

TC012 MicroRTU™ Capacitor Bank Monitor and Control

The Telemetric TC012 MicroRTU is one of several application-specific configurations of the general purpose T646. Its purpose is to remotely monitor and control fixed or switched capacitor banks. It monitors the AC line voltage, outages, the open or closed status of the capacitor bank, and the capacitor bank neutral current reading. It can directly control the capacitor bank using two 30 Amp relays.

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 value is converted back into Amps by the Telemetric web server. This neutral current value provides valuable data about the condition of the capacitor bank. 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 is purchased with a meter base mounting, it can be simply plugged into an appropriately wired meter socket. If the enclosure without the meter base mounting is purchased, AC power is connected and the TC012 outputs are wired to the capacitor bank. Then, the neutral current analog sensor is connected to the pre-wired connection at the bottom of the TC012 enclosure.
2. As soon as it is powered up, the TC012 will automatically establish two-way communications over the public cellular network to the www.telemetric.net Intelligent Web Server.

3. 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.
 - Configure selected events to trigger an immediate control command or user notification by pager or e-mail.

Feature Summary

- Low cost to buy and to operate
- Two-way operation
- Communicates anywhere in the North American cellular coverage area using Aeris MicroBurst technology and the public cellular system
- AC Line Voltage Monitor reports under and over voltage conditions as well as momentary and continuing power outages
- One Analog Input to monitor the neutral current and two Digital Outputs used to open or close the capacitor bank
- Optional DNP interface to SCADA system

How it Works

When a Telemetric module makes 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 module's identification numbers and data to the central cellular hub. The Telemetric module passes its data packet in a normally non-utilized data field. This technique allows the transmission of an identification number and the time and date, plus customer specific data, all at a very low cost. At the fully automated Telemetric Network Operations Center (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 data center to the field module.

The Intelligent Web Server records and displays all incoming status messages and, depending on the customer's instructions, will:

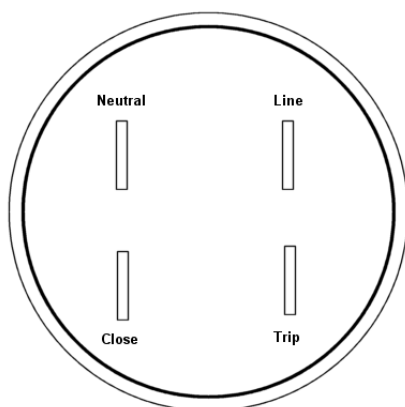
- Notify a designated person of the reported event,
- Send pre-determined control commands back to the field device, and/or
- Pass the data to the customer's designated IP or e-mail address

Digital Outputs

The TC012 has two control outputs. Output 1 is wired to the capacitor bank's Open (Trip) coil and Output 2 is wired to the capacitor bank's Close coil. When a close or open command is received by the TC012, the appropriate output momentarily closes to carry out the trip or close operation.

Note: If the Amp draw from the load on the outputs will be equal to or less than 12 Amps, the load can be connected to the green terminal blocks. If the load will be greater than 12 Amps, the load must be connected to the spade connectors in the black relays behind the terminal blocks.

If the TC012 is purchased with the meter base mounting option, the outputs are pre-wired to the meter base, as shown below. The Trip and Close outputs from the Capacitor Bank must then be wired to the appropriate jaws on the meter socket.



**TC012 Meter Base
(viewed from back of TC012)**

Local control of the TC012 outputs

The TC012 also comes with easily accessible on-board switches for locally controlling the capacitor bank. 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. 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 second switch on the local control board is the Open/Close switch, which locally controls the state of the capacitor bank. A green LED indicates when the cap bank is open and a red LED indicates when the cap bank is closed. After operating this switch, the appropriate LED starts blinking to indicate the operational delay timer. This programmable 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.

When the Capacitor Bank is locally switched 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.

Analog Input (Neutral Current)

The Analog input is pre-wired to the Cannon ITT connector at the bottom of the TC012 enclosure. The output from the capacitor bank neutral current sensor is plugged into this connector.

Two-Way Communications

Two-way communications allow all remote control commands to be positively acknowledged with a report that includes the status of the outputs and the voltage and neutral current readings. This provides a valuable verification of all switching operations. After any remote control action is activated, the user has the ability to compare the reported values to the expected states or conditions. If the report is not as expected, they can initiate a retry, thus ensuring maximum compliance with all remote commands.

Automated remote control functionality can reduce the need for locally controlled switching, with control decisions based upon centralized monitoring and control algorithms.

On-board RS-232 Serial Port

The serial port can be connected directly to a handheld, laptop, or desktop computer to facilitate system configuration, testing, radio configuration, and installation.

Local Programming Application

A configuration program is included with the TC012 at no extra cost. This program is designed to run on a Windows based computer. Connecting a computer to the device's RS-232 port and starting the program initiates local communication with the device.

The configuration program allows the user to carry out the following tasks: Display Operating Status, View (existing) Programmable Parameters, Upload (new) Parameters, Control Outputs, and Update Voltage Calibration.

Programmable Operating Parameters

A variety of programmable set points are available to configure the operation of the product. These set points are saved into permanent (EEPROM) memory through the use of the configuration program.

The default values for the following parameters are programmed into the device at the factory. These values can be changed in the factory by special order or changed by the user during the local programming process.

Digital Outputs

Both of the TC012 outputs are preformatted to carry out only momentary close commands. The duration of the momentary close can be programmed to last anywhere from 1 second to 240 hours, 59 minutes and 59 seconds. The default setting is 30 seconds.

Local Control Delay Time

For local personnel safety, the TC012 provides a programmable delay time for local open and close operations. The delay time can range from 0 to 240 seconds. The factory default is 30 seconds.

Between-Controls Delay Time

The TC012 also provides a minimum delay time between a trip and close operation. This delay is used for local control operations only. The delay time can range between 0 and 15 minutes. The default setting is 3 minutes.

Command Acknowledgements

After receiving and implementing an output change command, the TC012 will delay for a specified amount of time, then report the status of the outputs, voltage and neutral current. The acknowledgement delay can range from 3 seconds to 240 minutes and 59 seconds. The default is 40 seconds.

Time Scheduled Reports

Up to four standard reports can be time scheduled, with the call frequency set anywhere from once every hour to once every 240 hours (10 days). Time scheduled reports are disabled by default.

Daily Call Limits

To limit the number of calls that might result from over-active input conditions such as changing voltage conditions, the number of event-based calls per day can be limited. Time scheduled calls, user requested status calls and command acknowledgements will continue to be placed even after this limit has been reached. The daily limit can be set from 1 to 20. The factory default setting is 12.

Analog Input Monitor / Reporting

When the TC012 measures the analog value for the Neutral Current, it is reported as a number ranging from 0 - 4095. This value is converted into Amps at the web server and displayed in Amps on the device Current Status page.

If desired, the user can also set up three limits for the analog value. Once these limits are set up, a report is initiated when the measured value crosses one of the limits (and when the change lasts longer than the programmed trigger time). This call reports the present reading as well as the minimum and maximum values measured since the last report.

The three set points can be set anywhere from 0 to 4095. Setting any of these values to 0 will disable that set point. The trigger time can be set in 1-second increments from 0 (no delay) to 240 minutes, 59 seconds. The factory default settings are 0 (disabled) for all three set points and 10 seconds for the trigger time.

Power Outage Reporting

Outage calls report the number of state changes (OFF-ON-OFF =3) and the final state (ON or OFF) at the time of the call. If the power is ON at the time of the call, the report will also include the highest and lowest measured voltage reading. If the power is OFF at the time of the call, the report will include the highest measured voltage reading and a battery voltage indicator. The outage call will be triggered by any power outage that lasts longer than a specified duration. The range of trigger duration is 0.1 second to 240.9 seconds. The default setting is 0.1 second.

Under / Over Voltage Reporting

A report is initiated when the AC voltage decreases below a preset level or increases above a preset level for more than N seconds. This call reports the present voltage, plus the minimum and maximum voltage measured since the last report.

The Under Voltage set-point can be set anywhere between 100 and 120 Volts and the Over Voltage set-point can be set anywhere between 115 and 135 Volts. Either or both settings can also be disabled. The factory default settings are 110 and 128 VAC for 5 seconds.

Cellular Channel Selection

Auto Select is enabled by default. In this mode the device will automatically communicate with the nearest cell tower to determine whether it should communicate on the A or the B cellular channel. If there are multiple MicroBurst carriers in the area, and there is a preference for one of them, it is possible to locally specify the preferred channel. This setting should not be changed without first consulting with Telemetric Technical Support.

Extended Battery Operation

The TC012's default mode of operation is to turn the battery off one minute after reporting an AC power outage. To maintain continued operation during a power outage, the Extended Battery Option can be enabled during local programming.

Operating Power & Backup Battery

The TC012 is designed to operate from 120 VAC. A 4.5 Amp Hour sealed rechargeable battery (5 year expected lifetime) and an on-board battery charger is included. The battery is required in order for the TC012 to report power outages. All other functions, including under and over voltage conditions and power restorations will be reported without a battery.

A battery voltage indicator is reported with every power outage report. This value can be used to detect a weak battery.

Remote Programming Options

During local programming, the user has the opportunity to program a number of “Options” into the TC012, which can then be used to remotely change programming settings from the web site. For example, the user can enter four options for the set points for the Neutral Current analog input. This allows a range of neutral current trip points, suitable for four different sizes of capacitor banks, to be pre-entered. The user can then remotely select the appropriate option after the device is installed. Other programmable options for the TC012 include:

- Time scheduled report frequency
- Analog 1 – four set point options
- Under and Over Voltage set points
- Under and Over Voltage trigger times
- Power Outage trigger time
- Daily call limit

In addition, there are three commands that facilitate remote maintenance and support for the TC012:

- Restore factory default settings.
- Remotely turn on or off the Extended Battery Option.
- Remotely reset the TC012 and initiate a power on Registration call.

Basic Specifications

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

Antenna

The included antenna is a “rubber duck” style, ½ 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.

CPU / Memory

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

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.

Electrical Specifications

Operating Voltage Range: 100 -135 VAC, 60 Hz.

Surge Withstand: ANSI C62.41-1987
ANSI C37.90.1

Electrostatic Discharge Test: IEC 801-2, 15 KV
ANSI C37.90

Power Consumption: less than 100 Watts

FCC Part 15: Compliant

Output Relays: Number: 2

Maximum continuous load: 120 VAC, 30 Amps

Contact Closure Period: 1 second to 240
seconds momentary

Standard Battery: 12 VDC, 4.5 AH
Sealed lead-Acid,
Rechargeable

On-board battery charger: 13.8VDC float, current
limited to 700mA

On-board fuse: 120 VAC, 1 Amp

Mechanical Specifications

The standard enclosure is a steel box. Features include:

- NEMA 4 enclosure rating
- Hinged door with padlocking hasps
- Gray steel construction
- Three conduit compatible cable entry holes on the box bottom
- Dimensions: 10.5” x 8.5” x 4.5”
- Weight: 17 lbs

Additional product configurations are available including:

- Non-metallic enclosures
- 4-jaw socket mounting
- A variety of antenna options