



# User's Manual

## M2500

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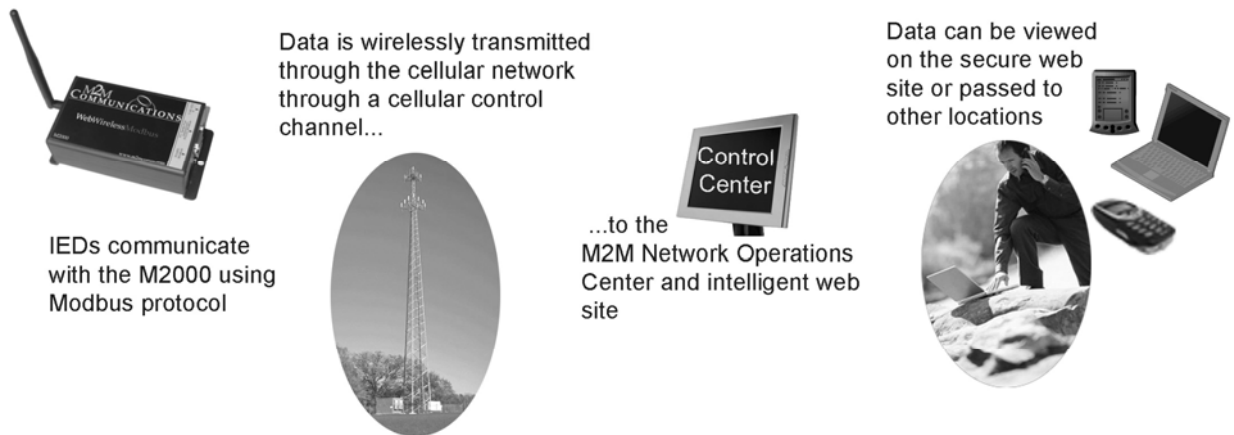
## Introduction

The M2M Wireless Communicator is a web-to-wireless remote monitoring and communication device. Its internal cellular modem provides two-way communications to the automated M2M operations center and the [www.m2mcomm.com](http://www.m2mcomm.com) web site. The GSM cellular network provides very wide spread coverage throughout North America with no requirement for a local cellular account. The small size and low cost make it suitable for a wide variety of general monitoring applications.

This user's manual covers the model M2500, which is one of a family of four models.

- M2000 Monitors and controls other Intelligent Electronic Devices (IEDs) using a Modbus port.
- M2500** Directly monitors up to 10 digital inputs, which can be configured as alarms, counters, or counter/timers. There is no Modbus port.
- M2510 Combines both – Monitor and control other Intelligent Electronic Devices (IEDs) using a Modbus port and monitor 10 direct connect digital inputs.
- M3000 Directly monitors up to 10 digital inputs and 3 analog inputs. Directly controls 3 output relays.

The models M2000, 2510, and M3000 are covered in separate manuals.



M2M Communications Process Diagram

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## Operation is very simple

1. Connect the M2M M2500 Communicator to the device(s) to be monitored and turn it on. Set up the values to be read from and written to the device.
2. The M2500 will automatically establish two-way communications over the public cellular network to the [www.m2mcomm.com](http://www.m2mcomm.com) web site.
3. Log onto your private page on the web site to:
  - View the last reported status of your equipment – switch positions, diagnostic information, tank levels, temperature, pressure, number of pulses received....
  - Request an up-to-date report from the unit.
  - Configure selected events to trigger an immediate user notification by voice phone or e-mail.

## How it Works

When an M2500 makes a call from anywhere in North America (where there is cellular coverage), it is recognized locally as a roaming cell phone. As a part of the standard roaming protocol, the local cellular network automatically passes the module's identification numbers and data to the central cellular hub. The M2M module passes its data packet in the normally non-utilized data field. This technique allows the transmission of an identification number and the time and date, plus 25 digits of customer specific data, all at a very low cost. At the M2M network operations center, the data is validated and processed for distribution to the end user. In addition, configuration information can be sent from the M2M data center to the M2500.

This is called cellular control channel communications. The primary advantages of this method are low cost and wide spread coverage throughout North, Central, and South America. The disadvantage is that the customer specific data packet is relatively small (25 digits). The control channel is best suited for applications that send a small amount of data infrequently.

**The M2500 maximizes the potential of the control channel technology by internally testing the data from monitored devices and only sending data when a reportable event occurs.**

Reports are only generated when:

- A monitored input changes, or
- A time scheduled report is due, or
- A report is requested from the web site

## Direct Connect Digital Inputs

The model M2500 monitors up to ten digital status inputs. All inputs are opto-isolated and protected with surge suppression circuitry per ANSI C37.90.1-2002 to minimize the effect of external transient voltages. In the standard product configuration, the inputs are defined as follows:

- 1 Alarm style or 5-digit counter
- 2 Alarm style or 5-digit counter
- 3 Alarm style
- 4 Alarm style
- 5 Alarm style
- 6 Alarm style
- 7 Alarm style
- 8 Alarm style or maintenance/tamper switch
- 9 Alarm style or Counter / Timer
- 10 Alarm style or Counter / Timer

The unit will report the state of all 10 inputs when any “alarm style” input changes state in either direction (open-closed or closed-open) for longer than a programmable trigger time. The trigger time of each alarm style input is programmable by the user through the local programming utility and can be varied from a minimum of 1 second to a maximum of 30 minutes and 59 seconds. A different time can be specified for each input and each direction (open-closed and closed-open). Any change that does not remain stable for the specified trigger time will be ignored. The factory default trigger time is 5 seconds for both directions.

The digital inputs are designed for dry contacts. A loop voltage of +12 VDC is provided from a common terminal point. External voltages should not be connected to the inputs.

Inputs # 1 & 2 can be configured either alarm style or as counter inputs that count up to 99,999 closed-open state changes. They count at a maximum rate of 30 counts per second (at a 50% duty cycle). Either one or both inputs can be configured as counters using either the local programming utility or remotely from the web site. The unit can be programmed to report the counts on a time-based schedule, upon counter rollover, or upon request at any time. Each counter operates like an odometer, and rolls over to 0 after 99,999 counts. They can also be remotely reset to 0 at any time.

Input # 8 can be defined as alarm style or as a maintenance key. All changes to this input are reported. If maintenance mode is enabled and the key switch input is open, maintenance mode is ON and other input changes will not be reported. If the input is closed, maintenance mode is off and all input changes will be reported.

Inputs 9 & 10 can be individually defined as alarm style or as 3-digit timer / counters. This function is useful for reporting both the number of on/off cycles and the total run time of a pump or motor. The 3-digit timer values are reported in seconds, minutes, or minutes x 10 depending on the accumulated time.

*Small print logic:*

*When an input changes, the report will usually be initiated immediately after the trigger time is reached. However, if other input changes are in progress, the report will be delayed to allow the transmission of all data in one call.*

*If another input change is in progress at the time, the unit will delay the report until all other input changes either reach their trigger time or return to the original state. Except...*

*The unit will only wait for a maximum of 30 seconds after the first trigger. Then it will report all stable inputs. This timeout is necessary since the inputs can be programmed with trigger times greater than 30 minutes and it may be important to report the initial alarms.*

*If incomplete input changes are in progress when the unit reports, they will continue to be monitored and timed, and will be reported in another call if they reach their programmed*

## Reports

The M2500 is a wireless remote monitoring device that communicates over the cellular network using the cellular control channel. It can transmit a report for several reasons. Some of the features and reports are configurable and can be enabled or disabled by M2M and/or the user.

- (1) The unit may be configured to send time scheduled status reports at a specified frequency.
- (2) A report can be requested at any time from the web site.
- (3) When powered on, the unit will report "Initial Power On", either as a registration call or a power on call.
- (4) Reports will be sent when an input changes state.

The M2500 can send several different types of reports. Each report sends different register data as follows:

- 1) Power-On, registration, and configuration information
- 2) Direct Connect Input Information
- 3) Pump Data (Counter / Timer Information)

## Time Scheduled Reports

Any or all of the reports (except the power on call) can be time scheduled at a predefined frequency. Call frequencies can be set anywhere from once every hour to once every 240 hours (10 days). The factory default is disabled. Note that when this option is enabled, reports will begin at the specified time (for example, one hour) after the unit is powered on. To schedule daily calls at a specific time, leave this setting disabled and initiate the time scheduled reports from the web site at a specific time. Daily status or heartbeat type calls should be scheduled in the off-peak hours (10pm to 3am).

## Reports on Request

In addition to automatic reports based on events or alarms and time-scheduled reports, you can request an individual report from the web site at any time. See the 'Send Commands' function in the web site discussion for operating details.

In the same setup screen where time scheduled reports are defined, there is also an individual option to include the report in the "Report All" list. This is a convenient one-click command from the web site that will cause the M2500 to send all reports that are on the list.

## Integrated Power Supply & Battery Backup

The M2500\_DC models require an external regulated +15 VDC power supply, capable of supplying up to 1.6 Amps. The M2500\_AC models include a 120 VAC power supply.

The M2500 includes an on-board 12VDC voltage regulator that can be used to charge a small (0.8 Amp Hr) battery. In case of an AC power outage or inadequate incoming DC voltage, the M2500 will report an AC power outage.

Both AC power outages and low battery conditions (during an AC power outage) are detected and reported. When AC power is applied to the external power supply, the unit receives +15 VDC thru the input power terminals and turns on. The program then switches on the transistor that connects the battery. The unit then makes a Registration or Power On call. The battery is continually charged while AC power is present.

If the AC power is lost for more than one minute (if the incoming voltage drops below ~13 VDC, the unit will report the power outage. The Call Reason will specify that the call is being sent because of an AC power outage. After the report has been sent, the radio will be turned off to conserve the battery. (If a subsequent event and report is initiated, the radio will be turned back on long enough to make the report.)

The program will continue to operate normally until such time as the battery voltage drops to approximately 12 Volts. At that time, a low battery report will be made and then the battery will be disconnected to prevent an excessive battery discharge (which can reduce battery life).

If power is restored after the AC outage call but before the low battery call, a Power On call will be made. If the power is restored after the low battery call and shutdown has occurred, the power on call will be either a Registration call or a Power On call depending on the cell channel select setting.

## Low Power Mode

The M2500 unit has a user-selectable low-power mode. In the low power mode, the radio is turned off to conserve power and therefore is unable to receive remote requests for input status reports. However all other functionality remains active. If an input changes or a time-scheduled report is due, the radio will be temporarily turned on to make the call.

In the low power mode, the radio will be left powered on for one minute after all calls to the web site. Any commands from the web site must be implemented within the one-minute time that the radio is powered up. While the radio is on, the user can remotely request reports, configure operation and control the outputs from the web site

Low power mode is normally used for solar operation where an external battery is being charged by a solar panel and controller. The external battery powers the M2500 and no other battery is typically charged by the M2500. In the low power mode, an AC Power Outage Call will not be made when the voltage drops below approximately 13 VDC. Instead the unit will continue to operate until the voltage reaches the minimum voltage necessary to transmit (~ 12 VDC). At this point, the unit will report a Low Battery Shutdown and will discontinue monitoring operations. However, the board will remain alive as long as possible and if the voltage increases to a workable level (~ 13 VDC), the unit will send a new Power On call and will resume normal operation.

## Getting Started

Setting up your M2M monitoring device is a three-step process.

1. Configure the unit for your specific reporting requirements.
2. Attach the M2500 to the switches or contact closures that you want to monitor, and
3. Set up the device information on the M2M ([www.m2mcomm.com](http://www.m2mcomm.com)) web site.

This manual gives you the information you need to get started. There are two primary sections:

- Programming, installing, and using the M2M M2500 Communicator, and
- Using the M2M web site.

## Tech Support

For assistance, questions, suggestions, or just to praise the product designers, feel free to contact us. Official office hours are 8-5 Monday-Friday, although there is a very good chance that someone helpful will be working on the weekend. The contact number is 208-947-9500.

For prompt answers by E-mail, please describe the problems carefully. The address is [info@m2mcomm.com](mailto:info@m2mcomm.com).

## The M2500 Local Programmer

The M2500 Communicator arrives from the factory programmed with basic default settings. Unless you are incredibly lucky, some of these settings will need to be adjusted to work properly with your setup.

### Connecting the M2500 to a PC

The RS232 serial port provides a connection to a Windows based PC.

Use a standard 9-pin serial cable to connect the RS232-DB9 connector to a PC serial port. The baud rate and other communication settings between the Local Programmer and the unit are predefined. The only exception is the selection of the computer's COMM port. This can be selected with the File | Comm Port menu of the Local Programmer.

The Local Programmer can be used to create, edit and save profiles on the PC without being connected to the M2500. Obviously, data cannot be uploaded or downloaded to the unit until it's connected.

### Installing the Local Programmer on your PC

The Local Programmer is a Visual Basic utility program that you will use to configure the M2500 Communicator. It can be found in the main directory of the CD that is included with the M2500 and must be installed on your PC or laptop. It will then be used to create, display, edit, and save your configuration information. It can also be used to test the radio signal strength and the connection to your inputs.

To install the Local Programmer, insert the M2M CD into your CD drive and run the Setup.exe program. This will install the utility on your computer.

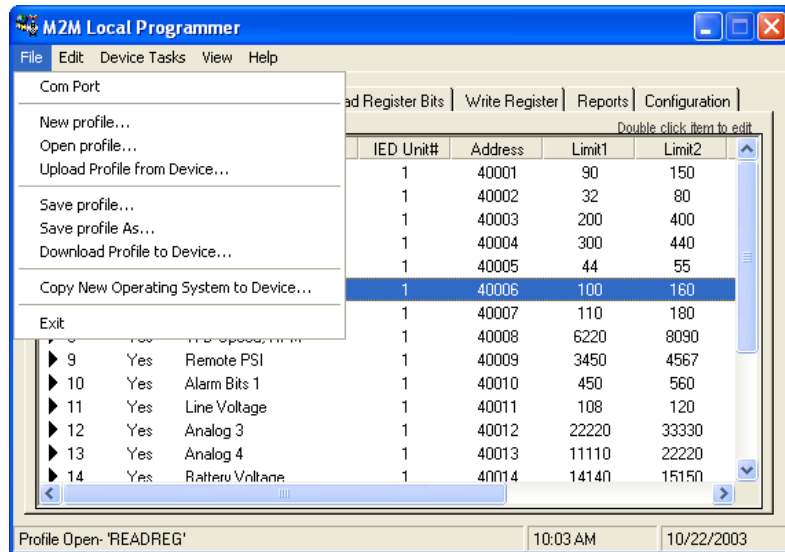
### Local Programmer Overview

The program is a standard Windows based program. Along the top of the screen is the primary menu. Below that are seven "tabs" that can be selected to display specific information.

For the M2500, the only tabs that are used are the Digital Inputs, Reports, and Configuration screens.

### File Menu

The File Menu can be used to create a new profile, open a saved profile or to save a profile that you have edited. (A profile is a list of the programmable parameters and settings.)



It can also be used to download an entirely new Operating System to the M2500 when new features are available.

Lastly, it can be used to specify the correct computer communication port or to exit the program

### Edit menu

When a row in the data grid is selected, you can use the Edit menu to open the edit screen for that row. An easier way is to just double click on the desired row to open it.

### Device Tasks

The three Device Tasks under this menu heading will initiate an immediate command to the unit, so these should be run only when connected to a powered-up unit (unless you REALLY like watching the little hourglass).

### Clear all Timers and Counters

Clicking on this button will send a command to the unit to clear all direct-connect timers and counters plus all event counters and call counters.

Another choice under the Device Task menu heading is: Restore Factory Defaults. This button reloads the default profile for you. The same task can be accomplished with the File | New Profile... selection. The new profile must be downloaded to the unit using the File | Download button.

## View Menu

This selection sends an immediate request to the M2500 asking for all monitored data including inputs and system configuration data. The Configuration Data includes the current Radio Signal Strength Indicator (RSSI). When the data is received, it will be displayed on the computer. This is useful for locally verifying the radio signal strength.

## Help Menu

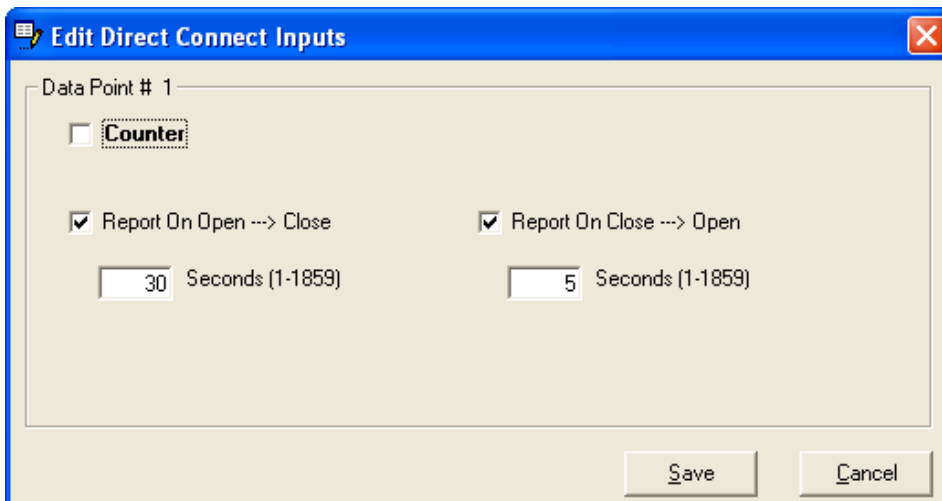
Displays the current software revision number of the Local Programmer utility program

## Editing the Operating Parameters

There are several “tabs” that are used to display and edit specific information. The basic functionality is the same for all of them. Open the window by clicking on the tab. A data grid for that selection shows all of the current settings. Double click on any row to open the row for editing.

## Digital Inputs

This screen shows the ten direct connect digital inputs. Use this screen to configure the digital inputs. Double click on one of the rows to edit the operating parameters for that input.



The default condition for each input is “alarm style” where any change will cause a report to be sent to the web site. For alarm style inputs, there are two options that can be changed:

- (1) You can specify that a change should only be reported on open → close or close → open state changes or both.
- (2) The unit will report the state of all 10 inputs when any alarm style input changes state for longer than the programmable trigger time. The trigger time of each alarm style input is programmable on this screen and can be varied from a minimum of 1 second to a maximum of 30 minutes and 59 seconds. A different time can be specified

for each input and each direction (open-closed and closed-open). Any change that does not remain stable for the specified trigger time will be ignored. The factory default trigger time is 5 seconds for both directions.

Several of the ten inputs can be configured for an alternate use as follows:

- 1 Alarm style or 5-digit counter
- 2 Alarm style or 5-digit counter
- 3 Alarm style
- 4 Alarm style
- 5 Alarm style
- 6 Alarm style
- 7 Alarm style
- 8 Alarm style or maintenance/tamper switch
- 9 Alarm style or Counter / Timer
- 10 Alarm style or Counter / Timer

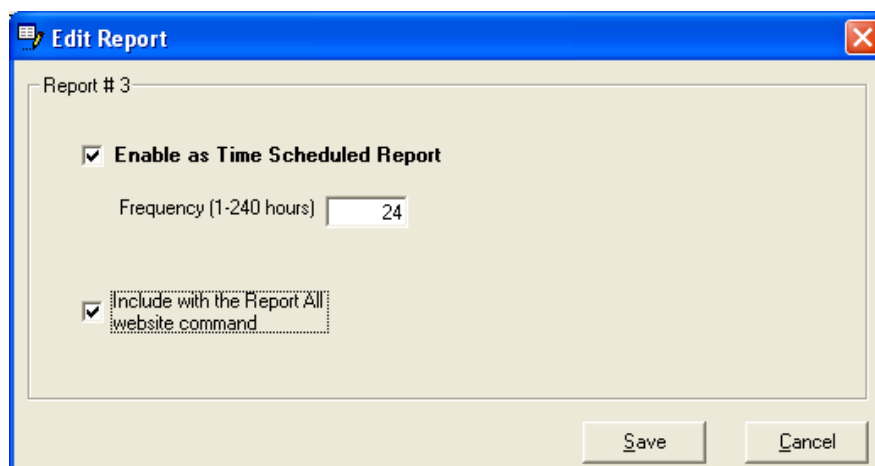
Inputs # 1 & 2 can be configured either alarm style or as counter inputs that count up to 99,999 closed-open state changes. They count at a maximum rate of 30 counts per second (at a 50% duty cycle). Either one or both inputs can be configured as counters using either the local programming utility or remotely from the web site

Input # 8 can be defined as alarm style or as a maintenance key. All changes to this input are reported. If maintenance mode is enabled and the key switch input is open, maintenance mode is ON and other input changes will not be reported. The unit is "Out of Service". If the input is closed, maintenance mode is off and all input changes will be reported. The unit is "In Service".

Inputs 9 & 10 can be individually defined as alarm style or as 3-digit timer / counters. This function is useful for reporting both the number of on/off cycles and the total run time of a pump or motor. The 3-digit timer values are reported in seconds, minutes, or minutes x 10 depending on the accumulated time.

### Time Scheduled Reports

This screen allows you to enable any of the reports (except the Power On call) as time scheduled reports. Double click on one of the rows to open the selected report. Use this screen to enable the time-scheduled reports.



Checking the “Include with the Report All website command” will also add the report to the list of reports that are reported with one click of the “Report All” button”.

Any of the reports can be scheduled at a predefined frequency. When time scheduled reports are enabled, the M2500 will call at set intervals to report its current readings, with the first call coming at the specified amount of time after the unit is powered up. Call frequencies can be set anywhere from once every one hour to once every 240 hours (10 days). To schedule a report at a specific time of day, fill in the frequency, but leave the Enabled box unchecked and then use the web site to initiate the first call at a specific time. All calls that follow the initial call will be at the programmed frequency and starting at that point. Note that all daily status or heartbeat type calls should be scheduled during the off-peak hours (10 pm to 3 am).

### Configuration Screen

This screen allows you to define the system configuration settings.

### Power Mode

The Normal power mode should be used whenever possible.

In the low power mode, the radio is turned off to conserve power and therefore is unable to receive remote requests for input status reports. However all other functionality remains active. If an input changes or a time-scheduled report is due, the radio will be temporarily turned on to make the call.

### Daily Call Limit

To reduce the number of calls that might result from over-active inputs or power cycling conditions, the number of event-based calls per day can be limited. Time scheduled calls and user requested status calls will continue to be placed even after this limit has been reached. The daily call limit should normally be selected so that the total number of calls is limited to no more than 20 calls per day and no more than 400 calls per month. The daily limit can be set from 1 to 20. The unlimited selection is for test and demo purposes only. The factory default setting is 10.

### Cellular Channel Selection

The M2500 can be configured to operate on either cellular channel A or B. In addition, it can be programmed to automatically select the correct channel for control channel operation.

If configured for auto selection, the unit will determine the proper cellular channel for operation each time it is powered on. The process starts by sending a registration call to

the web server on Channel B (the most commonly used channel). If the unit receives an acknowledgement from the web server, it will remain on that channel. However, if after one minute, it has not received an acknowledgement, it will repeat the process on Channel A. The program will continue to alternate channels until an acknowledgement is received. This cycle will normally find the correct channel on the first try and will repeat only once. If it continues, the web site is not receiving or responding to the unit's registration call.

The unit is shipped in the Automatic mode. For fixed locations, it is best to determine the correct cellular channel and set it to that.

Clicking the Default button will restore the factory default configuration settings.

### Installing the M2500

The installation process for the M2500 can be divided into three steps:

- Select an installation location.
- Test the device's ability to send and receive data.
- Attach the device to monitored switches and contact closure inputs.

### Selecting an installation location

The installation location will likely be determined to a great extent by the nature of the contacts or IEDs that you want to monitor or control.

The recommended operating temperature range is -22 to 140 degrees F (-30 to 60 C). The recommended relative humidity range is 5 - 95% non-condensing.

Antennas are available to match the environment and signal conditions. An external SMA connector provides the connection to a direct-mount 50-ohm antenna. If desired, a remote antenna can be attached to the connector.

The antenna should be located outside of any metal box or cabinet.

### Testing the receiver strength

After you have selected an installation location, it is a good idea to test the device's ability to transmit and receive before performing the actual installation. (The M2500 must be connected to 15 Volts DC power in order to carry out this test.)

The Radio Signal Strength Indication (RSSI) can be tested in two different ways.

(1) If the unit is able to transmit, the RSSI will be reported to the website in the Power On call.

(2) If a computer is connected and the Local Programmer utility is running, the RSSI can be read and displayed by clicking the View | View Data button. The RSSI will be shown under the System Info tab.

(3) To test the signal strength locally with no computer, wait until all LEDs have stopped blinking. Press and release the small black test switch near the edge of the radio. The M2500 will then read the Radio Signal Strength Indication (RSSI) from the radio. The signal strength is displayed using two of the LED's within the enclosure. They are the red and the green LEDs that are also near the edge of the radio.

The signal strength can be determined with the following table:

| <b>LED Appearance</b> | <b>Meaning</b>                   |
|-----------------------|----------------------------------|
| Solid red             | Inadequate signal strength       |
| Slow red blink        | Marginal or weak signal strength |
| Slow green blink      | Acceptable signal strength       |
| Fast green blink      | Good signal strength             |
| Solid green           | Excellent signal strength        |

If the signal is weak, try re-orienting the antenna or changing the mounting location. Note that it may be possible to improve inadequate signal strength with a directional or high gain antenna. High gain Yagi and omni-directional antennas are available from M2M Communications.

After maximizing the signal strength, proceed with the installation.

### Troubleshooting Tips

The two RSSI LED's are primarily used to display signal strength but also indicate key operating events, and can be useful in troubleshooting and system testing. The LEDs have many patterns that can sometimes be hard to understand. The best way to interpret them is to follow the blink patterns from the start-up.

### LED Indicator Guide:

- When the unit first powers up, it will blink green 12 times. During this time, the unit is simply killing time while the radio boots up and completes its initial registration with the cell tower.

- After a short (~ 1-2 seconds) pause, it will usually blink two short green blinks and then one longer green blink after a few seconds. The two short green blinks (0.2 seconds long) indicate that the unit has successfully verified that cellular service is available and the signal strength is OK. After it successfully transmits the Power On report and receives a positive Acknowledgment from the cell tower, the green LED will light for 1 second. This long green blink is what you want to see after every transmission.
- The unit is allowed to make only one call per minute. During the one-minute delay after every call, the red LED blinks on for 0.1 second about every 2 seconds. During this time, it will record input changes but will not report them until after the one-minute has passed.
- If (and only if) the unit is programmed to automatically select the cell channel, there will be a pattern of green and/or red blinks as the unit tests each channel. After the long transmit light, the green or red LED may begin blinking quickly. This blinking will continue until the ACK is received from the web server. This may only take one or two seconds or may last for up to one minute. Red blinks indicate that the unit is waiting for a registration acknowledgement (ACK) from the web site on the cellular A channel. If the green LED is blinking quickly, the unit is waiting for an ACK from the web site on the B channel. This cycle should normally only repeat once for up to one minute with each color. If it continues (one minute of each color), the web site is not responding to the unit's registration call. If there is a 10-second pause between color changes, the daily call limit has been reached (the unit can no longer transmit, but it can receive).

After the power on report has been completed, the light patterns are simpler to understand:

- Two short green blinks followed by a long green indicate a successful transmission
- After any failed transmit attempt (up to 4 tries), the red LED will light for 0.6 seconds. It is normal to receive occasional red blinks after transmitting. Sometimes the cell tower will simply be busy and will instruct the unit to try again.
- After the 5<sup>th</sup> failed transmit attempt, the red LED will light for 1 second. At this point, the report will be rescheduled for a later time.
- If the red LED keeps blinking slowly (on for 0.2 seconds every 1 second) this may indicate that there is no cellular service available or a weak RSSI. This blinking will continue until service is available. Verify the antenna connection or relocate the unit if it continues. This pattern could also mean that the daily call limit has been reached. If this is the case, there are several ways to fix this.
  - You can clear the call count with the Local Programmer ('Clear All Timers and Counters' button) or you can increase the Daily Call Limit.
  - You can remotely clear the call count from the web site.
  - You can clear the call count by holding down the black test switch for more than 2 seconds

- If the red and green LEDs blink at the same time, the radio is not communicating with processor.
- When the unit receives a command from the web site, or successfully verifies that cellular service is available, the green LED will light for 0.2 seconds.

### Troubleshooting Transmission or Reception Problems

The M2500 should operate anywhere there is cell coverage. Both the M2500 and the cellular/Internet transport system have proven to be very reliable and repeatable. In general, once the installation is set up and working, there are no ongoing problems. There are two categories of installation problems: (1) transmission or reception problems at the unit level and (2) data being lost in the carrier system.

Experience has shown that there are two categories of installation problems: inadequate signal strength and too much signal strength.

**Inadequate Signal Strength** – This is the simplest to understand. If the unit is being installed in a very remote location, there may not be enough signal. In this case, the RSSI will be less than 8 (less than -106 db). This is actually a very rare problem in North America. A variety of higher gain and/or directional antennas are available.

**Too much Signal Strength** – a more common problem, related to installations that are very close to cell towers and/or environments with nearby metal structures. Common examples are installations inside metal buildings or in buildings with internal metal structures or large metal objects nearby.

The problem occurs when the unit's transmission echoes from the nearby metal and effectively sends many simultaneous messages (echoes) to the cell tower. The cell tower says "What the...?" and rejects the call. The solution to this is to move the antenna to a different location inside or outside of the building until a good transmission point is found. Often movement of only a few inches will help.

### If the green LED indicates a good transmission

If the unit receives a positive ACK from the cell tower and lights the green LED for one second, it has done its job. The data has been sent, received, and acknowledged by the cellular network. If the data does not appear at the M2M web site, the data may be getting lost in the carrier network. This is unusual but does happen in new installations. Contact M2M Technical Support and we can track it down for you.

## Attaching the M2500 to Dry Contacts

The digital inputs are designed to monitor and report the open / closed status of dry contacts or open collector devices.

**DO NOT connect external voltages to the digital inputs.**

*Note: If external voltages are accidentally connected to the inputs, a purchase order for a replacement unit can be submitted to M2M Comm.*

A removable terminal block (J6) provides connection to the direct connect digital inputs.

On the input terminal block, four terminal points (Common) provide a 12 VDC loop voltage. The ten Digital Input terminal points detect the absence or presence of the 12 V signal. The contact closure input is optically isolated to 4000 VDC.

## M2M Network Operation Center

At the M2MComm data center, the data is validated and processed for distribution to the end user. In addition, configuration information can be sent from the M2M data center to the field module

The central web site records and displays all incoming status messages and depending on the customer's instructions, will:

- Notify the customer of the reported event via e-mail or telephone, and/or
- Pass the data to the customer's designated e-mail or IP address.

After entering a unique user ID and password:

- Both current and historical data can be viewed for all units. Displays can be customized with applicable labels.
- Data exporting options can be defined.
- Reporting options and user notification messages can be created and maintained.
- Time scheduled reports can be set up.

The M2500 web site supports up to 10 Direct Connected Digital Inputs

**Current Status** Register Value/Range Change Re as of 10/31/2003 3:04:59 PM

Device: **1009** Model: **M2510** Description: n/a

Jump to De

| #         | Description | Current Condition | Last State Change Occurre |
|-----------|-------------|-------------------|---------------------------|
| <b>1</b>  | Input 1     | Open              | Oct 31 2003 2:43f         |
| <b>2</b>  | Input 2     | Closed            | Oct 31 2003 2:43f         |
| <b>3</b>  | Input 3     | Closed            | Oct 31 2003 2:43f         |
| <b>4</b>  | Input 4     | Open              | Oct 31 2003 2:43f         |
| <b>5</b>  | Input 5     | Open              | Oct 31 2003 2:43f         |
| <b>6</b>  | Input 6     | Open              | Oct 31 2003 2:43f         |
| <b>7</b>  | Input 7     | Open              | Oct 31 2003 2:43f         |
| <b>8</b>  | Input 8     | Open              | Oct 31 2003 2:43f         |
| <b>9</b>  | Input 9     | Open              | Oct 31 2003 2:43f         |
| <b>10</b> | Input 10    | Open              | Oct 31 2003 2:43f         |

(**Bold** text indicates the latest change. **Red** text indicates a status in the alarm state.)

Using the Web Site

The M2M Comm web site, [www.m2mcomm.com](http://www.m2mcomm.com), gives you access to the data from your M2M units 24 hours a day, seven days a week, from any computer that has access to the internet. You can use the site to set up monitoring functions, to request a report from a device, and to set up automatic event notifications.

Logging In

To log in to your secure account on the web site, enter the user name and password that were sent to you with your unit(s).

When you click the Login button, the customer welcome screen will be displayed.

M2M COMMUNICATIONS

Device List Device Setup Alarm History Command Options Data Export

Logged in as ste

device setup  
device cloning  
modify users  
coverage map  
service agreement

**Device List**  
(Click on the Device ID number to see current status and details)

Order by Last Event Order by Device ID Refresh Screen

| Device               | Station # | Location/Description | Date/Time             | Current Status | Last Call Type  | Device         |            |
|----------------------|-----------|----------------------|-----------------------|----------------|-----------------|----------------|------------|
|                      |           |                      |                       |                |                 | Out of Service | In Service |
| <a href="#">1020</a> |           | M2M Test Lab         | 10/21/2003 9:58:11 AM | Normal         | Acknowledgement |                | ✓          |
| <a href="#">1009</a> |           |                      | 10/20/2003 9:11:51 AM | Normal         | Power On        |                | ✓          |

This screen has links to all of the device data and device configuration screens. The top selection is **Device List**. Clicking this link will show a list of all devices assigned to this account. The Device List gives a quick overview of the status of each device. It shows the date and time of the last call, and what that call reported.

For complete information on a specific device, go to the **Current Status** page. Click on a Device ID in the Device list and the Current Status page for that device will be displayed.

### Viewing Monitored Inputs

Once the M2500 is installed and turned on, it immediately begins to monitor its inputs. Within a few seconds after an input changes state, the device makes a call over the cellular network and reports the change. This data is immediately available on the M2M Communications web site. (You may need to click the Refresh link to update your screen.)

The Current Status page gives the status of each input at the time of the last report.

Several other links provide setup and information:

### Device Setup

This is used to create descriptive labels for the inputs, customer specific information, and to create user notifications.

### User Notifications

One of the more advanced features of the M2M Comm web site is to allow the user to create scenarios that will automatically send out a notification of an alarm or other important event. For example, a rule might be created to specify that "If motor 1 input reports OFF, send a page to Siegfred." These rules can also be more complex so that two conditions must be met before the action takes place. For example, "If temperature set point #2 has been reached AND Fan #1 is on, send an e-mail to Roy."

To create these rules, the M2M Comm web site has a step-by-step process that leads you through the process. After logging in to the web site, select the Device Setup link from the Welcome page or from the Current Status screen.

## Edit User Notification

Device: **1020** Description: **M2M Test Lab**

Notification Name:

**Notification Details:**

---

Select the first trigger for the user notification:

Digital Input       

I/O Point       

Register Bit       

Register Range       

2nd Trigger     And     Or     None

Digital Input       

I/O Point       

Register Bit       

Register Range       

Select Message:

Select type of Recipient:

On the 'Create Event Based Actions' screen there will be a list of any User Notifications that have already been created. These can be edited at any time by clicking on the Description.

An unlimited number of notification messages, rules, users, can be set up for any unit.

To set up a User Notification you first select the IF condition(s) that will trigger the notification, and then set up the recipient and message for the notification. There can be one "AND" or one "OR" condition for each rule.

Before creating your first User Notification you must first have at least one Message and one Recipient created for use in your notification.

Notification messages are sent to email addresses or phone numbers. An Internet email address can be used to send someone a regular email message that will appear in his or her email inbox, or a pager email address can be used to send a text page directly to a pager. Most modern pagers and cell phones have the ability to receive emailed pages.

Voice messages can be created in the same way. However, since the phone is more immediate and interactive, it also allows for acknowledgements. Up to 10 names and

phone numbers can be entered into a call list. The system will call the first number and play your predefined text message using a tacky text-to-speech robot voice. It will then ask the recipient to press a key as an acknowledgement. If you are an answering machine or you just don't want to press the button, the system will call the next person on the list. This will continue until the call is acknowledged.

### Device Activity

This is a complete history log for the unit. All commands sent to the unit and all reports received are saved in the database. The history report can display all calls or only the calls from a certain time period. When you click the Device Activity link, the history screen initially displays all calls for the past two months. Click the Date Range button to choose a different time period to view.

### Send Commands

From the Send Commands screen you can request an updated status report from the device at any time. To request a report, click the desired report from the pull down list and click the Send button. A status request will immediately be sent to the device and it will respond by sending back the requested report. Within 30 seconds you should be able to click the Refresh link at the bottom of the screen and see whether the unit has reported a state change for any of the inputs. You can also go to the History screen and see that the Status Report has been received.

In a similar manner, you can send a variety of configuration commands to the unit at any time. An acknowledgement report will be sent back from the unit verifying each change.

### Alarm History

For each I/O point and register, you can define an alarm condition. For example, a tank level monitor might have a "full" value that represents an alarm condition.

A history of all past alarms as well as any current alarms can be displayed by clicking on the Alarm History link.

### Data Exporting

Some users do not even view their data on the M2M web site. Instead they set up the system to immediately export all data to their own web site or to an email account. Or you can do both -- store and view the data at the M2M site and export it.

Click on the Data Export link to set up the standard exporting options. Incoming data for either specific unit(s) or for all units can be exported to an e-mail address.

Other customized exporting options such as XML can be arranged. Contact M2M for more details.

## Miscellaneous Operational Details

### Daily Call Limits

To reduce the number of calls that might result from over-active inputs or power cycling conditions, the number of event-based calls per day can be limited. Time scheduled calls and user requested status calls will continue to be placed even after this limit has been reached. The daily call limit is set in the Local Programmer Configuration screen and should be selected so that the total number of calls is limited to no more than 20 calls per day and no more than 400 calls per month. The daily limit can be set from 1 to 20. The factory default setting is 10.

### Cellular Carrier Requirements

There are several specifications and operating requirements that must be met prior to commercial deployment. These are all included in the requirements specification for the unit. Several may be apparent to the user so are worthy of mention here:

- The M2500 is software limited to a specified number of event-based change reports per day. The call limit is user-programmable and can be adjusted from 1-20 calls per day. If the daily call limit is reached, the **red** LED2 will continue to blink on and off every 1 second until the 24-hour timer has expired. During this time, all event-based calls are disabled, but time scheduled and user requested calls will continue to function normally.
- After each transmission, there will then be a 60 second delay before another call can be placed. During this delay time, the **red** LED2 will blink 0.1 second every ~3 seconds.
- The unit will not attempt to transmit unless service is available and the RSSI exceeds -106 dB.
- Antennas should be half wave. The use of quarter wave antennas is discouraged

### Retry Algorithm

The unit will delay at least 30 seconds between retries after a failed transmission. After five unsuccessful transmission attempts, the processor will power cycle the radio and then retry 5 more times. After a total of 10 unsuccessful attempts, the unit will discard the current data being reported.

It will then wait one hour and then attempt to send the same report with new current status information. After five unsuccessful transmission attempts, the processor will power cycle the radio and then retry 5 more times.

If ten tries are again unsuccessful, the unit will wait 2 hours and repeat this process.

If ten tries are again unsuccessful, the unit will wait 6 hours and repeat the process.

If ten tries are again unsuccessful, the unit will wait 18 hours and repeat the process.

If ten tries are again unsuccessful, the unit will abandon the data and stop trying.

If other reportable events or time-scheduled reports are initiated during the retry process, they will restart the process. A successful transmission of any call will terminate the retry process.

### Cellular Channel Selection

The M2500 can be configured to operate on either cellular channel A or B. In addition, it can be programmed to automatically select the correct channel for MicroBurst operation.

If configured for auto selection, the unit will determine the proper cellular channel for MicroBurst operation each time it is powered on. The process starts by sending a registration call to the web server on Channel B (the most commonly used Micro-Burst channel). If the unit receives an acknowledgement from the server, it will remain on that channel. However, if after one minute, it has not received an acknowledgement, it will repeat the process on Channel A. The program will continue to alternate channels until an acknowledgement is received. This cycle will normally find the correct channel on the first try and will repeat only once. If it continues, the web site is not responding to the unit's registration call.

### Hardware Specifications

#### Antenna

The standard antenna is a direct-connect ½ wave 50-ohm AMPS rubber duck cellular antenna. An external SMA RF connector provides the connection to the antenna. A remote antenna can be attached to the connector if desired. If the M2500 is located inside a metal cabinet, the antenna MUST be located outside that cabinet.

#### On-Board Radio Signal Strength Indicator

A pushbutton switch initiates a test in which LEDs are used to indicate the signal strength being received by the radio. This is used to facilitate installation, antenna selection and orientation, and troubleshooting. The same LEDs provide a momentary pass/fail indication after each transmission as well as other troubleshooting indications.

## Cellular Radio Operating Specifications

The CMM8700 cellular modem module has the following specifications:

- 0.6, 1.2, and 3 Watt transmit power at 824-849 MHz. Transmit power is automatically adjusted as necessary.
- Receive frequency: 869-894 MHz,

## Power Supply / Enclosure Options

The standard M2500 operates from 15 VDC (+/- 10%, 1.6 Amp peak current draw). A small enclosure and low cost make it suitable for a wide variety of general monitoring applications.

A 120 VAC powered unit is also available. Both standard enclosures are waterproof, gray aluminum boxes with latching hinged doors and integrated mounting flanges. Removable terminal blocks facilitate reliable field connections. Key and lock assemblies are also available as a special order.

Either the DC or AC powered units can be ordered without the enclosures. This configuration requires that the user will install the units in a waterproof and safe environment.

## CPU / Memory

The CPU is a Microchip PIC 18C452 product. Non-volatile (EEPROM) memory is used to store configuration and operational data.

## Environmental

The recommended operating temperature range is -22 to 140 degrees F (-30 to 60 C). The recommended relative humidity range is 5 - 95% non-condensing.

## Two LED indicators

are located inside the box to aid in field tests and installation. The two LED's are primarily used to display signal strength but also indicate key operating events, and can be useful in troubleshooting and system testing. For example, when the pushbutton switch is pressed briefly (for less than 2 seconds), the module will display the signal strength using the two LEDs as follows:

- |                     |                           |
|---------------------|---------------------------|
| • inadequate signal | = Red LED on steady       |
| • weak signal       | = slow blinking Red LED   |
| • good signal       | = slow blinking Green LED |
| • excellent signal  | = fast blinking Green LED |
| • awesome signal    | = Green LED on steady     |

## Other LED Indications:

- When the unit is first powered on, it will begin a routine in which it determines the proper cellular channel for Micro-Burst operation. The process starts by sending a registration call to the server on Channel B (the most commonly used Micro-Burst channel). If the unit receives an acknowledgement from the server, it will remain on that channel. However, if after one minute, it has not received an acknowledgement, it will repeat the process on Channel A.

While waiting for the registration ACK from the web site on B channel, there will be a fast green blink.

While waiting for the registration ACK from the web site on A channel, there will be a fast red blink.

This cycle will normally receive an ACK on the first try and so will repeat only once. If it continues, the web site is not responding to the unit's registration call.

- The normal operation after a contact changes will be two green blinks: Before transmitting, the unit checks for (1) Cellular Service Available and (2) adequate RSSI. If successful, there will be a short green blink. Then, after about 2-5 seconds, a longer green light will indicate that the cell tower has successfully received and acknowledged the report. There will then be a 60 second delay before another call can be placed. During this "dead-time", the red LED will blink 0.1 second every ~3 seconds. To summarize:

(1) When the unit successfully verifies that cellular service is available and signal strength is adequate, the green LED will light once for 0.2 seconds.

(2) After a successful transmission, the green LED will light for 1 second, then will blink red for 0.1 second every 3 seconds for one minute.

- If the daily call limit is reached, the red LED will continue to blink 0.1 second every ~3 seconds until the 24-hour timer has expired. If the call limit is reached, there are several ways to fix it. (You cannot just power cycle the unit).
  - Using the PC and the Local Programmer, you can clear the call count ('Clear All Timers and Counters') or you can increase the Daily Call Limit.
  - You can remotely clear the call count from the web site.
  - You can clear the call count by holding down the black test switch for more than 2 seconds
- If the red LED blinks on for 0.2 second every second, there is no cellular service available or there is an inadequate RSSI. There will often be one or two red blinks at power up until the radio registers with the cell tower. This is normal. The blinking will continue until service is available. Verify the antenna connection or relocate the unit if it continues. When service becomes available and/or signal strength increases, the report will be transmitted and the green LED will light for 1 second.

- When the unit receives a command from the web site, the green LED will light for 0.2 seconds.
- If red & green LEDs blink at the same time, the radio is not communicating with the processor. This will typically be corrected internally by repeating the communication. If the lights continue to blink, there is a problem with the unit (or the RS232 jumper is in the local programming position) .

### Serial Port

An RS232 serial port provides a connection to an external PC or other computer device. It is a full duplex, configurable serial port and is used to communicate with both the cellular radio and the 9-pin (DB9) connector.

The processor can automatically switch the serial port between the cellular radio and the DB9 port. When a PC or other serial communications device is connected and a communication port is opened, the processor will detect the port access, disconnect from the radio, and establish communications with the PC.

### Push Button

The small black push button on the board has two functions.

(1) Press it for less than 2 seconds to click the RSSI (signal strength)

(2) Press it for more than 2 seconds to clear all on-board counters, including the daily call count.

### Part Numbers

#### **M2500 Web-to-Wireless Communicator**

Monitors up to 10 Direct Connect Dry Contacts  
On-board 12VDC Battery Charger & Power Monitor

Powered by 15 VDC

- M2500DC\_INT Board only - No enclosure
- M2500DC\_EXT Exterior NEMA 4 Enclosure

Powered by 120 VAC, Includes a 0.8 A-Hr Battery

- M2500AC\_INT Bracket Assembly
- M2500AC\_EXT Exterior NEMA 4 Enclosure