# Voltage Regulators

COOPER Power Systems

Service Information

## Tap-Changer Diagnostics

S225-11-6

### Contents



# PRODUCT INFORMATION

## Introduction

Tap-Changer Motor Trouble Diagnostics Output (TCMT): A Status Indication/Alarm introduced with the January 2009 release of the Leader/Follower version of CL-6 firmware (rev 1.06.20). TCMT will detect and notify you of impending mechanical problems with your voltage regulator.

An active status of this output indicates a problem preventing the tap-changer motor from performing or completing (or the control not sensing) an operation either called for by an Automatic Regulation Tapping request or a Remote Manual Tapping request received through Digital SCADA communications. Problem detection includes but is not limited to the following:

- Blown motor fuse
- Failed/failing motor capacitor
- Failed/failing tap-changer motor
- Stalled tap-changer motor
- Faulty motor signal output wiring
- Failed/failing holding switch circuit
- Failed/failing control motor circuit components
- Incorrect setting of controls tap-changer configuration (FC049)

This Output is available through SCADA or separately as a configured CL-6 Alarm State as defined in this document.

## ⚠ Read This Manual First

Read and understand the contents of this manual and follow all locally approved procedures and safety practices before installing or operating this equipment

## Additional Information

These instructions cannot cover all details or variations in the equipment, procedures, or process described nor provide directions for meeting every possible contingency during installation, operation, or maintenance. When additional information is desired to satisfy a problem not covered sufficiently for the user's purpose, please contact your Cooper Power Systems sales representative.

## Quality Standards

ISO 9001 Certified Quality Management System

# SAFETY FOR LIFE

Cooper Power Systems products meet or exceed all applicable industry standards relating to product safety. We actively promote safe practices in the use and maintenance of our products through our service literature, instructional training programs, and the continuous efforts of all Cooper Power Systems employees involved in product design, manufacture, marketing and service.

We strongly urge that you always follow all locally approved safety procedures and safety instructions when working around high-voltage lines and equipment and support our “Safety For Life” mission.

# SAFETY INFORMATION

The instructions in this manual are not intended as a substitute for proper training or adequate experience in the safe operation of the equipment described. Only competent technicians, who are familiar with this equipment should install, operate and service it.

*A competent technician has these qualifications:*

- *Is thoroughly familiar with these instructions.*
- *Is trained in industry-accepted high- and low-voltage safe operating practices and procedures.*
- *Is trained and authorized to energize, de-energize, clear, and ground power distribution equipment.*
- *Is trained in the care and use of protective equipment such as flash clothing, safety glasses, face shield, hard hat, rubber gloves, clampstick, hotstick, etc.*

Following is important safety information. For safe installation and operation of this equipment, be sure to read and understand all cautions and warnings.

## Hazard Statement Definitions

This manual may contain four types of hazard statements:

**⚠ DANGER:**

**Indicates a hazardous situation which, if not avoided, will result in death or serious injury.**

**⚠ WARNING:**

**Indicates a hazardous situation which, if not avoided, could result In death or serious injury.**

**⚠ CAUTION:**

**Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.**

**CAUTION: Indicates a hazardous situation which, if not avoided, could result in equipment damage only.**

## Safety Instructions

Following are general caution and warning statements that apply to this equipment. Additional statements, related to specific tasks and procedures, are located throughout the manual.

**⚠ DANGER:**

**Hazardous voltage. Contact with high voltage will cause death or severe personal injury. Follow all locally approved safety procedures when working around high- and low-voltage lines and equipment.**

**⚠ WARNING:**

**Before installing, operating, maintaining, or testing this equipment, carefully read and understand the contents of this manual. Improper operation, handling or maintenance can result in death, severe personal injury, and equipment damage.**

**⚠ WARNING:**

**This equipment is not intended to protect human life. Follow all locally approved procedures and safety practices when installing or operating this equipment. Failure to comply may result in death, severe personal injury and equipment damage.**

**⚠ WARNING:**

**Power distribution and transmission equipment must be properly selected for the intended application. It must be installed and serviced by competent personnel who have been trained and understand proper safety procedures. These instructions are written for such personnel and are not a substitute for adequate training and experience in safety procedures. Failure to properly select, install or maintain power distribution and transmission equipment can result in death, severe personal injury, and equipment damage.**

# SETUP PROCEDURE

## SCADA Reporting

Called “Motor Trouble”, this DNP Status (Object 1/2, factory Mapped Index 090, Internal Absolute point #103) can be read/reported from the control and can be included in any custom user defined map. Factory configured mapping is shown here.

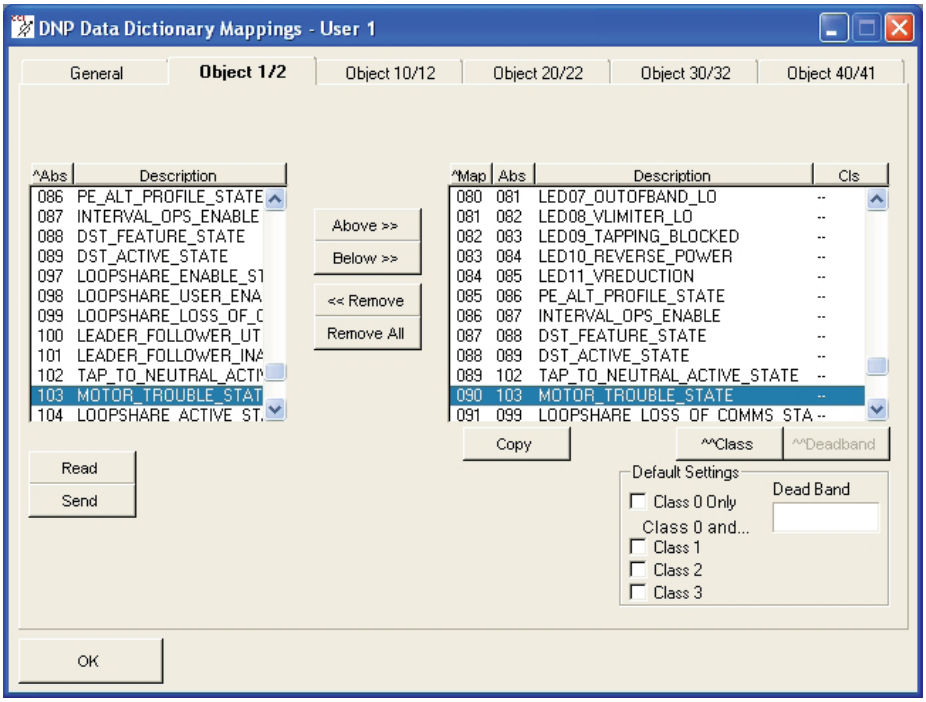


**Figure 1.**
**DNP Data Dictionary Mappings, User 1.**

There are two things to note when using SCADA communication to monitor the Motor Trouble State:

1. The DNP Status is not dependant upon being configured as an Alarm to be read/reported through DNP communications.
2. The status will become active any time the control sends a tap command and it is not successfully completed. The status will not clear until the control sends a tap command and the regulator completes a successful tapping operation. While the status is active, the control will continue to send a tapping command every 30 seconds as long as the sense voltage remains out of band.

## Configuring the Status Alarm

Called “Motor Trouble”, this Status Alarm can generate Events, System Profile snapshots, and report an alarm state. In the example below, this Alarm feature is configured to:

1. Illuminate the Red Alarm LED on the CL-6 front panel, (assigning a priority value between 1 and 50, has the effect of illuminating the alarm LED when the status item is active).
2. Record a time and date stamped Event in the Event Recorder.
3. Record a System Profile Snapshot in the Data Profiler.

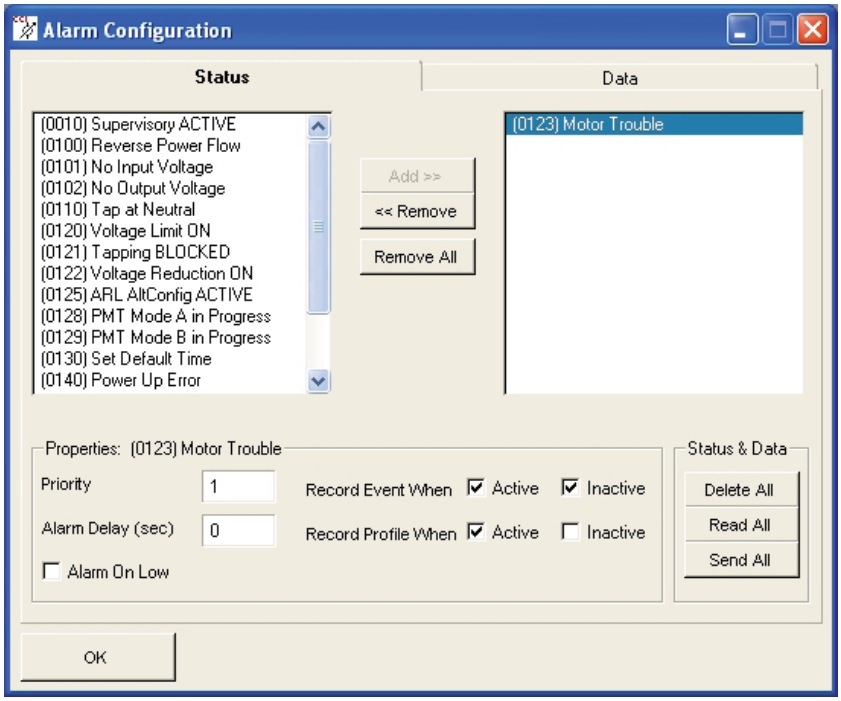


Figure 2.
Alarm Configuration.

4. Report the Alarm state through DNP for a standard Class 0 Static scan and/or a Class 1 Event scan.

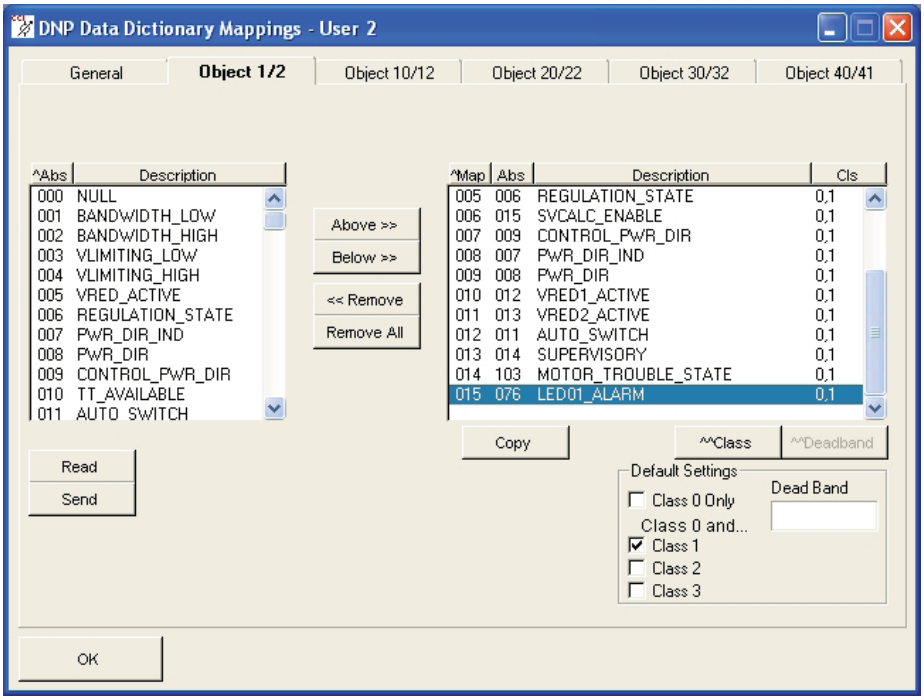


Figure 3.
DNP Data Dictionary Mappings, User 2.

## Diagnostic Output Supplementary Settings

1. For both native SCADA reporting and Status Alarm Indication, in order to prevent false-positives due to the tap-changer being at the limits (Hard position indicator limit switches are factory set to 16 Raise and 16 Lower), the Soft-ADD-AMP™ Feature must be enabled and the limits set to match the position indicator limit switches.

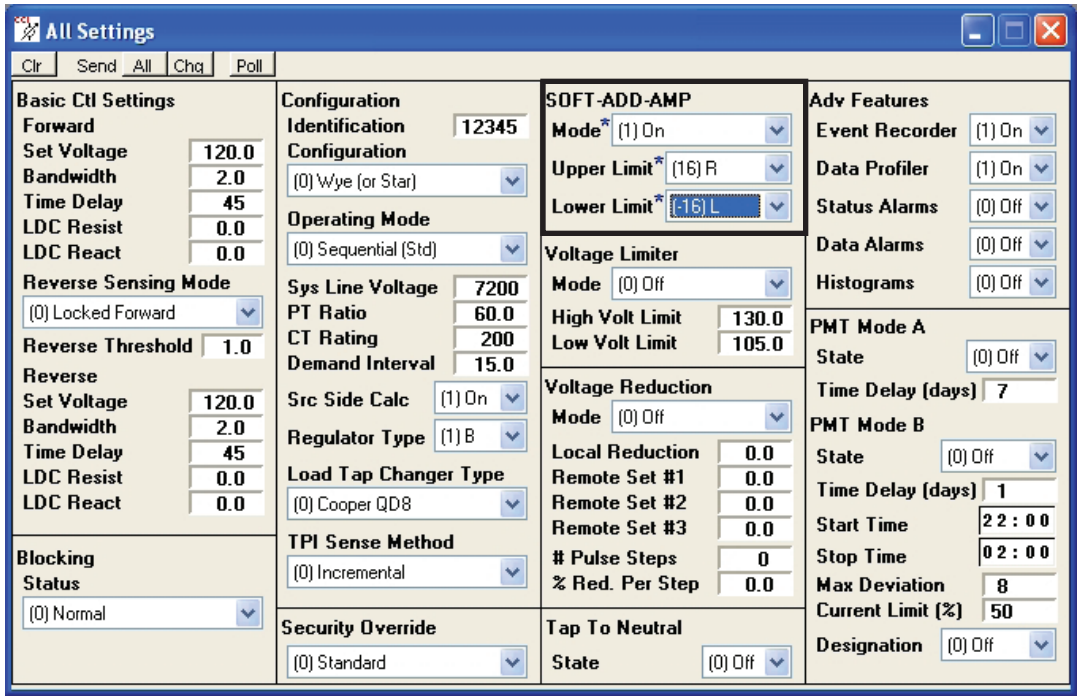


Figure 4.
All Settings.

2. For Status Alarm Indication, Status Alarms must be enabled in the control:

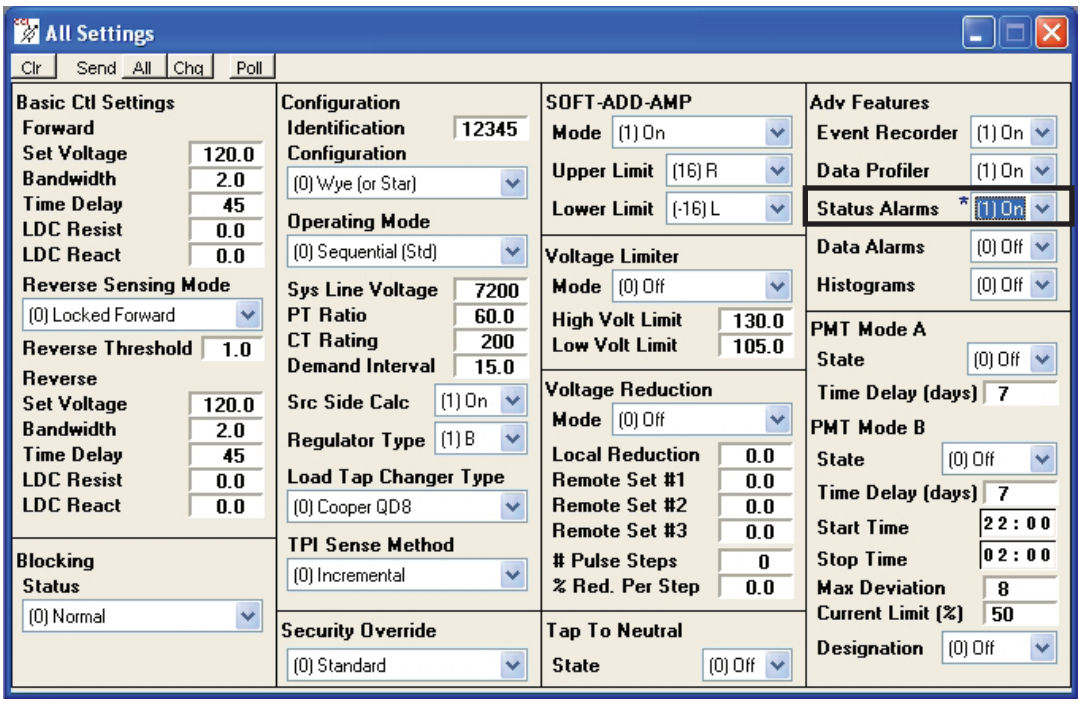


Figure 5.
All Settings.

## PROACTIVE TESTING OF THE MOTOR CIRCUIT

The Tap-Changer Motor Trouble Problem Diagnostics Output (TCMT) can be combined with the Preventative Maintenance Tapping (PMT™) feature to regularly test the motor circuit. By setting up the TCMT and then enabling PMT Mode A configured with a 1 day countdown timer, as shown in Figure 6, the control will exercise the motor circuit a minimum of once a day. The complete operation takes less than 1.5 seconds to perform with a Quik-Drive™ (QD) Tap-Changer on a Cooper Power Systems Voltage Regulator.

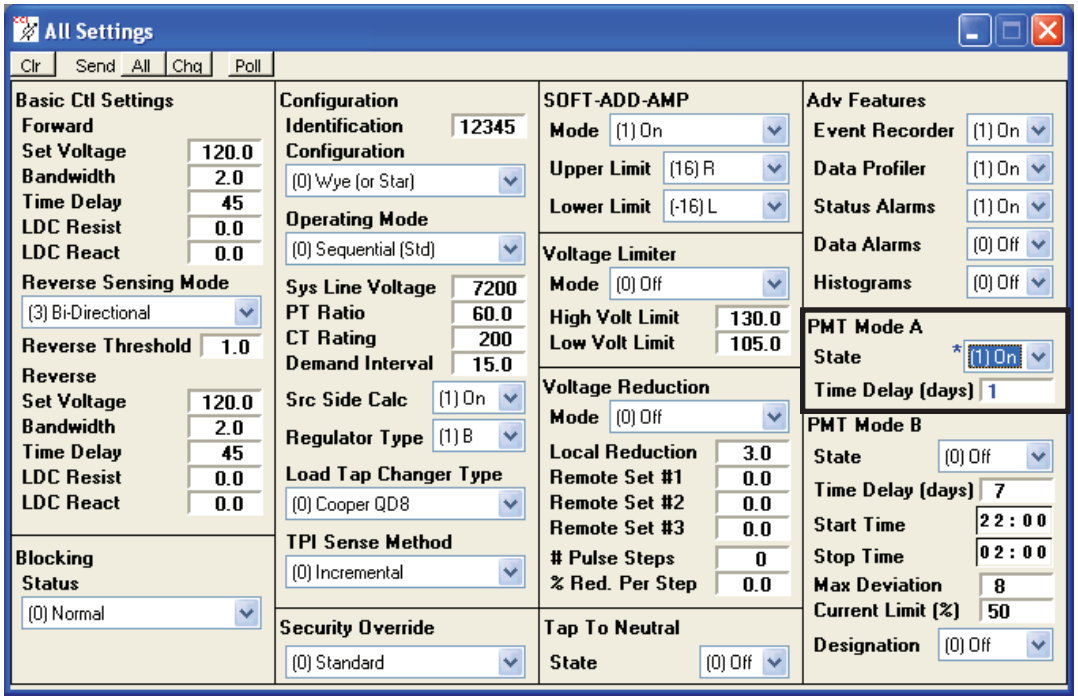


Figure 6.
All Settings.

PMT also includes the added benefit of insuring that along with the base Tap-Changer Movable Contact operation (PMT Mode A), the Tap-Changer Reversing Switch is also operated (PMT Mode B). PMT Mode B can be enabled using the steps in Figure 7.

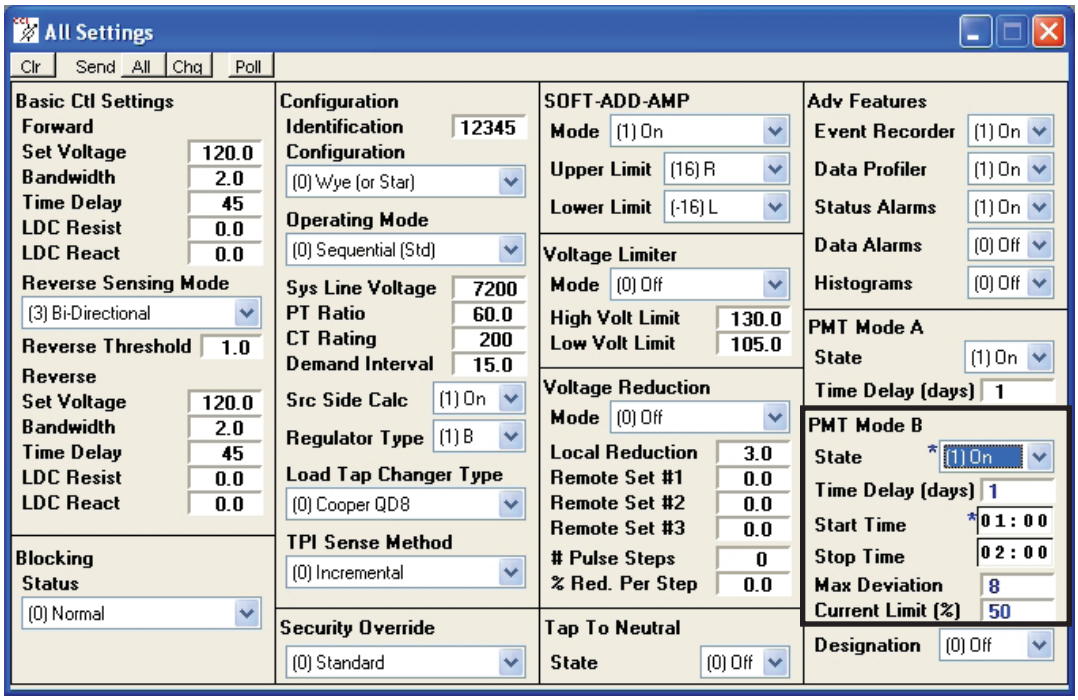


**Figure 7.**
**All Settings.**

When PMT Mode B is active, unless the normal tap-changer operation has caused the mechanism to cycle through neutral at least once during the day, the control is going to run it up one step past neutral and then back to its original position (on Cooper Power Systems QD mechanisms the operation time is less than 5 seconds). In this example, the operation will take place between 1:00 and 2:00 AM as long as the load current of the system does not exceed 50% of rated value.

Contact your Cooper Power Systems representative to answer questions or assist with implementing Tap-Changer Motor Trouble Diagnostics (TCMT) Outputs.




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