AI15 inclusive. The data will come from File 10 and it will read 16 words starting at an offset of 2 in the file (i.e. starting at the third word).



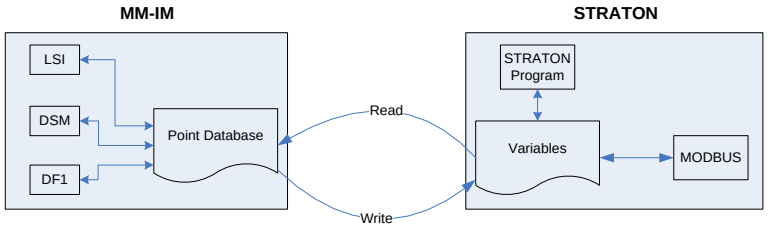
- *Note: For Digital Input/Outputs, a size of '1' indicates 1 word, which is 16 digital values.*

Ethernet/IP

It is not possible to configure Ethernet/IP connections using MicroMC; Straton Workstation must be used.

Straton Point Mapping

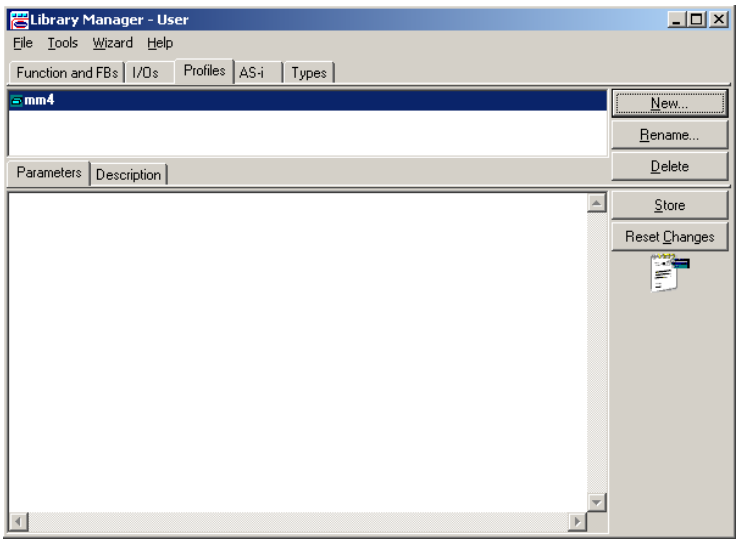
The MM-IM and Straton are two different environments that are linked through a mapping file (isa.map). This defines, for each point that is to be mapped, whether the point will be read from Straton or written to Straton. The diagram below helps illustrate this. The reading/writing of points to/from Straton happens every scan cycle.



All points read or written by the DG are processed directly from the MM-IM's point database.

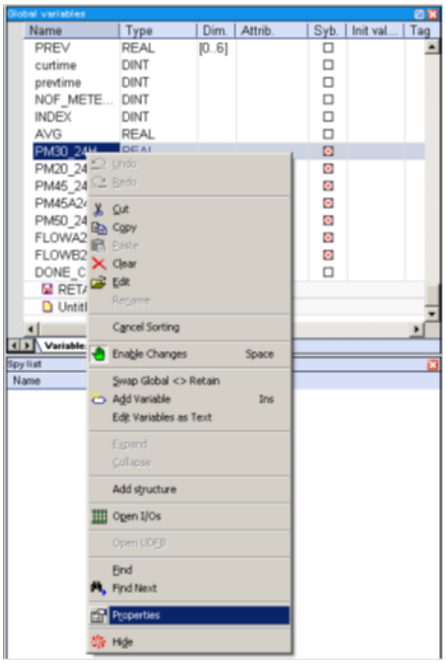
In order to enable the mapping of points between Straton and the MM-IM, a profile needs to be added to the Straton "Libraries" (this only needs to be done once).

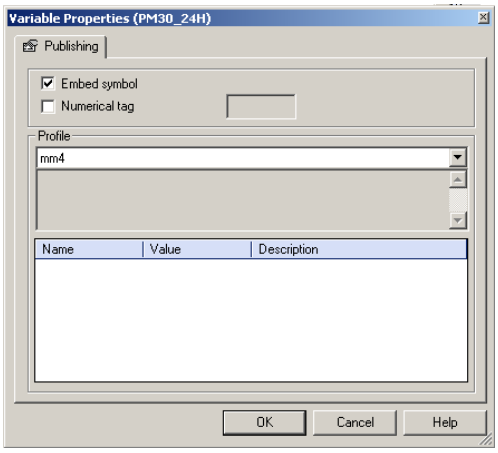
Select "Libraries" from the Straton program folder. Then select the "Profiles" tab and click "New". Enter "mm4" for the name and click OK. The library manager should look similar to that shown below.



Then choose “Save Library” from the “File” menu and then exit.

For each variable in Straton that you wish to map to the MM-IM, it needs to be assigned to the “mm4” profile. This is done in the properties of each point.



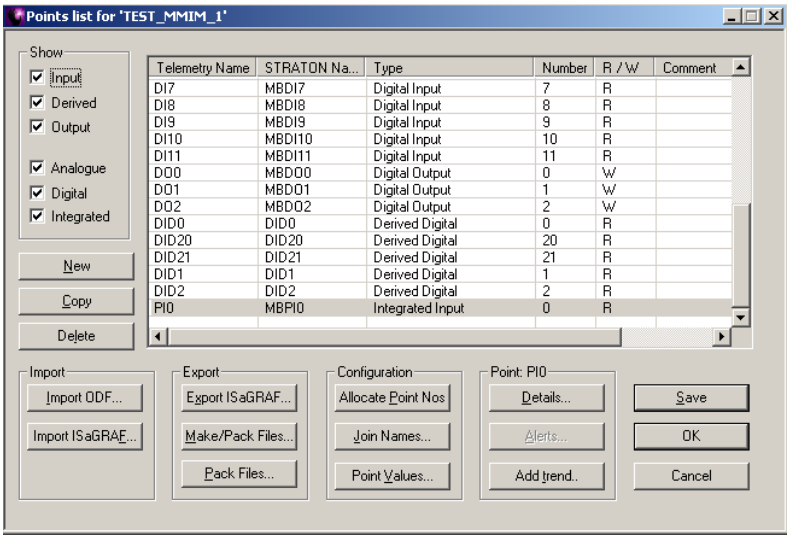


In the properties for the point you want to map (shown above), select the "mm4" profile and also "Embed symbol".

➢ **Note:** If you use the "copy" and "paste" functions to create points, the profile and "Embed symbol" settings are remembered.

The mapping for each point you wish to use in Straton needs to be made in the points list in MicroMC.

Open the points list by selecting "Points" and "List" from the menu. To populate the list you can either manually insert points or click the "Import ODF" button to import an ODF. The diagram below shows an example list.



The entries in the "telemetry name" column must contain a name for the point. The entries in the "Straton Name" column must contain the name of the Straton variable that will be mapped to this point. Usually these two names will be the same. The "R/W" column was previously used to indicate whether the point should be written to Straton (W) or read from Straton (R). However, from MM-IM firmware version V6.0C5122 all variables that you map are mapped as both read and write (i.e. bi-directional), so the choice of "R" or "W" doesn't matter, but it must be one of them. When you have finished, click "Save" and "OK".

Point Scaling

For MM-IMs running firmware versions earlier than V6.0C5122 , any analogue values which are written in to Straton will be scaled if the MM-IM has received scaling factors for those points. Scaling factors for all "onscan" analogue points configured on the DG are downloaded to the MM-IM during the power-up sequence. This means that for points

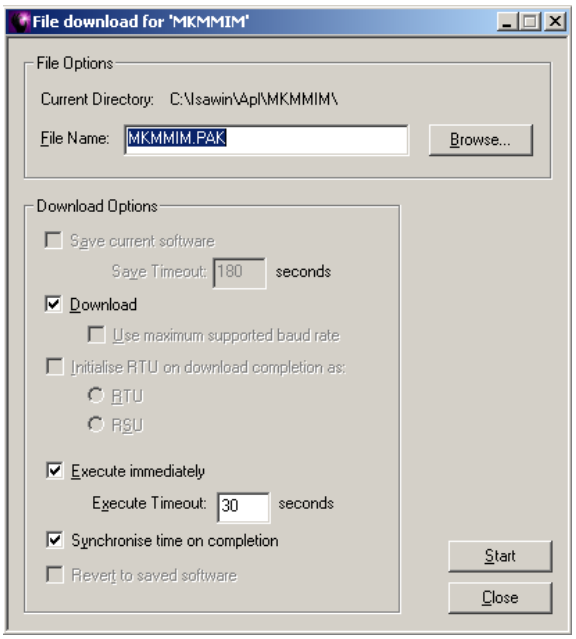
such as derived analogue points that are driven from the workstation, or analogue points read from DF1, the scaled values will be used in the Straton program. However, for points generated within the Straton environment such as Modbus points, the raw value will be used.

For firmware V6.0C5122 and later, the raw value of the point will always be used in the Straton program.

Downloading an MM-IM configuration

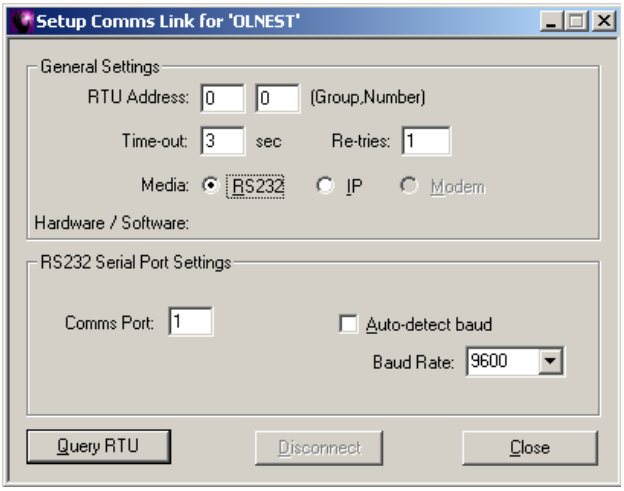
Once you've made your changes to the MicroMC and Straton configurations, the configuration file can be generated by selecting "Generate" or "OK" on the main configuration screen in MicroMC. When it is generated, MicroMC generates various configuration files based on information entered in the configuration screens and creates a "PAK" file (please see the section on *PAK files* for more information). For configuration files that are created by Straton, MicroMC will automatically take the files from the subdirectory with the same name as the RTU. If a subdirectory with the same name as the RTU does not exist, MicroMC will look in any other existing subdirectories for the Straton files. If no Straton files can be found, MicroMC uses default blank files.

The download screen will be displayed.



By default the configuration file you've just created will be ready for download. You can navigate using the "browse" option if you want to download a different file.

In order to download the configuration you must first establish the communication link between your PC and the RTU. Select the "Comms Link" screen or click on "RTU" and "Comms Link" from the menu.

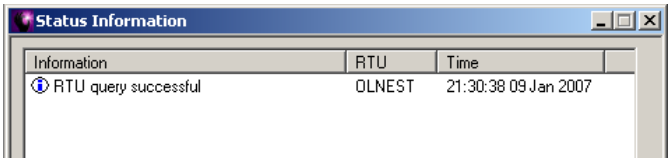


Entering "0,0" as the RTU address is a "Wildcard", and will return the current address of the RTU once it has been queried successfully.

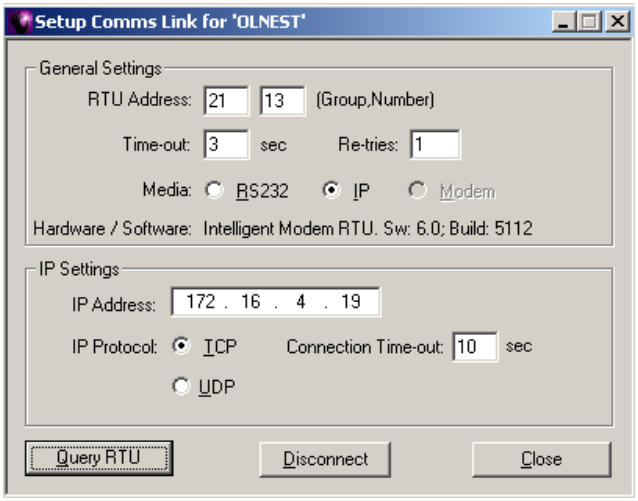
You can query the RTU using either a null-modem serial cable or over an IP connection.

Serial	IP
Enter the COM port on your PC that you will use to connect to the RTU (MicroMC only supports COM ports 1-4). Connect a suitable cable between that COM port and a COM port on the RTU that has been configured for Medina communication. The default port configured on an MM-IM is COM1, at 9600 baud	Enter the IP address that has been configured for the RTU. From firmware versions V6.0C5126, the default IP address is 192.168.1.1, subnet mask 255.255.255.0. For earlier firmware versions the default IP address of the MM-IM is 158.234.17.166 with subnet mask 255.255.248.0.

Make sure the RTU is running and Click "Query RTU". If successful, you should see a message in the Status Information window:



Once the RTU query is successful, you will see the RTU type and software version number displayed. If you entered (0,0) for the address, you will see the RTU address as in the example below:



After querying the RTU, you can download the PAK file. Click back on to the "File Download" window or select "Configure" and "File Download" from the menu and click start. The execute timeout is the time MicroMC waits after downloading the PAK file before querying the RTU and setting the RTU time.

If unsuccessful the message "Communications Error – Poll timed out" will be displayed in the status window. If the message "Communications Error – Communication Error" is displayed in the status window check that nothing else is using the serial port on your PC – close all other applications and all other RTU configurations in MicroMC. If that does not help try restarting MicroMC, if that does not help try restarting Windows.

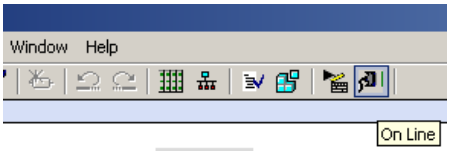
Straton Debugging

It is possible to debug a Straton program by going "online" with the MM-IM. This can only be done over an IP connection, so you must know the IP address of the MM-IM. Once you have downloaded the configuration (including Straton program), you can connect to the device from within Straton.

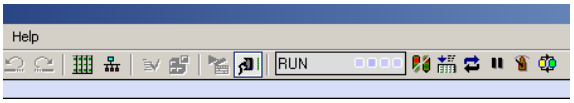
At the bottom of the Straton window, it displays the current IP address that will be used to connect to the MM-IM. Double click on it to change it.

To go online, first ensure you have built the Straton program and generated and downloaded the configuration using MicroMC. Also check the MM-IM is running by observing the System LED.

Click the toolbar icon to go online:



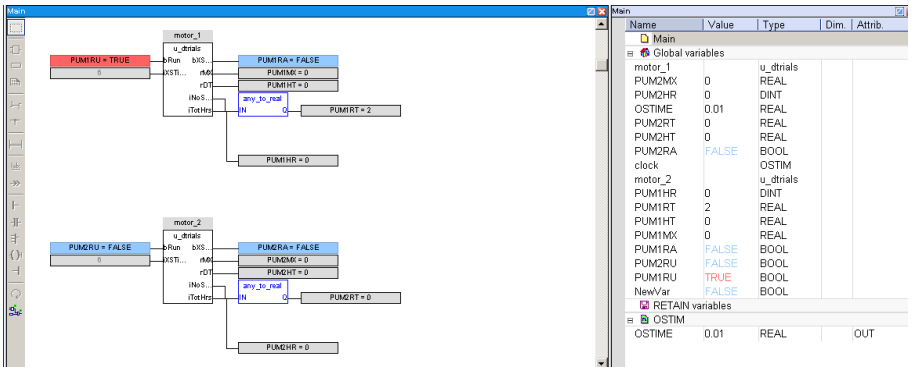
Assuming that the version of the Straton program on your PC matches the version on the MM-IM, you will see that the program is running by observing the toolbar status:



WARNING

Do not download a Straton program directly to the MM-IM through the Straton Workbench. If you make any changes to the program, please re-compile the Straton project and then re-generate the configuration in MicroMC. This will automatically load the new Straton program on to the MM-IM.

If you now look at the Straton program and/or variable list, you will see the current state of each variable. Digital values change red or blue to indicate TRUE and FALSE states respectively. If you have the Straton-Medina enhancements, the mnemonic will be shown instead of TRUE and FALSE.


Main
motor_1
u_dtrials
PUM1RU = TRUE
bRun
bXSTi...
rMX
rDT
iNoS...
iTotHrs
any_to_real
IN
PUM1RA = FALSE
PUM1MX = 0
PUM1HT = 0
PUM1RT = 2
PUM1HR = 0
motor_2
u_dtrials
PUM2RU = FALSE
PUM2RA = FALSE
PUM2MX = 0
PUM2HT = 0
PUM2RT = 0
PUM2HR = 0
Main
Name
Value
Type
Dim.
Attrib.
Main
Global variables
motor_1
u_dtrials
PUM2MX 0 REAL
PUM2HR 0 DINT
OSTIME 0.01 REAL
PUM2RT 0 REAL
PUM2HT 0 REAL
PUM2RA FALSE BOOL
clock OSTIM
motor_2
u_dtrials
PUM1HR 0 DINT
PUM1RT 2 REAL
PUM1HT 0 REAL
PUM1MX 0 REAL
PUM1RA FALSE BOOL
PUM2RU FALSE BOOL
PUM1RU TRUE BOOL
NewVar FALSE BOOL
RETAIN variables
OSTIM
OSTIME 0.01 REAL OUT

Dynamic Configuration and Reporting

Some configurable values are able to be dynamically controlled, affecting the behaviour of the MM-IM without needing to download a different configuration. Operational status of the MM-IM can be reported in a similar manner for specific values. This section details which configuration items can be dynamically controlled, which report status, and how to achieve this.

General

The dynamic configuration and reporting requires that each value is mapped to a specifically named Straton point. These values are able to be used as any other point in Straton, allowing the user programme to locally update its configuration during execution. The name of the point is used to map to the configuration or reporting data within the MM-IM.

The master can set the configuration and read reported values as it can for any point.

Dialout Test

The MM-IM is capable of supporting primary and redundant communications media, each with multiple outgoing addresses. When an alarm is generated, the MM-IM attempts to connect to the master to report the alarm using the configured dialout communications details. If an attempted connection fails to reach the master it will try the other connections until one is successful. When the primary media has a failure, there is the possibility that the redundant media is also in a failed state.

The dialout test functionality enables each configured connection to be tested to determine whether its media is available or failed. This is performed proactively to allow for example the failure of the redundant communications media to be reported while the primary is available.

The High Dialout Failure (HDF) status bit reports whether either communications media has failed with 10 successive failures to contact the master. This will only be reported when there is communications with the outstation, and thus it indicates failure of the other media. To determine which media has failed, the successful connection is reported by the outstation dynamically.

Dialout Test Frequency

The frequency of each test dialout connection from the MM-IM to the master can be independently configured. This allows each connection to be tested at a suitable rate. The testing relies on the MM-IM needing to dialout to the master (it is irrelevant for an outstation that is only ever contacted by the master). The values relate to the interval at which each particular connection is tested, based on the number of attempted connections. Thus a test frequency of 5 will ensure the connection is tested every sixth dialout.

As each dialout connection maintains its test record independently, each has its own configurable test frequency. A value of 0 indicates that the connection is never explicitly tested (which does **not** mean that it is never used). There are up to 18 connections (10 IP Address and ports, and 8 PSTN numbers), with each point name within Straton configuring a single test frequency. If a connection is not used, there is no need to include the point.

Dialout test frequency point names must take the form:

CFG_TEST_FREQ_IP_[0 – 9]

CFG_TEST_FREQ_PSTN_[0 – 7]

If no points are created in Straton with these names, the dialout test functionality will be disabled.

Last Dialout Connection

The index of the last attempted connection is reported using a specifically named point: RES_LAST_DIAL_IN_CONN[3]

Connection	Name	Straton Type	Embed Profile
0	CFG_TEST_FREQ_IP_0	REAL	MEDINA_AI
1	CFG_TEST_FREQ_IP_1	REAL	MEDINA_AI
2	CFG_TEST_FREQ_IP_2	REAL	MEDINA_AI
3	CFG_TEST_FREQ_IP_3	REAL	MEDINA_AI
4	CFG_TEST_FREQ_IP_4	REAL	MEDINA_AI
5	CFG_TEST_FREQ_IP_5	REAL	MEDINA_AI
6	CFG_TEST_FREQ_IP_6	REAL	MEDINA_AI
7	CFG_TEST_FREQ_IP_7	REAL	MEDINA_AI
8	CFG_TEST_FREQ_IP_8	REAL	MEDINA_AI
9	CFG_TEST_FREQ_IP_9	REAL	MEDINA_AI
10	CFG_TEST_FREQ_PSTN_0	REAL	MEDINA_AI
11	CFG_TEST_FREQ_PSTN_1	REAL	MEDINA_AI
12	CFG_TEST_FREQ_PSTN_2	REAL	MEDINA_AI
13	CFG_TEST_FREQ_PSTN_3	REAL	MEDINA_AI
14	CFG_TEST_FREQ_PSTN_4	REAL	MEDINA_AI
15	CFG_TEST_FREQ_PSTN_5	REAL	MEDINA_AI
16	CFG_TEST_FREQ_PSTN_6	REAL	MEDINA_AI
17	CFG_TEST_FREQ_PSTN_7	REAL	MEDINA_AI

Name	Straton Type	Embed Profile
RES_LAST_DIAL_IN_CONN	REAL	MEDINA_AO

[3] It is named *Dial in* from the perspective of the master, not the MM-IM

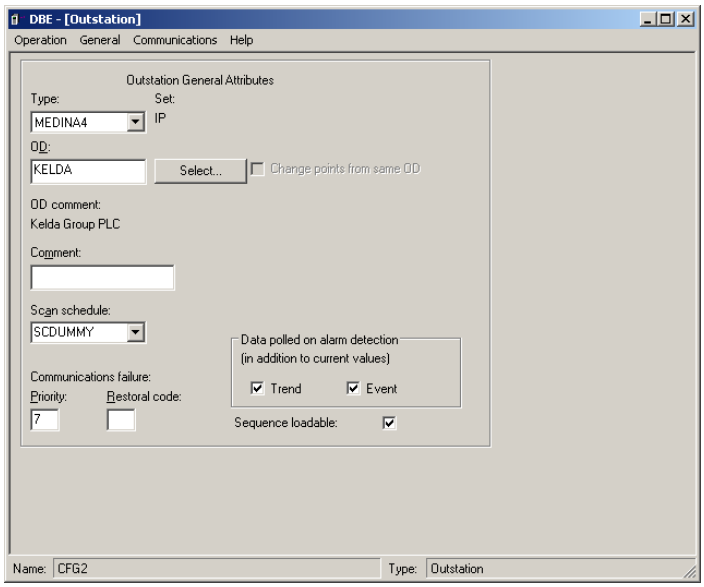
Configuring Master Control for a MM-IM

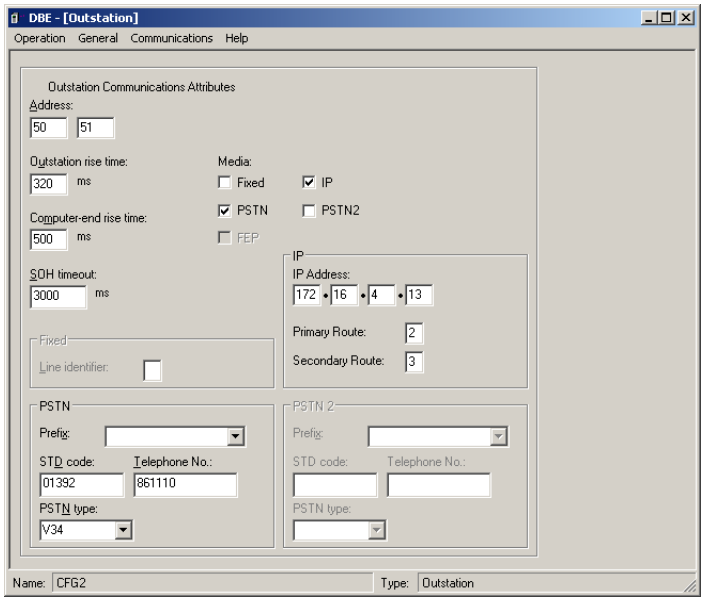
Before using the MM-IM, you must configure Master Control with information about the RTU so that the device is recognised and data communications will take place as required.

Creating a configuration

Configuration of any RTU on Master Control is performed by DBE, the DataBase Editor. A separate manual “Master Control Database Editor” is provided with full details of how to use the tool. This document is intended to show only the pertinent points relating to MM-IM configuration.

After invoking DBE and choosing to create an outstation configuration, you will be presented with the following screens, one showing general information and the other showing details of the communications.



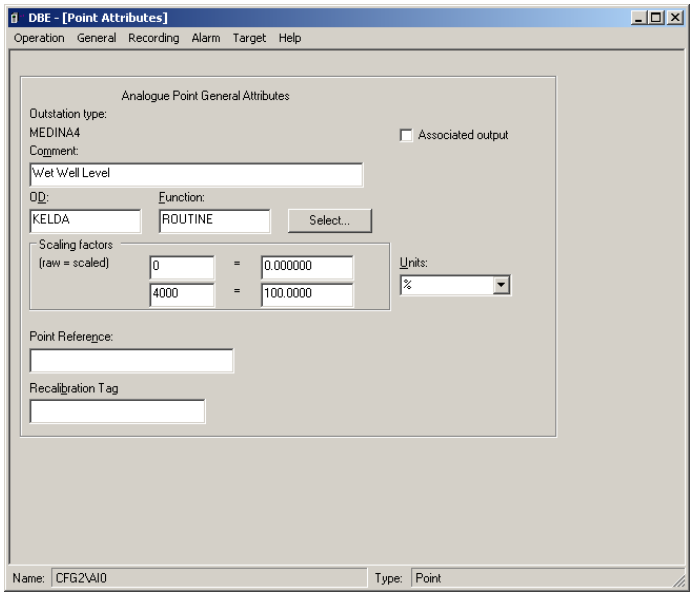


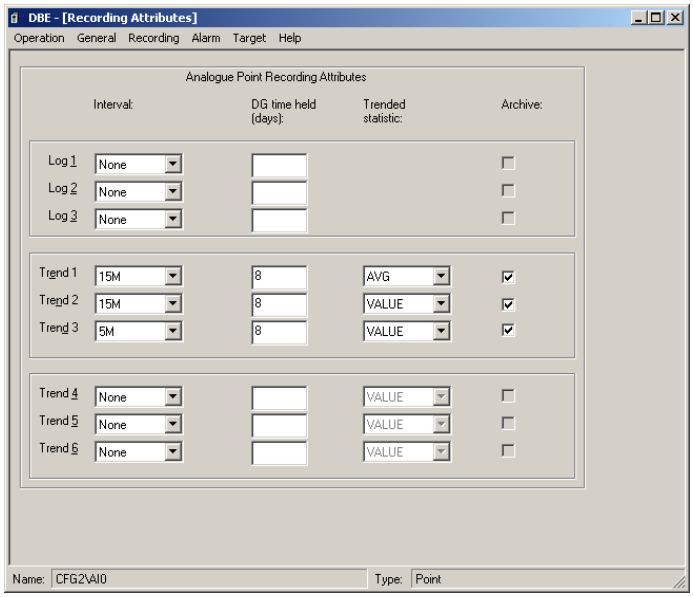
Key configuration points to note for the MM-IM are:

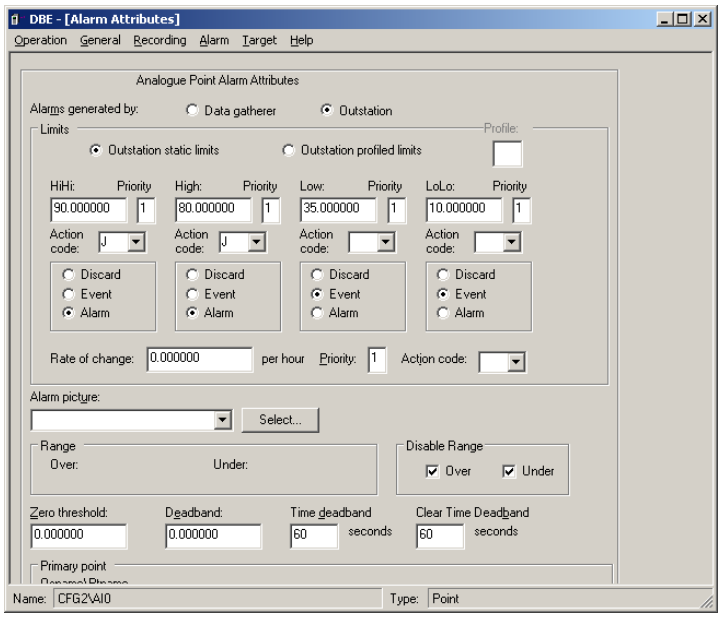
- The type is "MEDINA4" – The MM-IM communicates using the Medina protocol with enhanced features for the MM4 family of RTU's.
- The PSTN type must match the modem connected to the MM-IM (or a compatible variant – e.g. V34/V22bis will work with the MM-IM's internal V92 modem).
- The media can be a combination of Fixed/PSTN/IP
- The PSTN STD code and telephone number are the details for the MM-IM being configured.

Creating points

Points are configured for MM-IM RTU's just as for any other Medina RTU, using the three screens in DBE's create point option: General, Recording and Alarm.






DBE - [Alarm Attributes]
Operation General Recording Alarm Target Help
Analogue Point Alarm Attributes
Alarms generated by: Data gatherer Outstation
Limits
Profile:
Outstation static limits
Outstation profiled limits
HiHi: Priority
High: Priority
Low: Priority
LoLo: Priority
90.000000 1
80.000000 1
35.000000 1
10.000000 1
Action code: J
Action code: J
Action code:
Action code:
Discard
Event
Alarm
Rate of change: 0.000000 per hour Priority: 1 Action code:
Alarm picture:
Select...
Range
Over:
Under:
Disable Range
Over
Under
Zero threshold: 0.000000
Deadband: 0.000000
Time deadband 60 seconds
Clear Time Deadband 60 seconds
Primary point
Name: CFG2\AI0
Type: Point

Installing the MM-IM

General installation guidelines

The following diagram is intended to show key elements of a typical RTU installation. Use this information together with the latest installation regulations and guidance from both the Institution of Engineering and Technology (IET) and your own organisation.

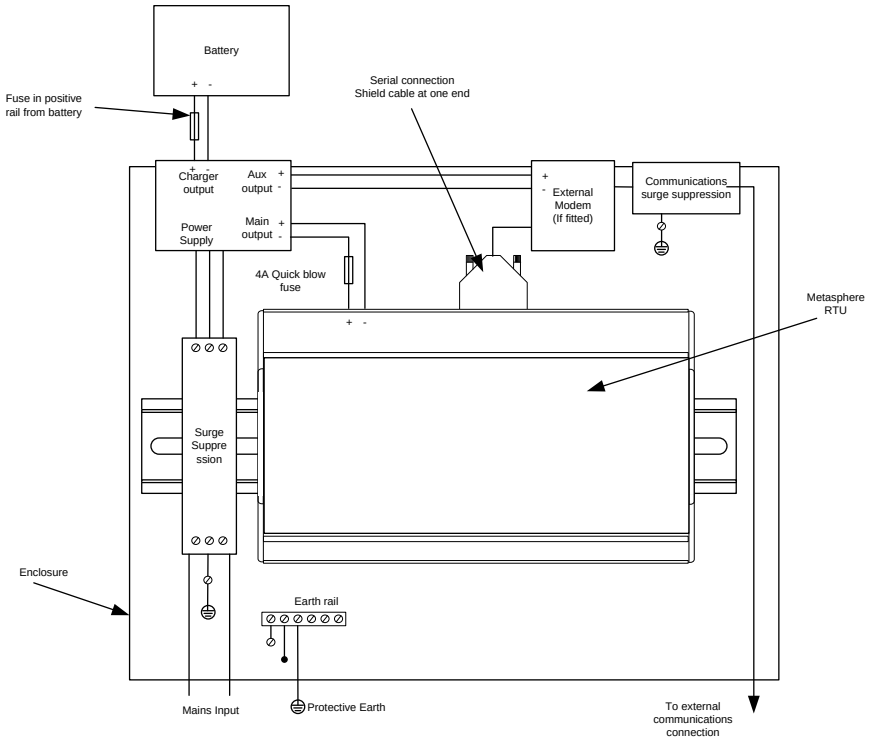


Figure 5: Typical RTU installation

Key points to note are:

1. You should fuse the battery to charger connection in the positive rail to protect against short circuit or over current damage.
2. A 4A quick blow fuse should be used between the DC power supply and the MM-IM (as illustrated).
3. All Analogue and serial cables should be shielded and the shield should be connected to a common earth point.
4. Connections to the site earth point should be as short as possible to reduce voltage drop and minimise potential for damage from external transients.
5. Surge suppression may be applied to mains input and communications lines.
6. The negative power input should be connected to the nearest earth point to ensure there are no floating potentials in the unit.

Safety precautions

1. Except where statutory or local procedures are followed and appropriate safety equipment worn, the Medina range of RTU's and ancillary equipment should be installed in a safe place away from areas where personnel may be at risk from falling, moving machinery, high voltage, passing traffic.

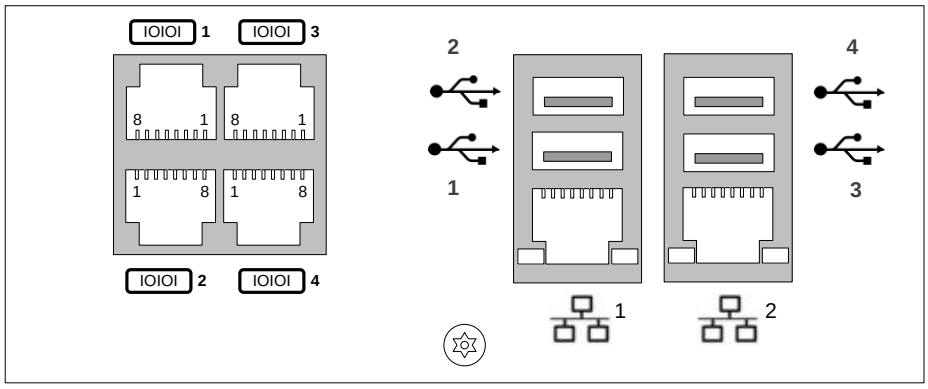
2. All installations must be performed by a competent professional to a standard at least compliant with BS7671 (see IET Wiring regulations 16th Edition) or other local standards where these may apply.
3. Take care to avoid wiring mains inputs to I/O connections.
4. Do not use RTU's using radio communications in applications where the transmission of data may have safety implications (e.g. system critical alarms) without establishing the necessary risk mitigation measures. Full hazard analysis is available on request.
5. Unless explicitly stated, RTU's are not certified for installation in hazardous environments covered by the ATEX directive.
6. Install an independent watchdog where the RTU and ancillary equipment is used for automated control of safety related equipment. This watchdog must put the equipment into a safe state in the event of a failure of the RTU or ancillary equipment.
7. Safety related equipment located in areas adjacent to Medina RTU's and ancillary equipment must be immune to EM radiation as specified by the EU EMC directive.
8. Other equipment installed near an RTU must not produce EM interference at levels higher than those that the RTU is immune to as specified by the EU EMC directive.
9. Power supply units used to power RTU's must carry the CE mark and therefore comply with the necessary EU directives.
10. If the MM-IM is not used as specified in this manual the protection provided may be impaired.

Connections, switches and indicators

MM-IM

The MM-IM has four serial ports provided by RJ45 sockets. It also has two RJ45 Ethernet ports and four USB ports.

Side View 1



USB Serial Adapters

The MM-IM includes support for additional serial ports using USB to serial adapters. The FTDI Chipi-X cable has undergone testing, although others may work. Up to 4 additional ports are supported and they can be configured by switching to the 8 COM port mode within Straton Workbench or MicroMC.

To ensure that multiple USB serial adapters are enumerated in the correct order, they are to be added in the order as shown in the side view above.

Any USB serial port can be used for any purpose, including modem communication. All USB serial converters should be connected before the MM-IM is reset following a download of the new configuration PAK file.

RS232 port connections

Function	Pin (COM1)	Pin (COM2-3)
DSR/RI	1	-
DCD	2	-
DTR	3	-
GND	4	4
Rx (input)	5	5
Tx (output)	6	6
CTS	7	7

Function	Pin (COM1)	Pin (COM2-3)
RTS	8	8

RS485/422 port (COM4) connection

Function	Pin
Tx+	1
Tx-	2
Rx+	3
GND	4
GND	5
Rx-	6
N/C	7
N/C	8

- *Note: When the unit is clean configured, COM4 Rx may be constantly lit. This is not a problem since COM4 is not configured in clean config and may be floating. It does not indicate a failed unit. For connection to Allen Bradley PLC or PC for use with MicroMC (RS232)*

RJ45 Pin	9-Way D-Sub female
1	4
2	1
3	6
4	5
5	3
6	2
7	7
8	8

For connection to Omron Modbus PLC (RS232)

RJ45 Pin	9-Way D-Sub male
1	-
2	-
3	-
4	9

RJ45 Pin	9-Way D-Sub male
5	2
6	3
7	-
8	-

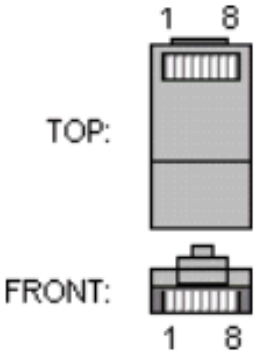
For connection to Wago/Beckhoff I/O (RS485)

RJ45 Pin	9-Way D-Sub male
1	3
2	8
3	3
4	5
5	-
6	8
7	-
8	-

For standard male RS232 port (e.g. for connection to modem or radio (RS232)

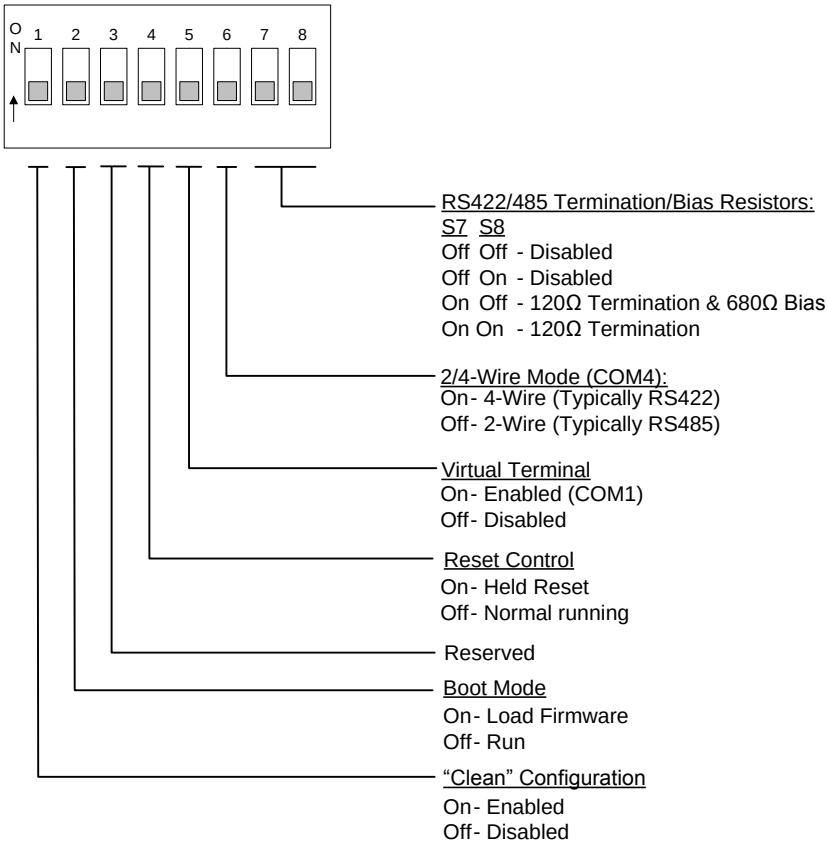
RJ45 Pin	9-Way D-Sub male
1	6
2	1
3	4
4	5
5	2
6	3
7	8
8	7

RJ45 Plug Pinout



DIL Switch Settings

The MM-IM has eight DIL switches mounted on the front of the enclosure. During start-up, the MM-IM reads the state of switches 1-3. These switches determine any special start-up actions it must perform (e.g. default configuration) and its final operating mode. Switches 6-8 configure settings for COM4.



To revert to a "Clean" configuration, please follow this procedure:

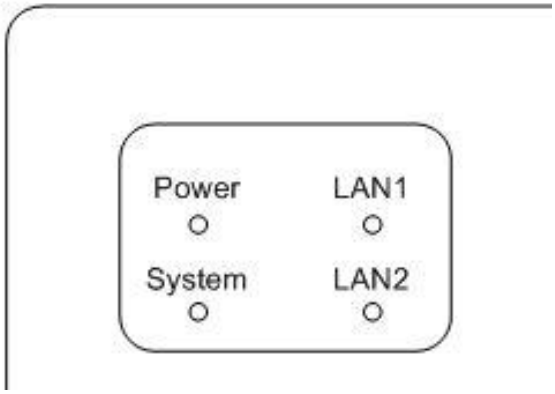
1. Set switch 1 ON
2. Reset the MM-IM or switch it on
3. Wait until System LED is flashing for longer on (1s) than it is off (1/4s), this should not take more than about 20 seconds
4. Set switch 1 OFF

5. Reset the MM-IM
6. When the MM-IM now starts up, it will have the default configuration with Medina address 4,4, COM1 @ 9600, and IP address LAN1: 192.168.1.1, subnet mask 255.255.255.0, LAN2: 192.168.2.1, subnet mask 255.255.255.0.

For Firmware upgrade instructions, please see the section Firmware Upgrade.

Status LED's

Four LED status indicators are provided on the front of the unit:



LED	Function
Power	Indicates status of power to the MM-IM
System	Indicates the running state of the MM-IM
LAN 1	Flashes off with network activity
LAN 2	Flashes off with network activity

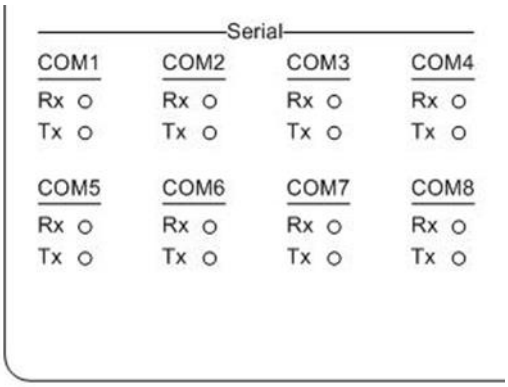
The system LED flashes in various sequences to indicate different states. There are 7 possible states.

MM-IM State	System LED Behaviour (repeating)
Not running	Permanently on or off
Starting up	Flashing very quickly (on 0.01s, off 0.01s)
Running	Flashing slowly (on 1s, off 1s)
Shutting down (will shortly change to "Starting up")	On 1/3s, off 1/3s, on 1/3, off 1s (i.e. flashes two times with a 1 second pause)
Watchdog Fired (will shortly change to "Starting up")	On 0.2s, off 0.2s, on 0.2s, off 0.2s, on 0.2s, off 1s (i.e. flashes three times with a 1 second pause)
Clean Configuration has been performed	Flashing longer on than off (1¼s on, ¼s off)
"Load Firmware" mode	Flashing twice quickly, followed by a short pause.

- *Note: There is an approximate 10-second delay between power being applied to the MM-IM and the system LED beginning to flash fast to indicate it is starting up. During this time, the System LED will be on and the MM-IM performs various start-up checks.*

Serial & LAN Port LED's

Two LED status indicators for each serial COM port (1-4) are provided on the front of the unit. (Mk4 will have 8 COM ports).



Serial Communications Interface	Four serial ports, one of which can be configured to be TIA/EIA-422-B or TIA-485-A compliant, whilst all others are TIA-232-F compliant. Data rates on all serial ports can be independently configured to one of either 150, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600 or 115200 bps. All support RTS and CTS modem control lines. COM1 additionally supports DCD, DTR, DSR and RI.
Power Supply	The MM-IM requires a supply of 8-30VDC and is suitable for use on both 12V and 24V systems. Typical Current consumption: 0.29A @ 12V, 0.16A @ 24V. Inrush Current: 1.0A @ 12V, 2.2A @ 24V. A mains power supply together with battery charging and monitoring circuitry is also available. Used in conjunction with an external lead-acid battery this can be used to provide the MM-IM with a high availability power supply tolerant of mains failures.

LED	Function

Rx	Indicates data being received by the corresponding port
Tx	Indicates data being transmitted by the corresponding port

- *Note: When the unit is clean configured, COM4 Rx may be constantly lit. This is not a problem since COM4 is not configured in clean config and may be floating. It does not indicate a failed unit.*

Security

In an increasingly connected environment, security is important. An RTU must be resilient to many forms of attack, while still providing its expected service. As the MM-IM can be used with IP connections that are externally accessible, the following security issues are described in detail.

Telnet

The MM-IM is supplied with a telnet server, however due to the lack of encryption or authentication in the protocol it has been disabled by default. Ssh connections are available as an alternative. This is in line with the needs of many customers.

Enabling telnet

If telnet is required for a specific MM-IM it can be enabled using a manual process. Any upgrade made to the MM-IM may revert to disabled telnet, and require the steps to be undertaken again.

1. Log in to the MM-IM using ssh to reach the command console
2. Enter `vi /etc/init.d/rcS` and page down or scroll to around line 90 to find the following text:
3. #echo $Linux_string: Starting telnetd...
4. #/sbin/telnetd
5. Uncomment the hashes by pressing 'x' while the cursor is over them.
6. Save the file and exit the editor with `:wq`
7. Reboot the MM-IM

Root password

The MM-IM runs the Linux Operating System, and contains a root user account to provide access for development, diagnostic and upgrade functionality. Previous to the v6.0c6135 firmware release a default password of *password* was used, which provides little security. Upgrading to v6.0c6135 will change the root password to **medinaM5** for security. The upgrade script will ask for the current password and only apply this if it has remained as *password*.

Changing the root password

While the new default root password is an improvement over using *password*, changing it can further improve security. The following steps indicate how this can be achieved.

Note: this should <u>not</u> be done to a MM-IM that is running in a production environment

1. Open an ssh connection to the MM-IM and login as root
2. Enter `./killa` to stop the MM-IM running
3. Enter `rw` to allow the filesystem to be writable
4. Enter `passwd` and follow the prompts
5. Power cycle or reboot with the `reboot` command

If the password is changed and subsequently lost or forgotten the unit will need to be returned to Metasphere and reprogrammed to return it to the default. Therefore it is advised that company procedure for changing the password is followed, as it would be for

a password on any other shared resource. The password is needed to upgrade the MM-IM not using the RFU method.

Troubleshooting

Configuration troubleshooting

Check	The MM-IM is powered and connected properly
Check	That nothing else is using the serial port. Close all other applications and all other RTU configurations in MicroMC
Try	Restarting MicroMC
Try	Restarting Windows
Try	Reverting to the default configuration using DIL switch 1

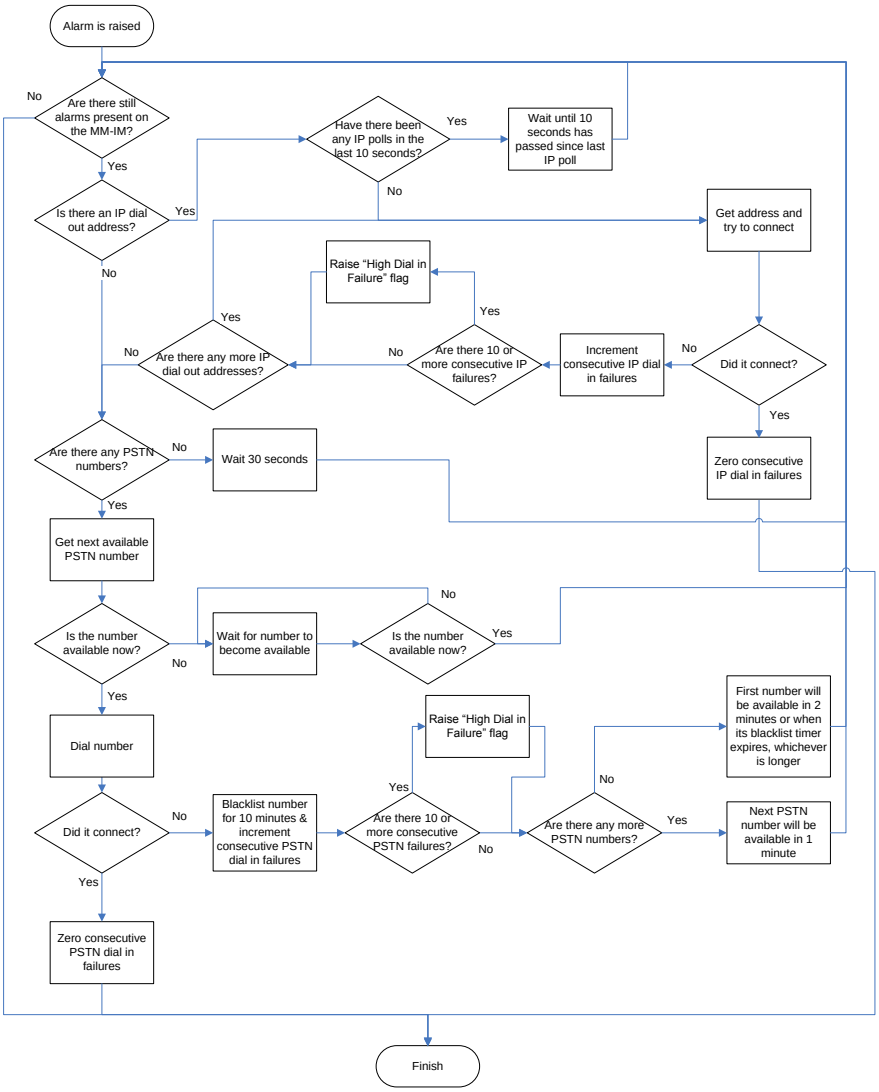
MM-IM troubleshooting

Check	The MM-IM is powered and connected properly and the System LED is flashing slowly
Try	Contacting the RTU using MicroMC. Click on the *Query RTU* button to confirm that the communication link is correctly established
Try	Resetting the MM-IM. Press the reset button on the side of the enclosure
Try	Reverting to the default configuration using DIL switch 1

I/O troubleshooting

Check	The MM-IM is powered and connected properly and the System LED is flashing slowly
Check	The serial port LED's for suspicious activity.
Check	Serial port settings (baud rate, data bits, stop bits, parity)
Try	If using a Straton program, try going online with the Straton Workbench to observe the state of the program.
Try	From the menu in MicroMC, select "Points" and "Monitor Current Values". A dialogue displaying the MM-IM's points appears. Click "Monitor" in the same dialogue. MicroMC will constantly poll the MM-IM for its input values. To add points to this list, you can either manually add points in the points list (select "Points" and "List" from the menu) or by choosing the "Import ODF" option in the points list.
Try	Connecting a known good input and verify that the value expected is displayed by MicroMC

Dialback troubleshooting



The above diagram shows how the MM-IM decides when to initiate a connection to the DG, and the blacklist timers involved. There can be a maximum of ten IP dial out addresses (e.g. primary and secondary DGs) and eight PSTN numbers.

Watchdog Diagnostics

The MMIM watchdog now creates a WD file which contains useful information regarding the potential causes of an MMIM reset. The file is a temporary file and will be lost if the MMIM is to lose power. It is possible to FTP the files from the MMIM in order to avoid losing the information stored within.

These files are located in the /tmp directory on the MMIM.

Web Server

The MM-IM has a built-in Web Server that is capable of serving up a page with read-only access to the current configuration files. This provides an easy way to view the configuration on the MM-IM, although it will require some familiarisation with the configuration files (see the section on PAK Files for more information).

To access the page, browse to the MM-IM's IP address in a Web browser.

Firmware Upgrade

- *Note: Downgrading of firmware on a MM-IM using these methods is not supported and is done at the user's risk.*

Local

Pre-requisites

The MM-IM firmware upgrade is provided in the form of a DOS batch file that uses FTP to transfer files to the MM-IM.

To download a new version of firmware to the MM-IM you will need:

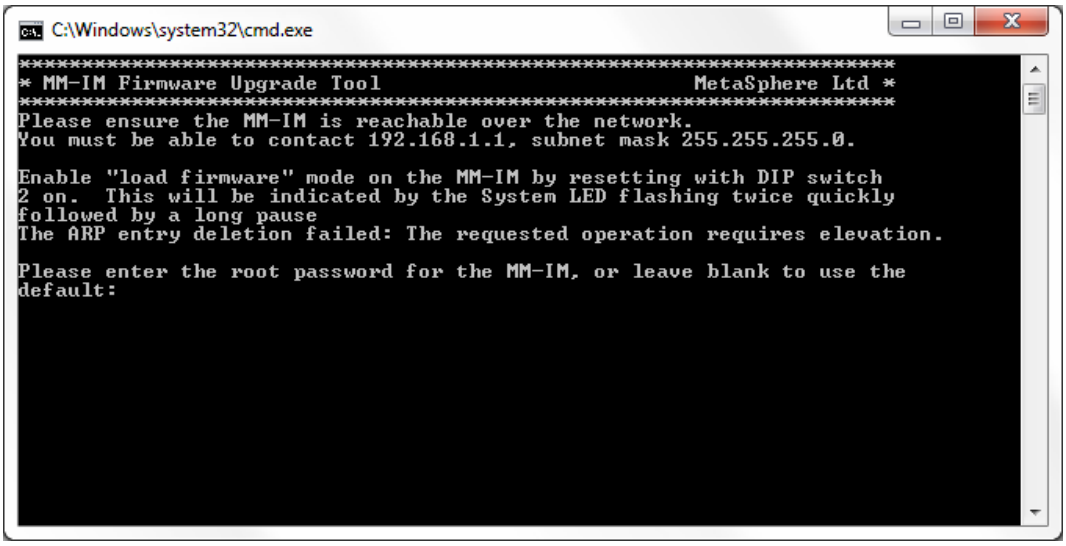
- The new firmware
- An IP connection to the MM-IM
- A power supply for the MM-IM
- The root password if it is not the default (see page 70)

Upgrade Procedure

Set DIP switch 2 to the "on" position. Ensure DIP switch 1 is off. Turn on the power to the MM-IM (or reset it) and connect the Ethernet cable to LAN1.

The IP address of the MM-IM will be 192.168.1.1, subnet mask 255.255.255.0. Your PC will need to have an IP address in the same subnet in order to communicate with the MM-IM. This can be done using a crossover cable if required.

Ensure the System LED is flashing twice quickly followed by a short pause. Then run the batch file provided.



Follow the instructions to enter the root password and press any key to continue when prompted.

Provided the file transfer was successful, switch DIP 2 back to the "off" position. This will cause the MM-IM to shut down cleanly and automatically reboot with the new firmware. Do not press the reset button as this forces a reset and will not shut down cleanly and may corrupt the file system. **DO NOT REMOVE POWER OR RESET THE MM-IM** before setting switch 2 back to the off position and waiting for the Status LED to flash slowly. Any power interruption during firmware upgrade can lead to memory corruption.

- *Note: It may sometimes be necessary to also load the device configuration – either because the existing configuration has been corrupted during the firmware upgrade procedure or because the existing configuration is no longer compatible with the new firmware (the corresponding individual release notes will tell you if this is necessary).*

Remote Firmware Upgrade

Pre-requisites

The MM-IM firmware upgrade is provided in the form of a Remote Firmware Upgrade (RFU) file (*.rfu) that can be remotely transferred to the MM-IM from the Data Gatherer.

To download an RFU file to upgrade the MM-IM you will need:

- The RFU file
- A Master Control Data Gatherer running version 8.2 or later
- The MM-IM to be upgraded, which must be in regular contact with the Data Gatherer

Upgrade Procedure

The Data Gatherer tool, `rfuload`, can be used to schedule the download of the RFU file. Details of this tool can be found in the Master Control Data Gatherer System Administration Manual.

Once the MM-IM RFU file has been transferred, the MM-IM will reboot to perform the upgrade.

PAK Files

Configuration files which are downloaded to the MM-IM must be in the form of a "PAK" file (the file has a .pak extension). This is a file that contains a number of other files. PAK files can be downloaded using a tools such as MicroMC and Straton, or via Master Control.

This section describes the purpose of each of the configuration files used on the MM-IM.

Medina.cfg

Medina.cfg is the most important file on the MM-IM. It defines the RTU address and communication parameters for ports that will use the Medina protocol. Without it, you will be unable to communicate with the MMIM. An example can be seen below.

```
CM
{
    CP
    {
        [1]=
        {
            BR=4;
            RT=100;
            MD=0;
            ST=3;
            SP=0;
            PA=0;
            BE=0;
            CD=2500;
            CS=;
            DS=;
            IS=;
        [9]=
        {
            BR=7;
            RT=60;
            MD=2;
            ST=3;
            SP=0;
            PA=0;
            BE=0;
            CS=ATDT;
            DS=ATH;
            IS=ATE0V0&S0=1+IFC=0,0;
            CD=4000;
        }
    }
    IP
    {
        INTERFACE
        {
            [0]=
            {
                IPADDR=172.16.4.19;
                MASK=255.255.0.0;
                GATEWAY=172.16.1.1;
            }
        }
        IPP
        {
            [0]=
            {
                IPO=32000;
                IPC=2;
            }
        }
    }
    PH
    {
        [0]=01372273311;
    }
}
```

```
OS
{
    GA=4;
    OA=4;
    EV=84;
    AL=84;
    TR=84;
    DP=S9;
    PO=NONE;
    BP=60000;
    OV=0;
    PD=1200;
    AF=0;
    TP=7200;
    TT=4;
    WEB=1;
}
```

Isa.map

Isa.map provides the mapping between Straton variable names and Medina point names. There is one line per point that needs to be mapped to/from Straton. The "R" or "W" is a legacy bit of information that used to indicate whether the point was to be read from or written to Straton. All points are now mapped as both "read" and "write", regardless of the letter.

```
OSTIME AID0 R
PUM1MX AID1 R
PUM1RT AID2 R
PUM1HT AID3 R
PUM2MX AID4 R
PUM2RT AID5 R
PUM1RU DI4 W
PUM2RU DI6 W
PUM1HR PID0 R
PUM2HR PID1 R
```

Df.cfg

Df.cfg is used to configure the DF1 driver. It contains details of the polling blocks that have been configured in MicroMC.

```
NAME=DI0;
BAUD=9600;
STATUS=AI0;
MM4=4;
NODE=1;
CH=2;
ACTION=R;
TYPE=N;
OFFSET=0;
SIZE=2;
FILE=10;

NAME=PI17;
MM4=4;
NODE=1;
CH=2;
ACTION=R;
TYPE=N;
OFFSET=0;
SIZE=1;
FILE=12;
```

Ipdial.cfg

Ipdial.cfg is a very small file that contains the IP addresses of the DG(s) on which the set that the MM-IM belongs to is configured. The MM-IM uses these addresses to contact the DG following power-up or reset.

```
2
172.16.3.2:21007
172.16.3.3:21006
```

Dsm.cfg

Dsm.cfg has a similar format to medina.cfg. It is used to configure the Data Sharing Manager on the MM-IM. It defines all points on remote outstations connected to the MM-IM that are to be read or written, and the points on the MM-IM that they are going to be read from or written to.

```
RO
{
    [6]=
    {
        RL=S2;
    }
}
RP
{
    [6]=
    {
        =d0000000;
        =p0000000;
        =a0000000;
        =D0000010;
        =P0000010;
        =A0000010;
    }
}
LP
{
    [6]=
    {
        =d0640640;
        =D0650650;
        =a0640640;
        =A0650650;
        =p0640640;
    }
}
```

pulse.dat

Pulse.dat contains the configured rollover values for each of the integrated inputs on the MM-IM. Each line contains the point ID, and the maximum value the point will reach before rolling over.

```
PI0    32767
PI1    32767
PI2    32767
PI32   65535
PID1   999
PID2   999
PID3   32767
PID20  32767
```

Scale.dat

Scale.dat contains the scaling factors for each analogue point used on the MM-IM. These factors are obtained from the scaling factors embedded in the Straton project, obtained from the ODF. For each point it gives a multiplier and an offset.

```
AI25 0.025000 0.00000
AID11 0.012500 0.00000
```

T5.cod

T5.cod is a binary file that contains the compiled Straton user program. Straton actually creates this file as appli.xti, but it needs to be renamed to t5.cod for the MM-IM to recognise it. MicroMC or Straton automatically makes this change. The file also contains the details to configure the Modbus driver which is part of Straton.

Technical details

Serial Communications Interface	Four serial ports, one of which can be configured to be TIA/EIA-422-B or TIA-485-A compliant, whilst all others are TIA-232-F compliant. Data rates on all serial ports can be independently configured to one of either 150, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600 or 115200 bps. All support RTS and CTS modem control lines. COM1 additionally supports DCD, DTR, DSR and RI.
Power Supply	The MM-IM requires a supply of 8-30VDC and is suitable for use on both 12V and 24V systems. Typical Current consumption: 0.29A @ 12V, 0.16A @ 24V. Inrush Current: 1.0A @ 12V, 2.2A @ 24V. A mains power supply together with battery charging and monitoring circuitry is also available. Used in conjunction with an external lead-acid battery this can be used to provide the MM-IM with a high availability power supply tolerant of mains failures.
Processor	ICOP Vortex86SX SoC CPU-300MHz.
System Memory	Onboard 128MB DDR2 SDRAM
LAN	LAN1 provided from LoC (LAN on Chip). LAN2 provided from Intel 82551 10/100Mbps Ethernet Controller.
Program and Data Storage	MSTI EmbedDisk Module (512MB)
Enclosure and connectors	Moulded plastic enclosure in black ABS. Size (excluding connectors) is 175 × 120 × 50 mm. Mounting is 35mm symmetrical DIN rail (length along rail = 175mm). Conforms to BS EN 60529 IP20 ingress protection All connections are made via plug-in connectors so that the module can be removed without disturbing the plant wiring.
Real Time Clock	Local crystal-controlled real time clock with Lithium Battery Backup. It is periodically synchronised to Master Control during normal RTU operation.
LEDs	Four pairs of red (Rx) and green (Tx), one pair per

	serial port. Plus four green status LED's as follows: Power, indicates power is present System, used to indicate overall system status LAN1, used to indicate Ethernet activity LAN2, used to indicate Ethernet activity
Watchdog	The watchdog function will reset the RTU if any of the MM-IM's internal tasks stop responding as expected.
USB	Four USB 2.0 Master ports

Standards and approvals

	Standard
Safety	EN-61010-1 Safety requirement for electrical equipment for measurement and control EN-60950 Safety of information technology equipment
Environmental	Operating temperature -10°C to +55°C Relative Humidity 5% to 95% non-condensing Vibration Sinusoidal, 10-150Hz, 4g Amp., 5 sweeps in 3 orthogonal axis Shock half sine, Acc. 15g, Pulse time 11ms, 3*6 shocks
Ingress Protection	Ingress Protection: BS EN 60529 IP20
EMC	EN-50081-1 EMC/emission light industry EN-50082-2 EMC/immunity heavy industry

Further information

For further information on the MM-IM or any of the other Master Control products, contact Metasphere using one of the methods below:

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