



# Remote Monitoring and Control

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## **TC012 MicroRTU<sup>TM</sup>** Capacitor Bank Monitor and Control

### **Users' Guide**

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v. 1.7



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Revision	Date	
1.4	01/03/03	Changed screen shots to match new web site design.
1.5	07/21/03	Updated for Rev H board and Rev 7 firmware.
1.6	09/08/03	Added new User Notification features.
1.7	02/09/03	Changed local programming defaults, added some notes.

# Introduction

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Telemetric monitoring and control devices provide a low cost wireless system for remote monitoring, measurement, data collection, and control of equipment or machinery anywhere in the North American cellular coverage area.

The Telemetric system provides two-way communications using the non-voice or "control" channel of the public cellular network. The low cost of this proprietary method makes remote monitoring and control very affordable.

## Overview

The Telemetric TC012 MicroRTU™ is one of several application-specific configurations of the general purpose T646. The TC012 is configured to monitor and control fixed or switched capacitor banks. It is designed for outdoor environments, and operates from AC power. The module's internal cellular radio provides two-way communications through the fully automated Telemetric Network Operations Center (NOC). Information can be accessed through a secure web site or can be sent to the utility's SCADA system using SCADA-Xchange™ or other SCADA interface programs.

The TC012 provides capacitor bank control through two 30 Amp digital outputs. After an output change, the acknowledgement report includes the AC line voltage, open/close status, and the capacitor bank neutral current.

The TC012 works with a customer-provided analog input sensor that converts the 0-100 Amp capacitor bank neutral current to a 0-10 Volt AC signal. The analog input has an auto range feature that improves accuracy below 20 amps. Low range is 0 to 20 Amps and high range is 0 to 100 Amps. The TC012 will automatically switch between low and high range as needed. A neutral current of zero when the bank is open indicates that the installation is switched out of service. Normal neutral current (a nominal value above zero) when the bank is closed indicates the bank is switched in service and the installation is operating as expected. A neutral current that is higher than average but below a predefined limit indicates the presence of high harmonic current or resonant conditions, which may indicate a partial pack failure. A higher, pre-defined level of current indicates a blown fuse or other serious problem.

Operation is very simple:

- (1) If the TC012 enclosure has a meter base mounting, you simply plug the TC012 into an appropriately wired meter socket. If you have purchased an enclosure without the meter base mounting, you connect AC power and wire the TC012 outputs to the capacitor bank. Then, attach the neutral current analog input to the pre-wired connection at the bottom of the enclosure. The MicroRTU will automatically establish two-way communications over the public cellular network to the **www.telemetric.net** Intelligent Web Server.
- (2) Log onto your private page on the Intelligent Web Server to:
  - View the status of the Cap Bank – Open/Closed state, AC Voltage, and Neutral Current.
  - Initiate a change – Open or close the Cap Bank.
- (3) Configure selected events to trigger an immediate control command or user notification by pager or e-mail.

The Telemetric Network Operations Center (NOC) records all incoming status messages and, depending on the customer's instructions, will:

- notify the customer of the reported event
- send pre-determined control commands back to the field device and/or
- pass the data to the customer's designated e-mail or IP address

When a MicroRTU receives a command to turn one of its outputs on or off, it will do so, and will then provide an acknowledgement to the control center.

## **How it works**

When a Telemetric MicroRTU initiates a call from anywhere in North America, it is recognized locally as a roaming cell phone. As a part of the standard roaming protocol, the local cellular network automatically passes the device's identification numbers and data to the central cellular hub. The Telemetric device passes its data packet in the normally non-utilized data field. This technique allows the transmission of an identification number, the time, the date, and customer specific data, all at a very low cost. At the Telemetric NOC, the data is validated and processed for distribution to the end user. In addition, control and configuration information can be sent from the Telemetric NOC back out to the field device.

## **Getting started**

Setting up the Telemetric monitoring devices is a three-step process.

1. Program the Telemetric device for your specific reporting requirements. This step is only required if you wish to change any of the factory default settings. Note that devices can also be ordered from the factory with the desired settings preprogrammed.
2. Plug the TC012 into a meter base that is wired to the cap bank, or (for models without the meter base mounting) install the TC012 near the cap bank, connect AC power, and wire the TC012 outputs to the cap bank.
3. Set up the device information on the Telemetric web site ([www.telemetric.net](http://www.telemetric.net)).

This manual provides the information you need to get started. It is divided into two sections:

- Programming and installing the Telemetric device, and
- Using the Telemetric web site.

# Programming and installing the TC012 Telemetric MicroRTU

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## Programming the TC012

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The Telemetric MicroRTU arrives from the factory programmed with the basic default settings shown in the table below. To change those settings before installing the Telemetric device (or at any time in the future), you can locally program the device by connecting it to a PC with a serial cable and using the Windows-based program that comes with the MicroRTU.

The table below shows the factory default settings.

<b>Setting</b>	<b>Default Value</b>
Analog Input 1 – three set points	Set Point Crossing Reports Disabled
Analog Input 1 trigger time	2 seconds
Analog Input type	AC
Time Scheduled Reports 1-4	Disabled
Call Frequency (Reports 1-4 option 1)	24 hours
Call Frequency (Reports 1-4 option 2)	2 hours
Time Scheduled Report 1	Report 45
Time Scheduled Report 2	Report 18
Time Scheduled Report 3	Report 41
Time Scheduled Report 4	Report 91
Momentary digital output duration	7 seconds
Output local control delay (Outputs 1 & 2)	30 seconds
Output between controls delay (Outputs 1 & 2)	3 minutes
Power outage trigger time (option 1)	0.1 second, enabled
Power outage trigger time (option 2)	4.0 seconds
Under voltage set point (option 1)	110 Volts AC, enabled
Under voltage set point (option 2)	112 Volts AC
Under voltage set point (option 3)	113 Volts AC
Under voltage set point (option 4)	100 Volts AC
Under voltage trigger time (option 1)	5 seconds, enabled
Under voltage trigger time (option 2)	240 seconds
Over voltage set point (option 1)	128 Volts AC, enabled
Over voltage set point (option 2)	122 Volts AC
Over voltage set point (option 3)	124 Volts AC

Over voltage set point (option 4)	135 Volts AC
Over voltage trigger time (option 1)	5 seconds, enabled
Over voltage trigger time (option 2)	240 seconds
Extended Battery Option	Disabled
Command acknowledgement delay	35 seconds
Command acknowledgement report	Report 45
Daily Call Limit (option 1)	12, enabled
Daily Call Limit (option 2)	20

For complete programming instructions and setting descriptions, see **Appendix B**.

## **Installing the TC012**

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The installation process for the TC012 can be divided into five steps:

- Connect the battery.
- Select an installation location.
- Grounding the device
- Test the radio signal strength.
- Attach the device to a capacitor bank.

### **Connecting the battery**

When you receive the TC012 the battery is disconnected. You must connect the battery (used for backup power) before installing the device.

#### **To connect the battery:**

1. Open the door of the enclosure and locate the black and red wires.
2. The battery is mounted on the underside of the device lid. Connect the black wire to the black battery terminal and connect the red wire to the red battery terminal.
3. Close the enclosure door.

### **Selecting an installation location**

The TC012 enclosure is weather resistant, so it can be installed in any convenient location. The recommended operating temperature range is -40 to +158 degrees F (-40 to +70 C). The recommended relative humidity range is 5 - 95% non-condensing. It is recommended that it be mounted out of direct sunlight if possible.

A flexible, 1/2 Wave, 2.5dB antenna is included with the MicroRTU. 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.

## Grounding the device

It is important that the TC012 be properly grounded. If the meter socket into which it is being installed does not have a ground connection, or if you are not using the meter socket option, an external ground must be used. A grounding lug is installed on the lower right corner of the TC012 board. To ground the device, connect an earth ground wire to the lug. The ground helps with surge protection and improves the device's ability to communicate by making the radio less susceptible to transient noise.

## Testing the receiver strength

After selecting an installation location, it is a good idea to test the device's ability to transmit and receive before performing the actual installation. (The device must be connected to power and an antenna attached in order to carry out this test.)

To test the signal strength, use a serial cable to connect the device to a laptop running the Telemetric local programming application. See Appendix B for detailed instructions on using this program. Run the program and select **View device inputs and control outputs** from the main menu. The program will establish communications with the device and will then display a continuously updated screen showing the device's current status. In the lower right corner of this screen there is a Radio Signal Strength Indication (RSSI) indicator that displays the current signal strength.



**Note:** A large RSSI window can be viewed by clicking on the RSSI bar graph or by clicking on **Tools** and then selecting **Large RSSI Window**.

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 Telemetric.

After maximizing the signal strength, proceed with the installation.

### Alternate method

If it is not convenient to test the device using a laptop, there are also LEDs on the device board that indicate RSSI. To test using the LEDs, wait until all LEDs have stopped blinking and then press and release the test button inside the device enclosure (Press for less than 2 seconds. See Figure 1 for the location of the test button.). After the test button is released, the TC012 reads the RSSI from the radio and displays the signal strength using the red and the green LEDs that are near the lower edge of the circuit board (see Figure 1).

The signal strength can be determined with the following table:

LED Appearance	Meaning
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

### Troubleshooting tips for testing with LEDs

It is normal to receive occasional red blinks after transmitting. Sometimes the cell tower will simply be busy and will instruct the device to try again.

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.

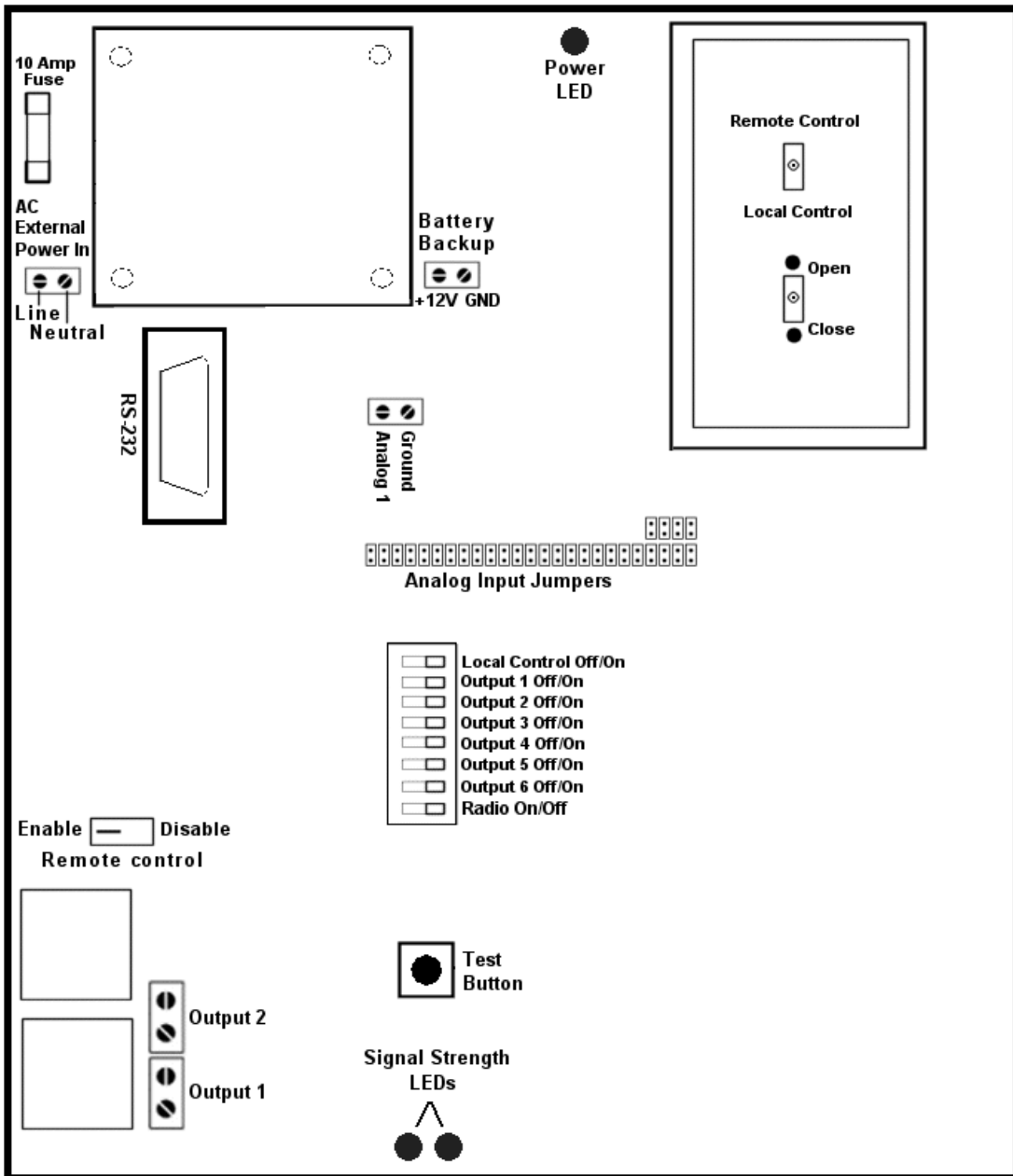
### **LED indicator guide**

- When the device receives a command from the web site, or successfully verifies that cellular service is available, the green LED will light for 0.2 seconds. After every successful transmit, the green LED will light for 1 second.
- After any failed transmit attempt (up to 4 tries), the red LED will light for 0.6 seconds
- After the 5<sup>th</sup> failed transmit attempt, the red LED will light for 1 second. At this point, the report will be abandoned. The next reportable event will restart the process.
- If the red LED keeps blinking slowly (on for 0.1 second every 3 seconds) this indicates that there is no cellular service available or a weak radio signal strength. There will be a number of blinks at power up while the radio registers with the cell tower. This blinking will continue until service is available. Verify the antenna connection or relocate the device if it continues.
- The device is allowed to make one call per minute. During the one minute delay after every call, the green LED blinks on for 0.1 second every 3 seconds. During this time, it will record input changes but will not report them until the one minute has passed. If this blink continues after one minute, the device has reached its call limit. The device can still make time scheduled calls, user requested status calls and command acknowledgement calls, but it will not make any more triggered event calls until 24 hours have passed.
- If the red LED is blinking quickly, the device is waiting for registration acknowledgement (ACK) from the web site on the cellular A channel. If the green LED is blinking quickly, the device is waiting for registration acknowledgement (ACK) from the web site on the B channel. This cycle should normally only repeat once for one minute with each color. If it continues, the web site is not responding to the device's registration call.

### **Attaching the device to the capacitor bank**

The figure below shows the TC012 board. If you ordered a TC012 with meter base mounting, the power and output connections are pre-wired to the meter base. If you ordered a TC012 with a standard enclosure, you will need to connect AC power and wire Outputs 1 and 2 to the capacitor bank.

**Figure 1: TC012 Wiring diagram**





**Note:** This equipment contains components that can be damaged by electrostatic discharge. To prevent unexpected operation or permanent damage, be sure to connect the ground lug to an earth ground and always touch the ground lug before touching any components inside the enclosure.

### **Power connections**

The terminal block in the upper left corner of the board provides the connection for AC power. AC Hot is connected to the outside terminal (“Line”) and AC Neutral is connected to the inside terminal (“Neutral”).

This power supply is protected by the 10 Amp fuse located just above it on the board.

If the TC012 has the meter base mounting option, the power connections are pre-wired to the meter base, as shown in Figure 2 below.



**Note:** Pay special attention to the power quality at the installation site. If there are power fluctuations at the site, they can cause the TC012 to call in with constant Over or Under Voltage calls – disrupting other communication. If this is the case, the Over or Under Voltage set point should be set very high or very low, or, alternatively, the Under or Over Voltage reports can be completely disabled. See Appendix B for instructions on adjusting the Over and Under Voltage settings.

### **Outputs**

Wire Output 1 to the capacitor bank’s Open (Trip) coil. Wire Output 2 to the capacitor bank’s Close coil. When a close or open command is received by the TC012, the appropriate output closes momentarily to carry out the trip or close operation.

**Important Note for Outputs 1 and 2:** If the Amp draw from the load on the output will be equal to or less than 12 Amps, the load can be connected to the green terminal block. If the load will be greater than 12 Amps, the load must be connected to the spade connectors in the black relay behind the terminal block.

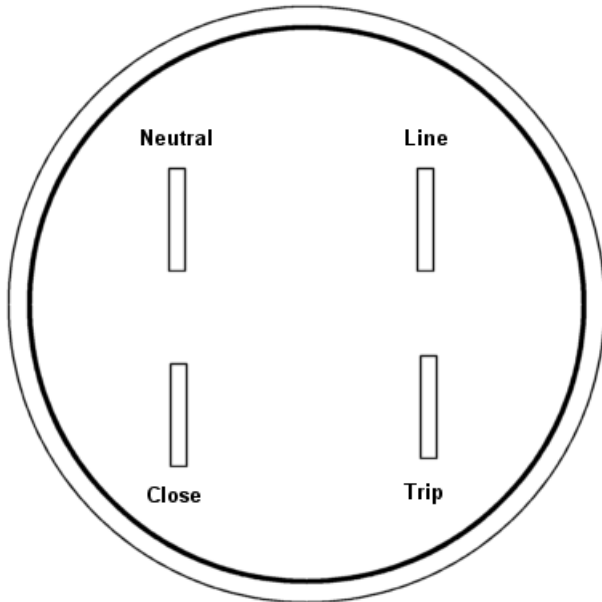
If you have purchased a TC012 with the meter base mounting option, the outputs are pre-wired to the meter base, as shown in Figure 2 below. Wire the Trip and Close outputs from the Capacitor Bank to the appropriate jaws on the meter socket.

### **Meter Base Wiring (applies to TC012 meter base option only)**

The power and output connections are pre-wired to the four-pin meter base in the following configuration (looking at the back of the TC012 enclosure):

AC hot – top right  
AC Neutral – top left  
Trip – bottom right  
Close – bottom left

**Figure 2: TC012 Meter Base**



**Analog Input (Neutral Current)**

The Analog input is pre-wired to the Cannon ITT connector at the bottom of the enclosure. Plug the output from the neutral current sensor into this connector.

**Using the Test button to trigger a call**

During installation, or when doing maintenance in the field, it may be necessary to trigger a call from the device into the web site. You can use the test button to trigger a Maintenance Report call from the TC012.

To trigger a call, wait for the LEDs to stop blinking and then hold in the test button for at least 2 seconds. The green LED will flash one short flash and then one longer flash, indicating that the TC012 is making a call.

**Disabling remote control and locally controlling the outputs**

On the TC012 local control board (in the upper right corner of the enclosure) there is a Remote /Local Control toggle switch that enables or disables remote control of the TC012 outputs. To disable remote control of the outputs, move the switch toward "Local." When the switch is in the Local position, commands from the Telemetric NOC will be ignored. This allows a technician to perform testing or maintenance without fear that one of the outputs will be remotely operated.

The LEDs on the local control board indicate the present state of the Capacitor Bank; green for open and red for closed. Move the switch toward Open or Close to locally control the Capacitor Bank. After you operate the switch, the appropriate LED will start blinking to indicate the operational delay timer. This is a programmable delay time between when the output is switched on or off locally and when the output change actually occurs. This delay allows field personnel to manually initiate a control action and then move a distance from the equipment before the output

change is made. The default for this delay is 30 seconds and it can be set from 1 to 240 seconds. The delay is programmed using the Local Configuration program.



**Note:** Neither of the Open and Close LEDs will be lit immediately after power up. A local or remote Open or Close command must be sent to the capacitor bank in order for these LEDs to correctly display the open or closed status.

If you switch the Capacitor Bank to open, the green LED will start a slow blink after the operation. This indicates the control delay timer, which provides a minimum delay time between a trip and close operation. The default for this delay is three minutes. It can be set from one minute to fifteen minutes using the Local Configuration program.

# Using the Telemetric web server

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The Telemetric Intelligent Web Server, [www.telemetric.net](http://www.telemetric.net), provides access to the data from Telemetric devices 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 all monitoring and control functions, to set up automatic event notifications, and to remotely control devices that are connected to your Telemetric device.

## Setting up Your Account on the Intelligent Web Server

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### Logging In

To log in to your secure account on the Intelligent Web Server, click on the **Client Login** link on the web site ([www.telemetric.net](http://www.telemetric.net)). On the login screen, enter the user name and password that were sent with your Telemetric device(s).

When you click the Enter button the customer **Welcome** screen will be displayed. This screen displays the most recent critical events for your devices, and the navigation panel on the left side has links to all of the device data and device configuration screens.

### Entering customer information

After logging in for the first time, click on the **Customer Information** link in the navigation panel. This will display the Customer Information page where you can fill in your name and address and change your password to one that is easier to remember.

While on the Customer Information page, take note of the following fields:

- **Time Zone Offset:** This needs to be set to the number of hours difference between your local time zone and Eastern Standard Time. For example, if you're on the east coast of the United States this would be set to zero, and if you're in California this would be set to -3. After setting the Time Zone Offset, all device report times will be displayed for your local time zone. If you have devices that are in a different time zone, you also have the ability to set device time zones individually on the **Device Info** page.
- **Status Call Interval:** This is the default interval in hours between status calls for your devices (a number between 1 and 240). The Status Call Interval allows the Missing Device Report to accurately list those devices that did not call in when they should have. The factory default is for Status Calls to be disabled, so if you have not programmed your device to make Status Calls, or if you do not plan to make use of the Missing Device Report, you do not need to fill in this field. If some devices are making status calls at different intervals, set up their call intervals individually in the Device Info screen (reached from the device Status page).
- **Additional Info field:** Use this text box to enter a custom name for the device "Additional Info" field. The Additional Info field is a customer specified data field. It appears as the name of a column on the Device List. It can be used to categorize any device-specific data. For example, it could be used to save GPS coordinates for the device, or to record the device's location on the power grid. This data can then be used to sort the devices in the Device List.

If you do not want to use this extra field, you can leave this box as it is.

## Entering device-specific information

Each time a new Telemetric device is installed, you can enter that Device's location information and customize some display options. To do this, go to the Welcome screen and click on the **Device List** link. In the Device List table that is displayed, click on the Device ID of the device that was just installed. The **Status** screen for that device is displayed.

<a href="#">History</a>	<a href="#">Request Data</a>	<a href="#">Change Settings</a>	<a href="#">Edit Device Info</a>	<a href="#">Refresh</a>
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### Status

Line Voltage, Neutral Current and Outputs Report as of 1/16/2003 6:58:28 AM

Device: **6121** Model Configuration: **TC012** Description: **TC012 v.5**

**Address:**

Note: A Bold indicates the latest change. A red background means that an output change has been requested and is waiting for an acknowledgement from the device. on the Refresh link for the latest status.

**Output Status**

Status	Date/Time
Cap Bank Close	1/16/2003 6:58:28 AM

**Voltage, Neutral Current and Outage**

Description	Value	Date/Time
AC Voltage	Present: 118.9	1/16/2003 6:58:28 AM
Neutral Current	Present: 0.0 AMPS; Range: LOW	1/16/2003 6:58:28 AM
Power Outages	None	1/16/2003 6:58:28 AM

**Switches**

Description	Status	Date/Time
Remote/Local	Remote	1/15/2003 6:53:22 AM
Manual Control	Not Reported	1/15/2003 6:53:22 AM

At the top of the Status screen, click on the **Edit Device Info** link. This brings up a screen that allows you to enter a customized description for this device and the device's location information.

Edit Labels	
<h2>Edit Device Information</h2>	
Description:	<input type="text" value="TC012 v.5"/>
Additional Info:	<input type="text" value="Pacific"/> <a href="#">more information</a>
Address:	<input type="text"/>
City:	<input type="text"/>
State:	<input type="text"/>
Zip:	<input type="text"/>
Time Zone Offset:	<input type="text" value="-3 (Pacific Time)"/> <a href="#">more information</a>
Status Call Interval:	<input type="text" value="24"/> hours <a href="#">more information</a>
<input type="button" value="Save Changes"/>	

Fill in the appropriate information for this device. The **Additional Info** field can be used for any additional device data that may need to be saved for this device. For example, it could be used to save GPS coordinates for the device, or to record the device's location on the power grid. As explained previously, the title of this field can be changed by filling in the field on the Customer Information page. If this field has been named in the Customer Information page, the new name will be displayed here, in place of "Additional Info."

To set up the device for a specific time zone, set the **Time Zone Offset**. This is used if the device is reporting from a different time zone than the default setting on the Customer Information page (see above). If the device is not in a different time zone, this setting does not need to be changed.

The **Status Call Interval** field should be filled in only if this device has a different status call interval from the default interval entered on the Customer Information page. This is the device's programmed interval between status calls (a number of hours between 1 and 240). The Status Call Interval allows the Missing Device Report to accurately list those devices that did not call in when they should have.

Click the **Save Changes** button when the device information has been completed. You will return to the Status screen.

### **Editing Neutral range descriptions**

The analog input that measures neutral current has four ranges into which the Neutral current may fall. The labels for these ranges can be customized based on your own installation parameters. To do this, return to the **Device Info** page and click on the **Edit Labels** link at the top.

Add/Edit Label Defaults

## Add/Modify Labels

Device: **6121** Description: **TC012 v.5**

Use this page to change the labels that are used for the four Neutral Current ranges. Go to [Add/Edit Label Defaults](#) to add more labels. If you would like to copy the labels from another device, go to the [Copy Device Configuration](#) on the Advanced Programming menu.

If you are not using all three set points, you will not need to use all of these labels. If you are using one set point, you need to use the Low and Low-Mid labels. If you are using two set points, you need to use the Low, Low-Mid and High-Mid labels.

#	Analog Input	Low Reading	Low Mid Reading	High Mid Reading	High Reading
1	Neutral Current	LOW	LOW-MID	HIGH-MID	HIGH

The Add/Modify Labels screen lets you choose a descriptive label for each range. To select a description, click on the drop down list box.

The Analog input for Neutral Current has three set points, so the four labels are used for readings below the lowest set point, readings between the lowest and middle set point, readings between the middle and upper set point, and readings above the highest set point. These are referred to as the Analog ranges.

If the MicroRTU has been locally programmed to use only one or two set points instead of three, you will not need to use all of these labels. If only one set point is being used, use only the Low and Low-Mid labels. If two set points are being used, use only the Low, Low-Mid and High-Mid labels.

If a suitable description is not found on the list, click the **Add/Edit Label Defaults** link at the top of the page to display the Default Labels screen. The Default Labels screen allows you add new labels. When finished adding new descriptions, click the **Return to Labels Page** link at the top of the page to return to the Edit Labels screen.

When finished selecting labels, be sure to click the **Update Labels** button at the bottom of the screen to save any changes.

You are now ready to begin receiving data from the Telemetric MicroRTU.

## Viewing monitoring and control data

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Once the Telemetric MicroRTU is installed and turned on, it immediately begins to monitor its inputs. Within a few seconds after any change, the device makes a call over the cellular network and reports the change. This data is immediately available on the Telemetric web site.

To view the current status of the device, log in on the customer login page and choose the **Device List** link from the navigation panel.

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, click on the Device ID in the Device List to go to the **Status** page for that device.

The Status page gives the status of each input and output and the time of the last report. (Click the Refresh link to update the screen.)



**Note:** The status of the Capacitor bank will not be displayed when the device is first powered up. An open or close command must be sent from the web site, or sent locally from the TC012, before this status is displayed.

## Request Data

From the Status screen, an updated status report can be requested from the device at any time by clicking the **Request Data** link at the top of the screen. On the Request Data screen, select a Status Report from the drop down box. If you want to receive the status report immediately, click the **Send Request** button. If you would like the report to be sent at a later time, select a time and a date and click **Send Request**. The request will be sent to the device either immediately or at the time you selected, and it will respond by sending back the requested report. After approximately 30 seconds, you can click the **Refresh** link on the Status screen to see the new data. You can also look at the History screen to see a record of the Status Report. See Appendix A of this document for a detailed list of all of the Status Reports.



**Note:** If the Status Report does not report any new status data or values, there will be no change on the Status page except for the date/time stamps.

To start or stop time scheduled status reports, click the **Time Scheduled Reports** link at the top of the Request Data screen. The Time Scheduled Reports page that displays allows you to start or stop receiving regular status reports from this device. Note that the factory default report interval is 24 hours, so if you start time scheduled reports, they will come in every 24 hours. If you want to use a different interval, it must be programmed into the device (using Local Programming).

## History report

Another tool provided by the Status screen is the **History** report. All activity for this device is saved in the database. The History report can display all calls, only a certain type of call, or calls from a certain time period. When you click the **History** link, the History screen displays all calls for the past two months. Select an option from the **Display History for** drop-down list to display only a certain type of call. Select a **Date Range** to choose a different time period to view.

## Controlling the Capacitor Bank

The Capacitor Bank can be opened or closed directly from the Status screen. To do so, select the appropriate command from the drop-down box and click **Send Command**. A command is sent telling the appropriate output to momentarily close, which opens or closes the Capacitor Bank. The duration of the momentary change is set in Local Programming. The factory default is thirty seconds.

Back on the Status screen, the output row in the table will change to a red background. This indicates a pending state change. When the device acknowledges the output change, this will change back to the normal table background color. Click on the **Refresh** link to update the Status page. Note that the time delay before the device's acknowledgement call is

programmable, so there may be some variation in how soon the device acknowledges the contact change. The factory default delay time is forty seconds.

## Remote Configuration Commands

---

The web site gives you the ability to remotely change certain TC012 programming parameters. This is carried out through the use of “Options.” During local programming, the device can be set up with a number of different Options (settings) for certain parameters. These Options can then be remotely enabled and disabled from the web site. The following settings have remotely configurable options:

- Time-scheduled report frequency – 2 options for each of the four reports
- Analog 1 set points – 4 options
- Under Voltage set point – 4 options, plus disable command
- Over Voltage set point – 4 options, plus disable command
- Under Voltage trigger time – 2 options
- Over Voltage trigger time – 2 options
- Power Outage trigger time – 2 options, plus disable command
- Daily Call Limit – 2 options

In addition, three other remote commands are available:

- Reset the device
- Restore factory programming defaults
- Turn off or on the Extended Battery option

All of these commands can be carried out by following the **Change Settings** link at the top of the Status page.

On the Change Settings screen there is a drop-down list that contains all of the available commands. Select a command and click **Send Command** to send it to the device.

For more information about these programming options, see the local programming instructions in Appendix B.



**Note:** If you want to know which programming options the device is currently using, go to the Request Data page and request a “Programmable Parameters” report (Report 81). This will tell you which Option the device is using for each parameter.

## Event-based actions

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The Telemetric web software allows the user to create scenarios that will automatically carry out a control action or send out a notification. For example, a rule might be created to specify that “If Voltage reports ‘high’ then set Cap Bank 1 to ‘Open’.” Or a notification rule might be created so that “If Neutral Current reports ‘high’, send a page to George.” These rules can also be more complex so that two conditions must be met before the action takes place.

To create these rules, the Telemetric Intelligent Web Server has a step-by-step interface that walks through the process. After logging in to the web site, select the **Event Based Actions** link from the navigation panel.

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

## Creating a new control action

To create a new Control Action, click the **Create New Control Action** button. (To create a new User Notification, see the instructions on page 22.)

1. The first step of the process is the selection of a Device ID. This is the Telemetric device that will be carrying out the Control Action. If the control action is to be triggered by one device but carried out by another, the second device must be selected here as well.

### Select Device ID

Please select a device ID to create a new Control Action.

Select the device that will carry out the Control Action.

Event-triggered action     Time-triggered action

Select an ID number from the drop-down list box, select a device to carry out the control action (if applicable) and select whether the action will be event-triggered or time-triggered. A time-triggered action is one that is carried out at the same time every day or on certain days.

2. Click the **Proceed** button to view the Control Action setup page. The screen shot below shows the setup page for event-triggered actions.

## Setup Control Action

Set up a control action to be carried out by the selected MicroRTU. You can create up to five triggers for the control action.

**Triggering Device: 6121**

Select the first trigger for the control action

### Additional Triggers

2nd Trigger	<input type="radio"/> And <input type="radio"/> Or <input checked="" type="radio"/> None	<input type="text" value="Cap Bank Open"/>
3rd Trigger	<input type="radio"/> And <input type="radio"/> Or <input checked="" type="radio"/> None	<input type="text" value="Cap Bank Open"/>
4th Trigger	<input type="radio"/> And <input type="radio"/> Or <input checked="" type="radio"/> None	<input type="text" value="Cap Bank Open"/>
5th Trigger	<input type="radio"/> And <input type="radio"/> Or <input checked="" type="radio"/> None	<input type="text" value="Cap Bank Open"/>

**Select the action to be carried out by device 6121**

Action:

Control Action Name\*:

3. The first step of the Control Action creation process is to select the first input that will trigger the Control Action.

Select the input from the drop-down box and move on to the next step.

4. The next step asks whether multiple inputs are needed to define this rule.

Select the **And** radio button and select the second condition to specify that both conditions must be true in order for the action to be carried out. For example, "If voltage is High AND Neutral Current is High, then Open Cap Bank."

Specify **Or** radio button and select the second condition if only one of the conditions needs to be true in order for the action to take place. For example, "If AC Voltage is Outage OR AC Voltage is Under Voltage, then Close Cap Bank." (Obviously there is a lack of realistic applications for AND/OR for the TC012.)

Continue adding conditions as needed, up to a total of five.

If no other conditions need to be added to the rule, leave the selections in the **Additional Triggers** table as they are.

5. Next, select the action to be carried out, for example, Open Cap Bank.
6. Finally, type a name for the control action into the text box at the bottom of the page and then click the **Save Control Action** button to complete the process.

When the Control Action has been saved, it appears in the Event Based Actions table. It can be edited at any time by clicking on its description.

## Setting up Time-Triggered Actions

Time-triggered actions are set up the same way as event-triggered actions. The following set up page is used.

### Setup Control Action

Set up a control action to be carried out by the selected MicroRTU. You can create up to five triggers for the control action.

**Triggering Device: 6121**

If it is:  and the time is:   minutes

**Additional Triggers**

2nd Trigger	<input type="radio"/> And <input type="radio"/> Or <input checked="" type="radio"/> None	<input type="text" value="Cap Bank Open"/>
3rd Trigger	<input type="radio"/> And <input type="radio"/> Or <input checked="" type="radio"/> None	<input type="text" value="Cap Bank Open"/>
4th Trigger	<input type="radio"/> And <input type="radio"/> Or <input checked="" type="radio"/> None	<input type="text" value="Cap Bank Open"/>
5th Trigger	<input type="radio"/> And <input type="radio"/> Or <input checked="" type="radio"/> None	<input type="text" value="Cap Bank Open"/>

**Select the action to be carried out by device 6121**

Action:

Control Action Name\*:

At the top of this page, select the day and time for the action. An action can be carried out every day, on week days only, or on any certain day of the week (e.g. every Wednesday). You can also add additional triggers for your action. This means that when the chosen time arrives, the software will look to see whether the other triggers exist before carrying out the action.

## Event-based user notifications

The User Notification process is very similar to the Control Action process. First select the condition(s) that will trigger the notification, and then set up the recipient and message for the notification.

Before creating the first User Notification, at least one Message and one Recipient must be created for use in the notification.

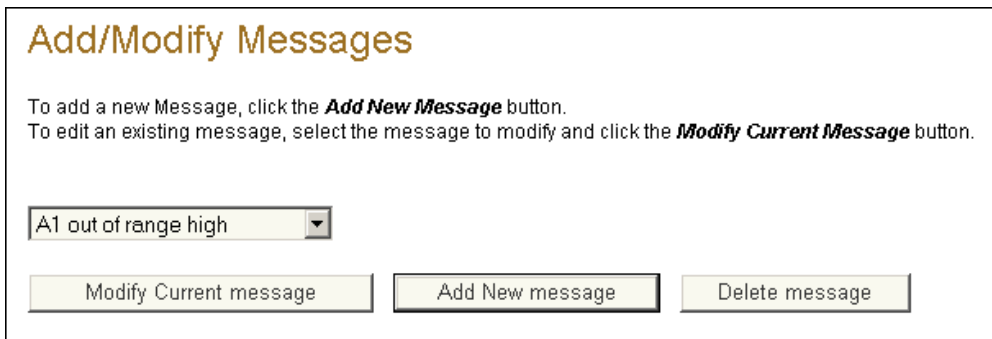
To set up new Recipients and Messages, select the **Messages & Recipients** link from the navigation panel. On the screen that displays, select the **Messages** link to create a new message, the **Recipients** link to create a new recipient, or the **Recipient Distribution List** link to create a Recipient List (you must first have set up some recipients for the list).



**Note:** All notification messages are sent using email addresses. An Internet email address can be used to send someone a regular email message, which will appear in their email inbox, or a pager email address can be used to send a text page directly to a pager or PDA. Most modern pagers have the ability to receive emailed pages. Check with your pager company if you have questions.

## Create a message

When you click the **Messages** link the Messages screen is displayed.



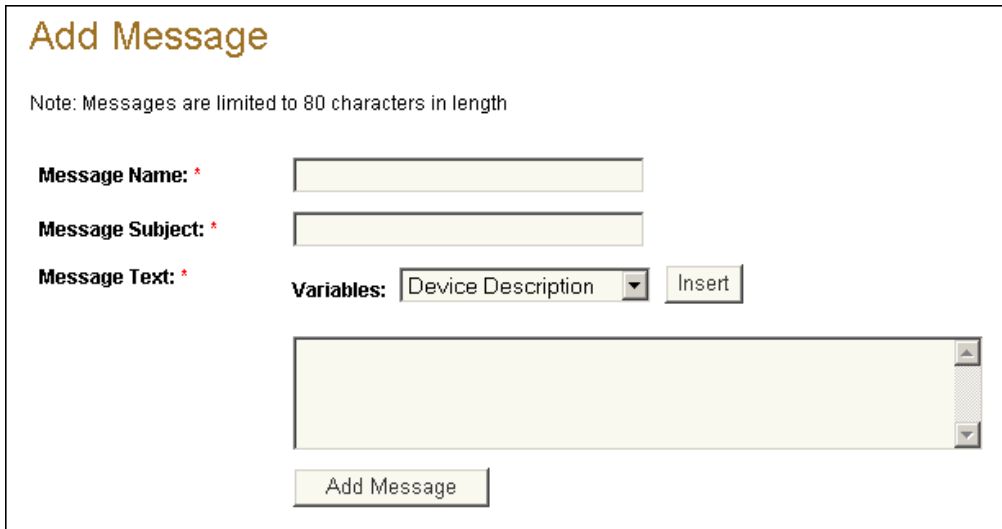
**Add/Modify Messages**

To add a new Message, click the **Add New Message** button.  
To edit an existing message, select the message to modify and click the **Modify Current Message** button.

A1 out of range high

Modify Current message    Add New message    Delete message

To create a new message, select the **Add New Message** button.



**Add Message**

Note: Messages are limited to 80 characters in length

**Message Name: \***

**Message Subject: \***

**Message Text: \*** Variables: Device Description

It is required that all three fields in this screen be filled in to create a message. Type in a name for the new message in the **Message Name** field. This is the name that will appear in the list of previously created messages. Fill in the **Message Subject**. This will appear in the Subject line if the message is sent via Internet email. Type a message of less than 80 characters into the **Message Text** field. You can also insert a variable into the message by putting your cursor in the appropriate spot and selecting a variable from the drop-down box. The variable is a placeholder that tells the software to insert the appropriate data from the database into the message before it is sent. Using variables, one message can be created and used for a number of different devices, instead of having to make a separate message for each device. The variables currently available are:

- Device Description
- Device Address
- Additional Information field
- Present Voltage

When you are finished with your new message, click the **Add Message** button to save it.

## Add a recipient

To add a new message recipient, click on the **Recipients** link on the Messages and Recipients page.

### Add/Modify Recipient

To add a new Recipient, click the **Add New Recipient** button.  
To edit an existing Recipient, select the name and click the **Modify Current Recipient** button.

caiyun 3 ▾

Modify Current Recipient   Add New Recipient   Delete Recipient

The drop-down box on this page lists any previously created recipients. Click the **Add New Recipient** button to add a new recipient to the list.

### Add Recipient

Recipient Name: \*

Email Address: \*

Add Recipient

Enter the recipient's name and their email address. As mentioned before, this email address can be either an Internet email address or a text pager email address.

After entering the recipient information, click the **Update Information** button. You will be returned to the Recipients page.



**Note:** If you want to send email to more than one recipient, first enter all of the recipients on the Recipients screen, then select the **Recipient Distribution List** link from the Messages & Recipients menu. This allows you to select a number of recipients and group them together for notifications.

## Setting up a user notification

To create an event-based User Notification, select the **Event Based Actions** link from the navigation panel.

On the Event Based Actions page, there is a list of previously-created Control Actions and User Notifications. Click the **Create New User Notification Action** button to create a new event-based user notification rule.

1. The first step in the process is to select the Telemetric device ID number for the device that will trigger the User Notification. (You also have the option of creating a Global user notification. See the instructions below.)

### Select Device ID

Please select a device ID to create a new User Notification.

3597

Proceed

After selecting the device, click **Proceed** to display the User Notifications setup page.

### Setup User Notification

Set up a user notification to be carried out by the selected MicroRTU. You can create up to five triggers for the user notification.

**Triggering Device: 6121**

Select the first trigger for the user notification: Cap Bank Closed

**Additional Triggers**

2nd Trigger	<input type="radio"/> And	<input type="radio"/> Or	<input checked="" type="radio"/> None	Cap Bank Open
3rd Trigger	<input type="radio"/> And	<input type="radio"/> Or	<input checked="" type="radio"/> None	Cap Bank Open
4th Trigger	<input type="radio"/> And	<input type="radio"/> Or	<input checked="" type="radio"/> None	Cap Bank Open
5th Trigger	<input type="radio"/> And	<input type="radio"/> Or	<input checked="" type="radio"/> None	Cap Bank Open

**Select a message and a recipient:**

Select the message that should be sent to the recipient: Cap bank is closed

Select the recipient: Gary

User Notification Name\*:  Save User Notification

2. Select the device input change or event that will trigger a User Notification. (If you select Missing Device or Command Failure, the appearance of this page will change. See specific instructions for these options below.)
3. Choose whether multiple inputs are needed to define this rule.

Select the **And** radio button and select the second condition to specify that both conditions must be true in order for the action to be carried out. For example, "If voltage is High AND Neutral Current is High, then Open Cap Bank."

Specify **Or** radio button and select the second condition if only one of the conditions needs to be true in order for the action to take place. For example, "If AC Voltage is Outage OR AC Voltage is Under Voltage, then Close Cap Bank." (Obviously there is a lack of realistic applications for AND/OR for the TC012.)

Continue adding conditions as needed, up to a total of five.

If no other conditions need to be added to the rule, leave the selections in the **Additional Triggers** table as they are.

4. Select the message that will be sent to the selected recipient. The messages in this drop down list box are those that were created on the Create Messages page.
5. Next, select a previously created message recipient. The names that appear in this drop-down box are the Recipient names that were assigned on the New Recipient page, as well as any Recipient Lists that have been created. Each Recipient is associated with an email address – either for Internet email or a text pager.
6. In the final step, give the User Notification action a name and click the **Save User Notification** button to save it.

The new User Notification will now appear on the Event Based Actions list. As soon as it has been created it is active. The notification message will be sent to the recipient whenever the trigger event takes place.

## Global User Notifications

You can create a global user notification that applies to all of your devices. Presently there are only two possible triggers for global user notifications: Command Failure and Missing Device. These are explained in detail below.

When the Global Notification option is selected, the User Notification screen that is displayed is slightly different.

### Setup User Notification

**Triggering Device: Global**

Select the first trigger for the user notification:

**"Missing" Device Notification**

If a device does not make its time-scheduled call within the time period indicated below, it will be classified as "missing" and an email will be sent out.

Status Call Interval:  hour(s)

Note: The value entered here will override the value entered on the Customer Information page.

**Select a message and a recipient:**

---

Select the message that should be sent to the recipient:

Select the recipient:

User Notification Name\* :

Select either Missing Device or Command Failure and then fill in the necessary data. As with a normal user notification, select a message and a recipient or recipient list. Then give the user notification a name and save it. Once created, the global notification will be triggered by any of

your devices, and new devices that are added to your web site will also be included in the global notification.

### **Command Failure Notification**

The command failure user notification will be triggered every time a command is sent to a device and an acknowledgement is not received. If the device is set up to use Acknowledgement Retries (see the Advanced Programming menu), the command failure notification will not be sent out until all of the retries have failed. The software waits five minutes after the command is sent, or after the final retry is sent, before it sends out the command failure notification.

Commands include any output change or programming command that is sent to a device. For the purposes of this notification, commands do NOT include report requests.

Command failure notifications can be set up for individual devices or globally for all devices.

### **Missing Device Notification**

The missing device user notification will be triggered when a device has not called in within a certain set period of time. This time period is specified when the user notification is set up. The time period used should be slightly longer than the period between time scheduled calls. When a device does not call in by the expected time, the user notification is sent out and the device also appears on the Missing Device Report, which can be reached from the navigation panel.

Missing device notifications can be set up for individual devices or globally for all devices. If a global notification is created it will override any individual missing device user notifications that are created.

## **Using groups**

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Another advanced feature of the Telemetric Intelligent Web Server is its ability to assign a number of units to a group and then order an action or request a report for all units in that group, instead of one unit at a time. This is carried out on the **Device Groups** page, which you can reach by selecting the **Device Groups** link in the navigation panel.

### **Create or maintain a group**

Follow the instructions below to create or edit a group.

1. Select the **Create New Group** link at the top of the Device Groups page, or click on the **Modify Group** link next to the group you want to edit.
2. If you are creating a new group, select the Telemetric model that will be part of this group (e.g. T646, T1000, etc.). Click **Continue** to proceed to the next screen, where all of the devices of this model type are listed.
3. To create a group, select the check box next to each device you want to include. To edit a group, select or un-select the check boxes to add or remove devices from the group.
4. After selecting the devices, type the group name into the **Group Name** text box at the top of the screen.
5. Click the **Save Changes** button to save the group.

After creating a new group, the group name will appear in the drop-down list at the top of the Device Groups screen.

## Request a report

After creating a group, you can request any report from all units in that group. Follow the instructions below to request a report.

1. Click the **Request Data** link next to the group on the Device Groups page.
2. Select the report that you want to request from the **Request a Report** drop-down list.
3. Click the **Request Report** button. You will see a web page verifying that your report request has been sent.

After requesting a report, you can go to the Status screen for any of the units in your group in order to see what was reported for that unit.

## Send a command

Once you have created a group, you can send a command to all members of the group at once. Follow the instructions below to send a command.



**Note:** You can only send a command to a group if one or more units in that group have output capability, for example T422 or T646 units.

1. Click on the **Send Command** link next to the group on the Device Groups page.
2. Select the command that you want to send from the **Send a Command** drop-down list. Note that each command can be either a permanent or a momentary action. The duration of the momentary change is set in Local Programming.
3. Click the **Send Command** button. You will see a web page verifying that your command has been sent.

The command will immediately be sent out to all units in the group. You can go to the Device History page for any of the units and see that they have called in to acknowledge that the command has been carried out.

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## Setting up data export

To export the data from one or more Telemetric devices for use in another data management program, set up the automated data export function. Currently the data export takes place in the form of machine-readable e-mail messages or CSV files (available for the TVM1 only). Other data export methods will be available in the future.

To set up one or more devices for data export, select the **Data Export Setup** link on the navigation panel.

Choose **Global Export via E-Mail** or **Device-Specific Export via E-Mail**. Global exporting exports all data for all devices that call in. Device Specific data exporting specifies one or more devices for data export.

## Global data exporting

To use Global exporting, check the **Enable Global Exporting** check box and enter an email address into the **Recipient Address** text box. Click the **Update Global Settings** button to save the changes. Once Global exporting has been enabled, each call from each device will generate an email message, which will be sent to the assigned email address. See the Email Data Export Format section, below, for details on how the data is formatted within the email.

## Device specific exporting

To export data only for specific devices, select **Device Specific Export via E-mail** and click the **Add Devices** button. On the Add Devices screen, select a device from the drop down list, and then select an email recipient. The recipients in the drop down list are the recipients that have been added on the Recipients web page (reached by following the “Messages & Recipients” link on the Welcome page).

After selecting a device and an email address, click the **Save Selection** button. A confirmation page will confirm the addition of the device, and the selected device and the e-mail address will be displayed in the Device Specific Exporting table. Follow this procedure for each device to be added. As soon as the device has been added to the table, each call from that device will generate an email containing the data from that call. See the Email Data Export Format section, below, for details on how the data is formatted within the email.

## Email data export format

The export data within each email message is in a specific comma-delimited format, so that it can be imported directly into a database. The format is shown below, with the actual export data represented in brackets. Only the data that has been reported in the specific call will be sent in the e-mail, so only a small part of this list will be received each time.

The Min and Max readings (for Analog inputs and Voltages) are always the minimum and maximum readings since the previous call.

Device, [Device ID],  
Call Reason, [event that triggered the call], [date and time – mm/dd/yy hh:mm:ss]  
Output1, [present state], [date and time – mm/dd/yy hh:mm:ss]  
Output2, [present state], [date and time – mm/dd/yy hh:mm:ss]  
Present Analog1, [present reading], [date and time – mm/dd/yy hh:mm:ss]  
Min Analog1, [min reading], [date and time – mm/dd/yy hh:mm:ss]  
Max Analog1, [max reading], [date and time – mm/dd/yy hh:mm:ss]  
Present AC Voltage, [present reading], [date and time – mm/dd/yy hh:mm:ss]  
Min AC Voltage, [min reading], [date and time – mm/dd/yy hh:mm:ss]  
Max AC Voltage, [max reading], [date and time – mm/dd/yy hh:mm:ss]  
Outages, [“None” or number since last call], [date and time – mm/dd/yy hh:mm:ss]

## Advanced programming

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The Telemetric Intelligent Web Server has an Advanced Programming section that provides access to some of the more advanced features of the Telemetric device. Follow the **Advanced Programming** link on the navigation panel to find these tools.

### Setting up the analog inputs

The TC012 comes with a pre-installed Analog lookup table for the analog input that measures Neutral current. This table converts the input from the Neutral Current Sensor into a 0-100 Amp Neutral current reading.

If the default lookup table does not appear to be providing you with accurate data, please contact Telemetric Technical Support.

## Acknowledgement retries

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The Advanced Programming menu also allows you to set the number of retries used by the Telemetric software when a command is sent to a device. Whenever the device is sent a command, such as a command to open or close one of its outputs, it always sends back an acknowledgement so that the user knows that the command was successfully completed. By default, the Telemetric software does not re-send the command, even if it does not receive an acknowledgement from the device. Some users place a higher priority on receiving this acknowledgement so that they can be certain that the command was carried out. By setting up retries, the user is able to make certain that the device receives and responds to the command.

In order to carry out these retries, the software needs to know how long the device has been programmed to delay before acknowledging any commands. This delay is called the Command Acknowledgement Delay and it can be changed during local programming. Some users want the device to delay a few seconds or minutes before acknowledging a command so that it can report any new readings that may have been triggered by the command. If the device has not been locally programmed, the default factory Command Acknowledgement Delay is 3 seconds.

In order to set Acknowledgement Retries there are three pieces of data that must be entered: the number of times the software should retry the command, and the device's **current** programmed Command Acknowledgement Delay, and the device's current programmed Acknowledgement Report (if it is other than the default).

To set Acknowledgement Retries:

1. Select **Acknowledgement Retries** from the Advanced Programming screen.
2. Select the device from the **Device ID** drop down list and click **Continue**.
3. Select the number of retries to use (from 1 to 5) from the **Number of times to Retry** drop down list.
4. Select the device's current programmed Command Acknowledgement Delay, using the **minutes** and **seconds** drop down lists. If this setting has not been changed during local programming, it will be 40 seconds.  
**Note:** You **cannot change** the device's Command Acknowledgement Delay from the web site. It can only be changed during local programming (See Appendix B).
5. Select the device's current programmed Acknowledgement Report if it is different from the default (the default is Report #45, Line Voltage, Analog 1 Value and Outputs).

6. Click the **Continue** button to save the new Acknowledgement Retries setting. A confirmation screen will verify that the change has been made. From this point forward, the software will use the specified number of retries whenever it does not receive a command acknowledgement from the device.

**Note:** With the use of retries, a very high level of reliability can be achieved for carrying out supervisory control commands. There are factors inherent in cellular communications, however, which prevent the system from being 100% reliable. If the device is having problems receiving messages, it will obviously be unable to receive the command, no matter how many times it is retried. If the device receives and carries out the command, it may then have problems communicating the acknowledgement back to the web software. In this case, the software may send the command out again. If the command was for a “permanent” output change, this will have no effect. For example, if the device has carried out the command to close a switch and it receives another command to close the switch, it will ignore the second command since the switch is already closed. However, if the command was for a “momentary” output change, resending that command may result in some unexpected results. If the device carried out a command to close a switch for five seconds and then two minutes later receives the command again, it will close the switch again. This may have an undesired effect on the equipment being controlled. The user should be aware of these limitations when using the Telemetric device for supervisory control applications. In addition, bear in mind that increasing the number of retries will increase the overall call volume.

## Create/edit user IDs

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This option allows a “master user” to create new user IDs that allow access to the Telemetric Intelligent Web Server without the ability to make edits or control the Telemetric devices. The “master user” is the initial user ID and password that is sent from Telemetric. Only the master user will see this item in the Advanced Programming menu.

### Creating a new user ID

1. Select **Create/Edit User ID** from the Advanced Programming menu.
2. Click the **Add User ID** button.
3. Fill in the User ID and Password for the new user. For the User ID, use alphanumeric characters only with no spaces or punctuation. The Password must be eight or more alphanumeric characters.
4. Select either the **View and Report** or **View Only** radio button. A View and Report user can view all device data and request reports from devices. They cannot send control commands to devices. A View Only user can only view device data. They cannot request reports or send control commands.
5. Click **Save Changes** to save the new User ID. This User ID and password can now be used to access the web site.

User IDs can be edited or deleted by using the **Edit** and **Delete** buttons on the Create/Edit User IDs page.

## Appendix A: Status reports

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The Telemetric MicroRTU has the ability to send data in a number of formats. The amount of data that can be sent in one call is limited, so these report types have been set up to focus on different types of data.

Status Reports can be sent upon request or automatically on a time based schedule. The default schedule for scheduled reports is set up during the local programming process. Four different reports can be set up to come in at scheduled times.

The available data for the reports will depend on the model. If a device does not support certain data types, unused fields will be empty.

All of the reports listed here can be requested from the web site and can be used as one of the four time scheduled reports.

### **Status report #13 – 120VAC Report**

This report reports line voltage data.

This report contains the following information:

- The number of transmission attempts
- The present AC line voltage
- The highest measured AC line voltage
- The lowest measured AC line voltage

### **Status report #16 – Digital Inputs and Outputs**

This report focuses on the status of the digital inputs.

This report contains the following information:

- The number of transmission attempts
- The present status of all digital inputs
- The number of state changes for each digital input
- The present status of all digital outputs
- The radio signal strength

### **Status report #17 – Digital Outputs and Inputs**

This report focuses on the status of the digital outputs.

This report contains the following information:

- The number of transmission attempts
- The status of each digital output, including a report of any momentary changes
- The present status of all digital inputs
- The radio signal strength

## **Status report #18 – Digital Inputs, Outputs and Present Line Voltage**

This report contains the following information:

- The number of transmission attempts
- The present AC line voltage
- The present status of all digital inputs
- The present status of all digital outputs
- The radio signal strength

## **Standard report # 41 – Analog Input 1 (Neutral Current)**

This report provides the present “range” of this analog input. The analog inputs each have three setpoints, so the four ranges are:

- Below the lowest setpoint,
- Between the lowest and middle setpoint,
- Between the middle and upper setpoint, and
- Above the highest setpoint.

The report contains the following information:

- The present range of the analog input (1-4)
- The present value of analog input 1 (0-4,095)
- The highest measured value for analog input 1 (0-4,095)
- The lowest measured value for analog input 1 (0-4,095)

## **Standard report # 45 – Present Line Voltage, Analog Input #1, Outputs 1 and 2**

This report is designed primarily to acknowledge a remote command to switch a cap bank on or off line. The resulting neutral current change (on Analog #1) is reported as part of the output command acknowledgement report. It provides the present “range” and value of the analog input, the present line voltage, the status of outputs 1 and 2 and the RSSI.

The report contains the following information:

- The present range of the analog input (1-4)
- The AC line voltage
- The present status of outputs 1 and 2
- The present value of analog input 1 (0-4,095)

## **Standard report # 81 – T646 Programmable Parameters**

*Supported only by firmware version 5 and greater*

This report reports which of the programmable options the device is currently using. It does not report what the actual value of the options are.

The report contains the following information:

- The Analog 1 set point option
- The time scheduled report frequency options (Reports 1-4)
- The Under Voltage set point option
- The Over Voltage set point option
- The Under Voltage trigger time option
- The Over Voltage trigger time option
- The Power Outage trigger time option
- The Daily Call Limit option
- The Extended Battery option
- The selected cellular channel

### **Standard report # 90 – Device Version Report**

The “I/O configuration” in this report is the number of inputs and outputs the user has configured during local programming. If a T646 has been installed but only four digital inputs, four analog inputs and four digital outputs are being used, the user can configure the device as a “T444” and only the inputs and outputs that are being used will be displayed on the web site.

The report contains the following information:

- The user specified I/O configuration
- The hardware version
- The firmware version
- The purchased model number
- The radio signal strength

### **Standard report # 91 – Maintenance Report**

This report contains the following information:

- The number of transmission attempts
- The present AC line voltage
- The present status of all digital inputs
- The present status of all digital outputs
- The radio signal strength

### **Standard report #92 – Device Configuration Report**

Similar to Report #90, this report also reports the status of the inputs and outputs. The “digital input configuration” reported here indicates whether each input has been configured as an alarm input, a counter input, a counter/timer input, or disabled.

This report contains the following information:

- The user specified I/O configuration
- The digital input configuration
- The present status of all digital inputs
- The present status of all digital outputs

## **Standard report #97 – Input/Output Configuration Report**

Similar to report, #92, this report also verifies the cellular channel.

This report contains the following information:

- The user specified I/O configuration
- The digital input configuration
- The hardware version and firmware version

## **Standard report #98 – Configuration Report**

This report provides the model number and hardware and firmware version.

This report contains the following information:

- Model number
- The present AC line voltage
- The hardware version
- The firmware version
- The radio signal strength

## Appendix B: Local programming, test and calibration

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The MicroRTU comes with a programming, test and calibration application that runs on a PC or laptop. The following instructions cover how to connect the MicroRTU to the PC and use the local programming application.

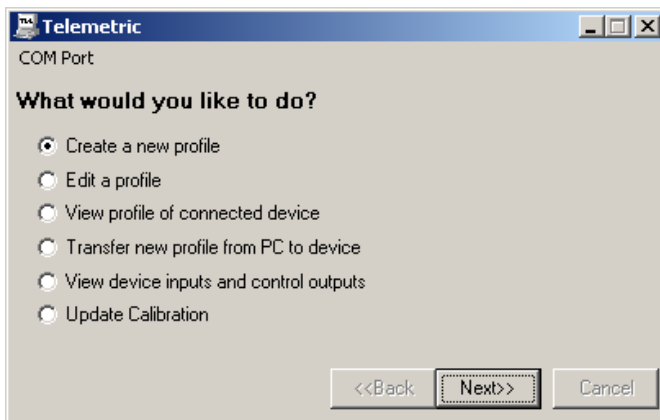
The system requirements for this program are as follows:

- Pentium® 90MHz or higher microprocessor.
- VGA 640x480 or higher-resolution screen supported by Microsoft Windows.
- 32 MB RAM for Windows 95, 128 MB for Windows NT.
- Microsoft Windows NT 3.51 or later (including Windows 2000), or Microsoft Windows 95 or later (including Windows XP).
- Hard Drive space 22 MB.

### Creating a local programming profile

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1. If the software has not already been installed, run the setup for the Telemetric TC012 Configuration Program. This software was shipped on a CD along with the Telemetric device(s). The program is also available for download from the telemetric.net web site.
2. Run the Configuration Program.
3. The first screen lists the tasks that can be performed using this program.



4. To create a local programming profile, select **Edit a profile** from the main menu and click the **Next** button.
5. On the next screen, select the **Default** profile. This will allow you to start out with the basic default settings for the TC012. Click **Next**.
6. The programming profile screen contains a series of tabs with all of the local programming options for the device. Select the **Digital Inputs and Outputs** tab if it is not already displayed.

Fill in the **Digital Output Duration (if temporary)** near the bottom of the screen. This is the duration of the momentary output change that is sent to open or close the Capacitor Bank.

The duration of the temporary signal can be programmed to last anywhere from 1 second to 240 hours, 59 minutes, and 59 seconds. The default is 7 seconds.

7. Fill in the **Digital Output Local Control Delay Outputs 1 & 2** at the bottom of this screen. This is the delay time between when Output 1 or 2 is controlled locally and when the output change actually occurs. The outputs can be locally controlled by using the on-board Open/Close toggle switch. This delay allows field personnel to manually initiate a control action and then move a distance from the equipment before the output change is made. The default for this delay is 30 seconds and it can be set from 1 to 240 seconds.
8. Fill in the **Between-Controls Delay Time Outputs 1 & 2**. This delay provides a minimum delay time between a trip and close operation. The default for this delay is three minutes and it can be set from 1 to 15 minutes.
9. Select the **Analog Inputs** tab.
10. For the Neutral Current Analog Input, set the low middle and high set points. Each of these must be a number between 0.25 and 100 Amps. To disable a set point, set it to zero. If your application requires only one set point, use the Low Limit and disable the Middle and High limits. To use only two set points, use the Low and Middle limits and disable the High limit. When the value of the analog input crosses one of these set points, the device reports a change. The factory default value for all set points is zero.
11. For Analog Input 1, you have the ability to set up four sets of limits. Each set is an "Option." You can then switch from one option to another by sending a command from the web site. If you want to take advantage of this feature, fill out the values for the four options. You should make your own record of the values you choose, so that you know which option to pick from the web site later (see Step 30). Select the radio button next to the option you want to use initially.
12. You can also set the trigger time for the Analog Input. This is the time a change must last in order to trigger a report. The value can be from 0 to 240 minutes and from 0 to 59 seconds. The default value is 2 seconds.
13. You can select the input type for the Analog Input: either AC or DC. The default for the TC012 is AC, since this is the input for the Neutral current sensor.
14. Select the **Miscellaneous** tab.
15. The **Cellular Channel** setting should not be changed unless you have been instructed to do so by Telemetric technical support. The default is Auto Select.
16. Choose whether to turn the **Extended Battery Option** off or on. When this setting is off, the MicroRTU reports any power outage and then turns its radio off one minute later. It will not be able to communicate again until power is restored. To keep the device from shutting down, turn on the Extended Battery Option. In this mode the device will report the outage and then leave its radio on for as long as it has battery power. The device can be connected to a larger battery, if needed, to increase its available power.
17. The next item is the **Command Acknowledgement Delay**. After receiving and implementing an output change command, the device will delay for a specified amount of time, then report the status of all inputs and outputs. The delay can range from 3 seconds to 240 minutes and 59 seconds. This delay can be used to retrieve the status of the controlled equipment or environment after the output change has had time to take effect. Enter minutes and seconds. The default is 35 seconds.
18. If desired, you can select a different **Command Acknowledgement Report**. The default Acknowledgement Report is "Line Voltage, Analog Input 1, and Outputs" (Report 45).

**Important Note:** ONLY report 45 or Report 17 (Digital Outputs plus Inputs) should be used as Acknowledgement Reports for the TC012. If any other report is used, the web site will NOT be able to report the open or closed status of the Capacitor Bank.

19. For the **Daily Call Limit** you can set up two options that can then be remotely selected from the web site. To use these options, enter a value in each one and then select the one you want to use initially. This setting limits the number of event-based calls per day in order to limit calls that might result from over-active input conditions. Time scheduled calls, user requested status calls and command acknowledgements will continue to be placed even after the call limit has been reached. The daily limit can be set from 1 to 20. For short term testing, you can set the call limit to Unlimited, but be very careful when using this setting as it can lead to a very high air time bill.
20. Select the **Time Scheduled Reports** tab.
21. Up to four reports can be configured to come in at four different time intervals. The default setting is for all four of these reports to be disabled. Each report has two Options for report frequency that can be remotely enabled or disabled from the web site. To enable a report, select the **Option 1** or **Option 2** check box and enter a call frequency between 1 and 240 hours, then select a report (or use the default). See Appendix A for a description of all reports that can be requested. Make a record of what you select for your frequency Options so that you know which option to choose on the web site later (see Step 30).
22. Select the **Power Quality** tab.
23. You can set up two Options for the trigger time for power outage reports. These Options can be enabled or disabled from the web site. The default is 0.1 seconds. Enter a zero to disable power outage reporting, or enter any value between 0.1 second and 240.9 seconds, then select the Option that you want to use initially. A report is initiated 60 seconds after the first power state change has been detected. A **continuing** outage call will be sent if the power is off at the time of the call, and a **momentary** outage call will be sent if the power is on at the time of the call. The Battery on time feature will only commence following a continuing outage call. The Event Based Actions trigger "Outage" refers to a continuing outage only.
24. For under voltage reports, you can set up two Options for the trigger time and four Options for the trigger voltage. A report is initiated when the AC line voltage decreases below the trigger voltage for longer than the trigger time. This call reports the current voltage, plus the minimum and maximum voltage seen after the set point has been crossed. The Under Voltage set point can be set anywhere between 100 and 119 VAC and the trigger time can be between 1 and 240 seconds. The default trigger voltage is 110 and the default trigger time is 5 seconds. Set up the Options that you want to use and then select the one you want to use initially. Make a record of the Options you create so that you know which option to choose on the web site later (see Step 30).
25. For over voltage reports, you also have two Options for trigger time and four Options for trigger voltage. A report is initiated when the AC line voltage increases above the trigger voltage for longer than the trigger time. This call reports the present voltage, plus the minimum and maximum voltage seen after the set point has been crossed. The Over Voltage set point can be set anywhere between 121 and 135 VAC and the trigger time can be between 1 and 240 seconds. The default trigger voltage is 128 and the default trigger time is 5 seconds. Set up the Options that you want to use and then select the one you want to use initially. Make a record of the Options you create so that you know which option to choose on the web site later (see Step 30).



**Note:** Pay special attention to the power quality at the installation site when setting the Over and Under Voltage options. If there are power fluctuations at the site, they can cause the TC012 to call in with constant Over or Under Voltage calls – disrupting other communication. If this is the case, the Over or Under Voltage set point should be set very high or very low, or the reports should be completely disabled.

26. If you have set up some options, you can create a report that lists the values for all of your options. To create this report, select **Save Profile as Text File** from the Profile menu. This prompts you for a text file name. Name the file and save it. You can then open the file and print it to keep as a record of your option settings.
27. When finished entering all values for this programming profile, click the **Finish** button.

## **Programming the MicroRTU with the new profile**

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Follow the instructions below to upload the new profile into the memory of the MicroRTU.

1. Use a serial cable to connect the Telemetric device to the PC serial port. (This must be the PC that is running the TC012 Configuration Program.) The serial cable should be DB9M to DB9F with pin-outs 2-2, 3-3, 5-5. To change the COM port setting, use the menu in the upper left corner.
2. If it is not already running, start up the Telemetric Configuration Program. On the first screen, select **Transfer new profile from PC to device**. Click **Next**.
3. On the next screen select the name of the profile to use for local programming. Click **Next**.
4. The program will now attempt to make contact with the MicroRTU. When the connection is made, the profile will be uploaded to the device. The program will display a message reporting that local programming has completed successfully. Click **Finish** to return to the main menu.

## **View current device profile**

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To see the contents of a MicroRTU's current programming profile, you can download and display its current settings. With the MicroRTU connected to the PC, select **View profile of connected device** from the main menu and click **Next**. The program will establish a connection with the MicroRTU and download its programming profile. The profile is displayed in the same form that is used for creating a new profile. The profile settings can be viewed in this form, or, if desired, they can be saved as a new profile by selecting **Save As...** from the Profile menu. Click **Finish** to return to the main menu.

## **View device inputs and outputs**

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To see the current status of the MicroRTU's inputs and outputs, or to locally control the outputs, select **View device inputs and control outputs** from the main menu and click **Next**. The program will establish a connection with the MicroRTU and then display a screen that is constantly updated with all of the current input and output values, as well as the AC line voltage, the battery voltage and the radio signal strength (RSSI).

## **Menu items**

The **Set Radio Channel** option in the **Tools** menu allows you to set the radio channel on the fly. This immediately reprograms the device to aid in testing.

The **Change RTU Model Number** option can only be used if you have the Telemetric-supplied password.

The **Reset Counters, Timers, Low's & Hi-s** menu item sends a command to the device that resets all of the timer/counter values and all of the Min and Max values.

The **Large RSSI Window** menu item will display a large, continuously updating, display of the RSSI value. This can be used for troubleshooting in the field when you need to be able to see the RSSI from a distance.

Select **Finish** from the menu bar to close this window and return to the main menu.

## **Update calibration**

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The TC012 has been calibrated at the factory. However, if the calibration appears to be inaccurate, you may re-calibrate the unit. The following procedure will calibrate the neutral current measurement as well as the AC line voltage. To perform the calibration procedure, the unit must be powered up with a steady voltage on the 120V line input and a steady 0.024 to 0.026 volts AC on the analog input.

To calibrate the device, select **Update Calibration** from the main menu and click **Next**. Follow the instructions that are displayed. The program will make contact with the device and display the device's current line voltage reading. Use a multimeter to measure the actual line voltage for the device. If it is different from the device's reading, enter the actual voltage into the text box on this screen and click **Next**. The program will connect to the MicroRTU and program it with a calibration factor to correct the voltage reading. The device will save this calibration factor and use it for all future voltage calculations. Click **Finish** to return to the main menu.

## Appendix C: Hardware specifications

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### Digital outputs

Output relays 1 and 2 are rated for 30 Amps of continuous current at 120V.

For test and maintenance, remote control of the outputs can be locally disabled by using the on-board toggle switch.

Outputs 1 and 2 have an optional programmable delay time between when the output is switched on or off locally and when the output change actually occurs. The outputs can be locally controlled by using the on-board switches. This delay allows field personnel to manually initiate a control action and then move a distance from the equipment before the output change is made. The default for this delay is 30 and it can be set from 1 to 240 seconds.

Outputs 1 and 2 also have a programmable “Between-Controls” delay time for control actions. This provides a minimum delay time between a trip and close operation. The default for this delay is three minutes. It can be set from one minute to fifteen minutes using the Local Configuration program.

### Analog inputs

The 12 bit analog input on the TC012 is wired to accept a 0-10 VAC input from the Neutral Current sensor.

A second analog input is configured as a battery monitor to check battery voltage during any AC power fail condition.

A third analog input is dedicated to 120 VAC line voltage measurements.

### On-board RS232 serial port

Connects directly to the serial port of a handheld, laptop, or desktop computer to facilitate system configuration, testing, radio configuration, installation and test. The port can optionally provide communication with an intelligent monitored device.

The specification for the serial cable connection is DB9M to DB9F with pin-outs 2-2, 3-3, 5-5.

### Battery

A built-in battery provides operating power for power outage reporting, data storage and orderly shutdown during AC power outages. An on-board circuit charges the battery.

### Antenna

The included antenna is a “rubber duck” style, 1/2 Wave, 2.5dB antenna. An external SMA connector provides the connection to this antenna or to a remote antenna if desired. Larger (50-ohm cellular frequency) antennas including Yagi or higher gain omni-directional models can be used to improve performance in fringe areas. Telemetric also sells Phantom Low-Profile antennas for the TC012.

### Test Button

The test button just above the LEDs on the TC012 board can be used trigger a Maintenance Report call from the TC012.

To trigger a call, wait for the LEDs to stop blinking and then hold in the test button for at least 2 seconds. The green LED will flash one short flash and then one longer flash, indicating that the TC012 is making a call.

## **On-Board radio signal strength indicator**

The test button also initiates a test in which LEDs are used to indicate the Radio Signal Strength (RSSI) 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.
- Receive frequency: 869-894 MHz,
- Compatible with the AMPS analog cellular system

## **Internal AC power supply**

The power supply operates from 100-135 VAC, 60 Hz.

## **CPU / memory**

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

## **Field wiring connections**

The connections for Outputs 1 and 2 are made using 9.5 mm terminal blocks, which accommodate 10-24 gauge wire.

**Important Note for Outputs 1 and 2:** If the Amp draw from the load on the output will be equal to or less than 12 Amps, the load can be connected to the green terminal block. If the load will be greater than 12 Amps, the load must be connected to the spade connectors in the black relay behind the terminal block.

## **Environmental specifications**

The recommended operating temperature range is -40 to +158 degrees F (-40 to +70 C).  
The recommended relative humidity range is 5 - 95% non-condensing.