



Clipper Power System (CPS) Installation and Operation Manual

(This manual applies to all CPS surge protection devices including Retrofit, Integrated, MCC and Busway applications)

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Integrated CPS



Retrofit CPS

Clipper Power System

SECTION 1 INTRODUCTION

Clipper Power System (CPS) surge protection and filtering units provide clean power for sensitive electronic loads.

The CPS units shunt high energy induced lightning surges as well as other forms of transient disturbances. Properly installed CPS units protect critical equipment in hospital, commercial, computer, manufacturing, telecommunication, financial and military facilities.

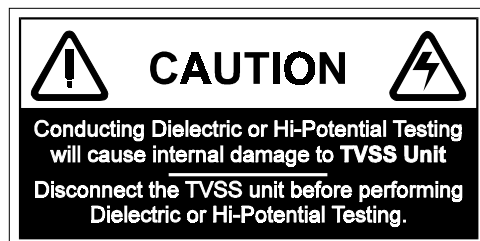
The CPS removes power disturbances from electrical distribution systems using a low impedance shunt path to ground. Surges and electrical line noise are absorbed by the CPS and are prevented from travelling through distribution system wires to sensitive electronic loads. Prior to installing the Clipper, check the unit's voltage and configuration to verify it matches your system voltage and wiring configuration.



Section 2.0 of this manual details the installation procedures for retrofit, caseless, MCC and busway applications. Integrated units are factory installed and require no additional on-site installation.

Section 3.0 of this manual describes the operating features for the suppressor. This section is relevant to all Clipper Power System units including integrated, retrofit, MCC and busway units.

Tech Note: Surge Protective Devices and Hi-Pot testing



Introduction

It is a common procedure to test distribution equipment with a form of hi-pot (or dielectric or megger) testing. The hi-pot tester outputs a high voltage signal at low current that will shut down if a short circuit occurs. The principle behind hi-pot testing is that the high voltage will find any faults in the distribution system and the low current and fairly quick shut down will not damage distribution equipment. Hi-pot testing is usually conduction phase and neutral to ground.

Surge Protective Devices

A Surge Protective Device (SPD) acts very quickly to suppressor high voltages before they can damage sensitive electronics. An SPD normally acts in the microsecond range and can withstand tens of thousands of Amps repeatedly. SPDs are not designed to prevent a continued overvoltage without damage. In order to protect electronics from damage, an SPD must be connected from phase to ground. Lightning surges are almost always shunted to ground and the SPD must be connected this way to provide protection.

The Problem

During a hi-pot test, the SPD will turn on and shunt the high voltage to ground. The hi-pot tester will continue to supply current until it internally records the fault condition. By this time the SPD has been exposed to a continuous current that can damage the internal components. It is critical that hi-pot testing not be performed on connected SPDs to prevent damage. From the installers point of view, it is also important that SPD are not connected while performing a hi-pot test since the SPD will always cause the test to fail thus defeating the purpose of the test.

Disconnecting SPDs / Performing Hi-Pot Testing

The only way to perform a hi-pot test in the presence of an SPD is to disconnect the SPD from the distribution system. If the unit is connected through a circuit breaker, the breaker should be shut off as a first step. This is sufficient for a delta system to remove the SPD. On wye connected systems, the neutral must also be removed so that all paths to ground are isolated. An alternative method is to remove the ground from the SPD before any hi-pot testing is performed. All grounds must be removed, the wired ground, the conduit ground, and even the case ground. Because it is easy to miss a ground connection, it is recommended that the line and

neutral connection are removed rather than the ground connection.

Integrated SPDs

An integrated SPDs has unique problems of its own. It is typically hard wired or permanently bus connected to the distribution system. This will still require removal of all phase and neutral or the ground connections. These types of connections are usually harder to remove and more care must be taken to prevent damage.

Cutler-Hammer Specific Instructions

Cutler-Hammer tests each device and assembly separately for dielectric breakdown. The assembled SPD or distribution equipment with SPD integrally mounted has already been tested at the factory.

Additional tests should not be required. Due to the possible damage that can occur, all integrated SPDs have a caution label applied warning against hi-pot testing of the assembly. We recommend that hi-pot testing not be done on distribution equipment with SPD already mounted, either retrofit or integrated devices. If hi-pot testing is still going to be done, it can be accomplished by following the above instruction and removing the phases and neutral from the SPD. Alternatively, for both integrated and retrofit models, if the unit has a black thermoplastic box with bolts sticking out from it, the ground connection can be removed. The terminal is label 'Ground' and has a short wire connecting it to the metal case. If all wires to this terminal are removed, a hi-pot test can be safely performed. It is very important to reconnect all wires after the test. If any wire is left off, it can constitute a serious safety hazard or can defeat the operation of the SPD rendering it non-functioning.

Table 1A: MCC, Busway and Integrated CPS Units and Table 1B: Retrofit CPS units should be used to verify the application voltage, diagnostic package and monitor options included with your CPS unit. Compare the catalog number shown on your unit to the information contained in Table 1A or 1B.

Table 1A, Integrated CPS: Catalog Description for MCC, Busway and Other Integrated Units

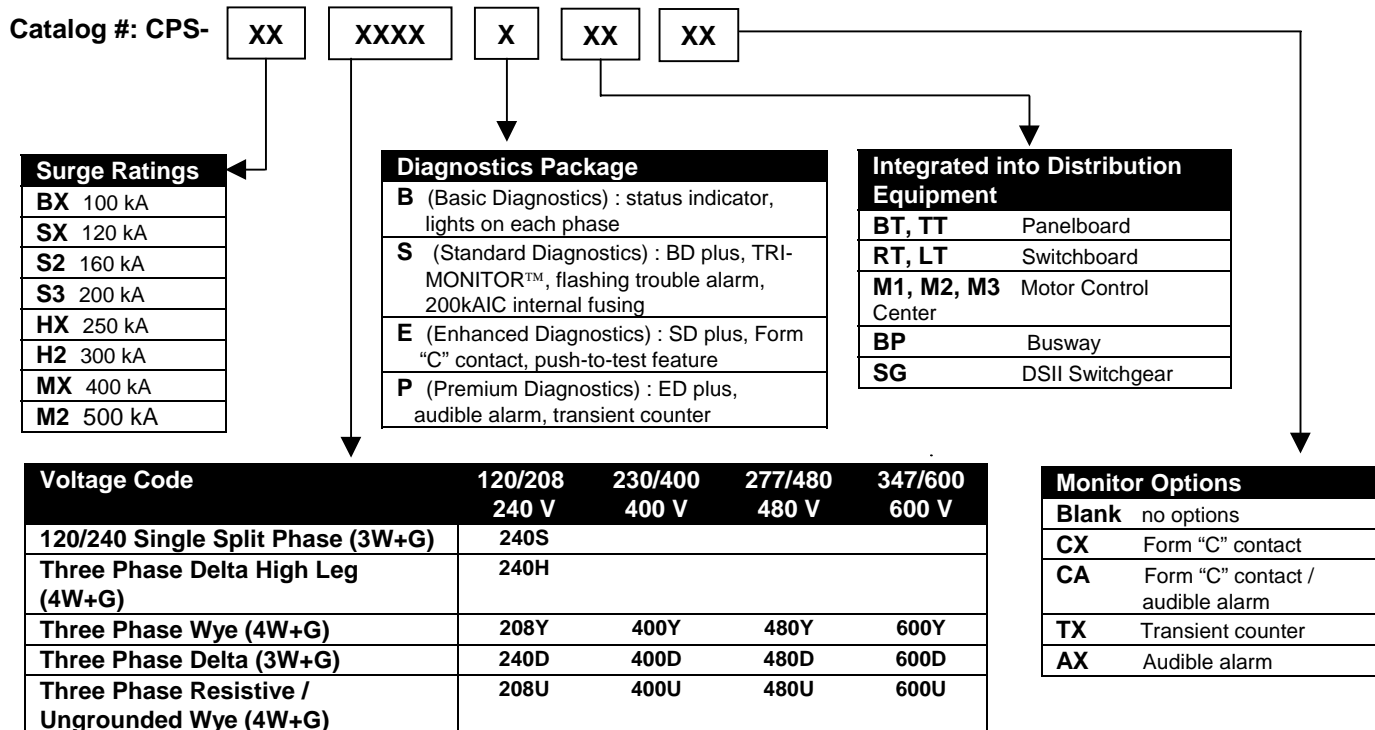


Table 1B, Retrofit CPS: Catalog Description for Retrofit Units

Catalog #: CPS-	XX	CH	XXXX	XX	XXX	XX
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Surge Ratings
BX 100 kA
SX 120 kA
S2 160 kA
S3 200 kA
HX 250 kA
H2 300 kA
MX 400 kA
M2 500 kA

Diagnostics Package
BD (Basic Diagnostics) : status indicator, lights on each phase
SD (Standard Diagnostics) : BD plus, TRI-MONITOR™, flashing trouble alarm, 200 kAIC internal fusing
ED (Enhanced Diagnostics) : SD plus, Form "C" contact, push-to-test feature
PD (Premium Diagnostics) : ED plus, audible alarm, transient counter

Integrated into Distribution Equipment
RSX Standard Retrofit (NEMA 12)
RFM Flushmount (NEMA 12)
R4X Non-metallic Corrosion / weatherproof
RSD NEMA 12 with disconnect switch
R4D NEMA 4 with disconnect switch
RC2 Caseless with remote diagnostic panel

Voltage Code	120/208 240 V	230/400 400 V	277/480 480 V	347/600 600 V
120/240 Single Split Phase (3W+G)	240S			
Three Phase Delta High Leg (4W+G)	240H			
Three Phase Wye (4W+G)	208Y	400Y	480Y	600Y
Three Phase Delta (3W+G)	240D	400D	480D	600D
Three Phase Resistive / Ungrounded Wye (4W+G)	208U	400U	480U	600U

Monitor Options
Blank no options
CX Form "C" contact
CA Form "C" contact / audible alarm
TX Transient counter
AX Audible alarm

CPS Retrofit Installation Diagrams

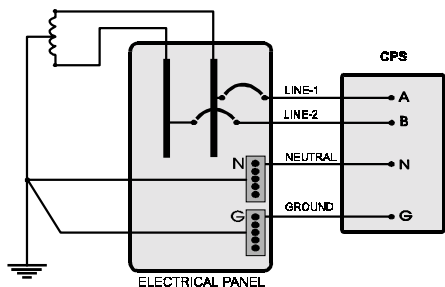


Fig. 1- Single phase (Split phase) 3 wire

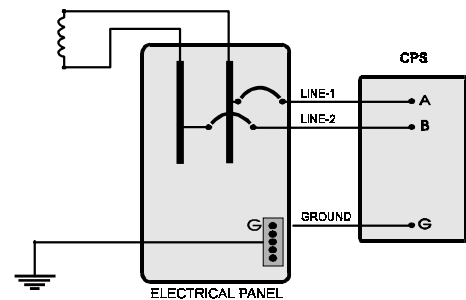


Fig 4 - Single Phase 2 wire

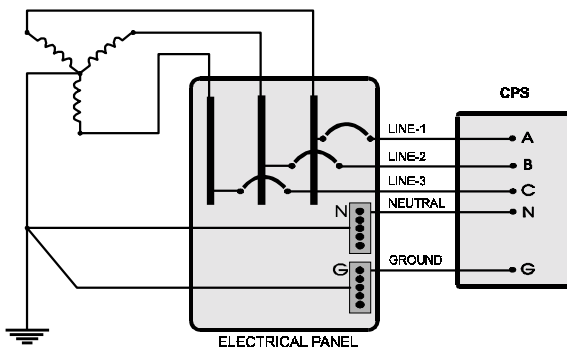


Fig 2 - Three phase Wye 4 wire

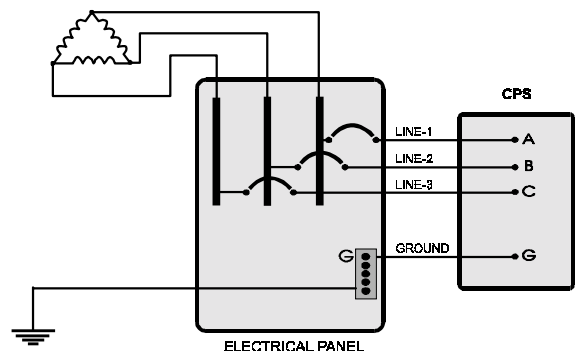


Fig 3 - Three phase Delta 3 wire

SECTION 2.1 INSTALLATION PROCEDURES

Retrofit Suppressor (externally mounted)

Retrofit Suppressor for Low Voltage Distribution Equipment



2.1.1 Site Preparation

Verify your system application voltage and wiring configuration is the same as the enclosed CPS by checking the voltage rating label located on the CPS container.

Review the site to ensure the physical space required to install the CPS filter exists.

Check the facility grounding system. All grounding, bonding and earthing must meet NEC or CEC, as well as local codes. A poor ground or grounding/bonding violations affect the suppressor's ability to function as specified.



2.1.2 Installation Recommendation – Where to Install the CPS?

Service entrance applications (Switchboards, Switchgear). The optimum location for the CPS unit is on the load side of the main breaker. If this is not possible, select the next closest location. *Minimize the lead length between the suppressor and bus bars (including the ground bus).*

Panelboard applications. For optimum performance install the CPS adjacent to the first breaker after the incoming lug/main breaker. If this location is occupied, select the next closest breaker. If no wall space is available at the side of the panelboard, locate the CPS directly above or below the panel.

2.1.3 Minimize Installation Lead Length

To ensure maximum performance and best possible protection for connected equipment, the CPS must be installed as close to the panel/switchboard/switchgear as possible. The wire length between the CPS and installation breaker should be as short as possible. For best performance, maintain lead lengths less than 14 inches (36 cm).

Lead lengths greater than 14 inches (36cm) dramatically reduce performance.



2.1.4 Wiring

Turn **OFF** the power to the electrical distribution equipment where the CPS Filter is to be installed.

Install a branch circuit breaker to feed the CPS filter device for ease of installation. The unit contains UL and CSA approved fusing to protect against short circuit fault conditions within the device.

Over current protection is not specifically required, although most customers choose to install a circuit breaker as a disconnect device on panelboards or switchgear assemblies. (See Table 2 for suggested circuit breaker size). Follow NEC, CEC and applicable local codes when connecting the CPS directly to the Bus Bar.

Install metal conduit (rigid or flexible) between the CPS and the electrical panel. Run wiring from the panelboard to the CPS terminals (See Table 2 for recommended wire size).

Note: Twist and bind together all leads. Route the wires such that their overall length is kept to a minimum. This reduces line impedance and optimizes performance.

Table 2: Suggested Circuit Breaker & Wire Size

CPS MODEL NUMBER	WIRE GAUGE REQUIRED	MINIMUM CIRCUIT BREAKER SIZE (IF USED)
CPS – B, S, S2, S3, H, H2, M, M2	# 10 - 2 AWG	30 Amp Suggested

Strip the ends of the wires and terminate them in the panelboard. Ensure the use of proper color codes; tighten all connections. Green or green/yellow (ground), white (neutral), red (hot), blue (hot), black (hot).

Recheck all connections.

If remote monitoring is employed, connect the form “C” contacts to an alarm or building monitoring system (such as an addressable relay). These contact relays will accept up to 220 VAC, 1A (See Section 3.2.3).

Switch the MAIN power to the **ON** position. Ensure all status indicator lamps are **lit** (see Section 3 - Operating Features).

SECTION 2.2 INSTALLATION PROCEDURES

Caseless Suppressor with Remote Display Panel (RDP) (enclosure style RC2)

Caseless Suppressors – Retrofit Applications

The “caseless” suppressor is designed for Contractors and OEMs that require a suppressor easily installed inside distribution equipment.

The benefits of the caseless design are:

1. Easily installed in existing/new equipment.
2. Small footprint enables the unit to be mounted close to the bus bar, significantly reducing installation lead length, thereby, improving suppression performance.
3. A Remote Diagnostic Panel (RDP) can be installed on the front of the distribution equipment trim to provide visual indication of operating status.

2.2.1 Site Preparation and Installation Recommendations for Caseless CPS

Refer to the following sub sections under Section 2.1 - Retrofit Suppressor for instructions on how to install the caseless CPS inside low voltage distribution equipment:

- 2.1.1 Site Preparation
- 2.1.2 Installation Recommendations – Where to Install the CPS?
- 2.1.3 Minimize Installation Lead Length
- 2.1.4 Wiring

2.2.2 Remote Diagnostic Panel (RDP) Installation

A. Location

Identify the most convenient location for mounting the RDP. Mark cut-outs and panel mounting holes (5.13 x 8.57 inches) (130.30 x 217.68mm) as shown in Diagram 1: RDP Installation.

B. Mounting RDP

Attach the RDP to the distribution equipment using the six panel mounting holes. Mounting screws (10-32 x 3/8”) are furnished with the RDP. Prior to mounting the RDP a cutout 5.13 x 8.57 inches (130 x 218 mm) must be made to mount the monitoring assembly (see attached diagram).

C. Wiring RDP to Caseless CPS Unit

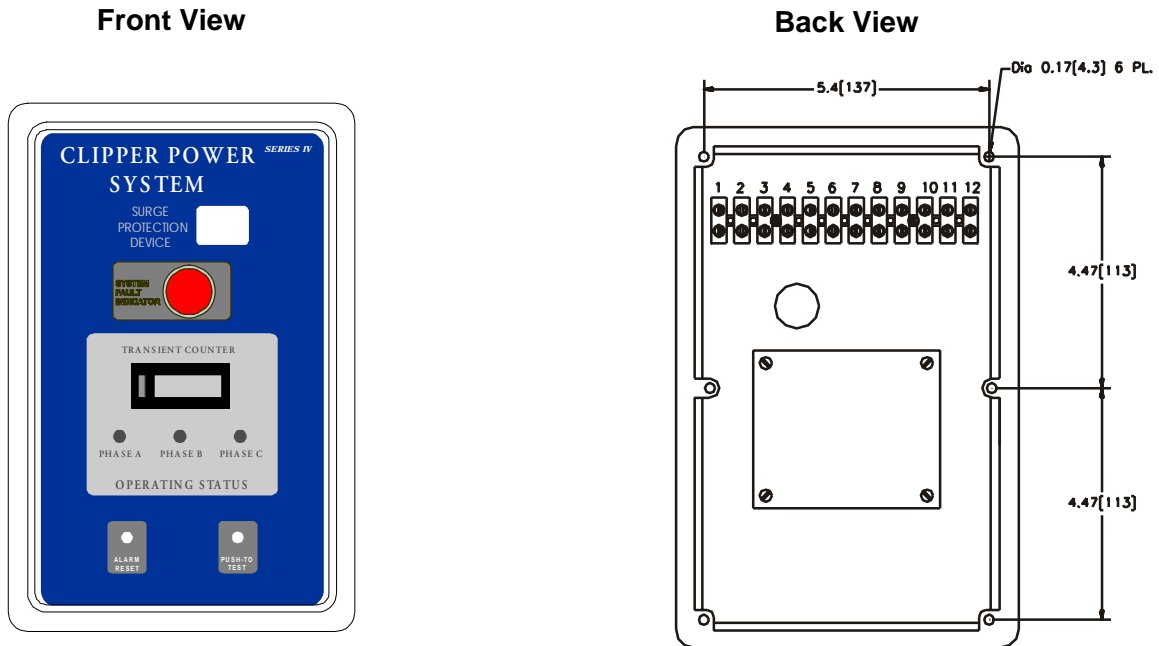
Measure the wiring distance between the CPS suppressor and RDP. Keep stray wire clear of all bus bars or internal power equipment. Total wiring distance should be less than 50 feet (15m).

RDP installation wiring is required for connecting the CPS to the RDP (#16 AWG minimum; #14 AWG maximum standard wire).

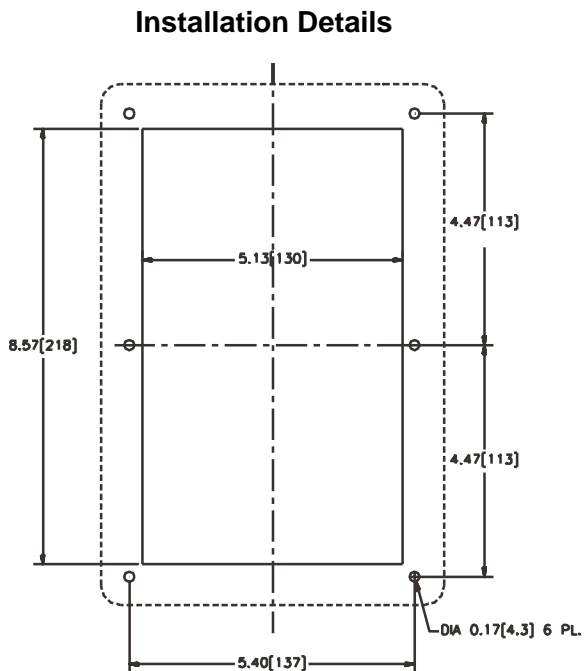
The CPS and RDP have clearly labelled terminal blocks (numbered 1 through 12). Connect the wires between the CPS and RDP. Ensure each wire is fastened to the same numerical location on both terminal blocks (e.g. the wire installed at location #1 on the CPS must be installed at location #1 on the RDP).

Bundle all internal wiring.

Diagram 1: RDP Installation



Premium Display Version shown. Can also be BD, SD, ED with differing monitoring options.



SECTION 2.3 INSTALLATION PROCEDURES

MCC & Busway

MCC & Busway Suppressors



2.3.1 Site Preparation

Verify that your application voltage and wiring configuration are the same as the enclosed CPS by checking the voltage rating label located on the CPS container.

Review the site to ensure the physical space required to install the CPS suppressor exists.

Check the facility grounding system. All grounding, bonding and earthing practices must meet NEC and CSA approved practices. A poor ground, or grounding/bonding violations seriously affect the suppressor's ability to function as specified.

2.3.2 Motor Control Centers (MCC) and Busway Components

The CPS unit has been installed in a standard MCC bucket or Bus Plug and factory tested to facilitate easy installation.

For MCCs, the diagnostic and monitoring system is attached to the integral device panel mounted on the MCC door.

For Bus Plugs, the diagnostic and monitoring system

has been mounted on the outside of the plug enclosure.

2.3.3 Recommended CPS Location (MCC/Bus Plug)

For service entrance **MCC structures**, the optimum location for the CPS unit is on the load side of the main breaker. For sub-feed MCC structures the CPS should be installed close to microprocessor based loads (i.e. PLC, sensors, digital equipment). In this location, the CPS reduces transient/EMI emission from drives and protects other associated motor loads.

Bus Plugs can be mounted directly into the busway system. For industrial applications, select a Bus Plug location close to sensitive loads such as robotic equipment, CNC machines or other electronic based equipment. For commercial buildings, where the busway is mounted vertically, the CPS unit can be located at the desired building floor.

2.3.4 Installation

For MCC applications, slide the CPS bucket assembly into the MCC structure. Close the door and securely fasten the lock.

For busway applications, insert the CPS Bus Plug into the busway system at the desired location. Ensure proper connection of all phase conductors including the neutral and ground connections.

For busway systems, turn the disconnect switch to the **ON** position to complete the installation of the CPS unit.

If a remote monitoring option is employed, connect the FORM C contacts to an alarm or building monitoring system. These contact relays will accept up to 220 VAC, 1A.

Switch the MAIN power to the **ON** position for the panelboard and CPS device.

Ensure indicator lights are **lit** (see Section 3 – Operating Features).

SECTION 3 OPERATING FEATURES FOR ALL CPS UNITS

The suppressor is a passive device and does not require regular servicing. To keep you informed of the suppressor's operating status, each CPS is equipped with status indicator lights. As described in Table 1 (Section 1 – Introduction), your unit may be equipped with additional features/options.

3.1 Internal Fusing and Status Indicator Lights

Most units are equipped with 200 kAIC internal fusing. Should the suppressor fail and create a short circuit, the overcurrent protection will isolate the fault.

All units are equipped with status indication lights on each phase. CPS models with BD display package have neon status indicator lights on each phase. These lights turn off if a fuse has opened or if power has been turned off.

Other diagnostic packages (SD,ED,PD) have green/red LED indicator lights on each phase. When the green light is illuminated, the system is operating properly. In the unlikely case the fuse opens, the LED's will change to red and the flashing alarm will signal a fault.

3.2 Monitoring Options

3.2.1 TRI-Monitor™ System

The TRI-Monitor™ is included on all SD, ED, and PD options and has the following features:

- i) Fuse sensing circuitry that identifies a short circuit failure and changes the status of the indicator lights.
- ii) Infrared sensor system that detects a component failure, including open MOVs on any mode.
- iii) Thermal Detection Circuitry to identify any component over-heating due to stress or failure.

3.2.2 TRI-Monitor™ Flashing Trouble Light

The large red trouble light is a standard feature on SD, ED, PD diagnostic packages. This trouble alarm

will flash if any fault condition is detected. The trouble light is visible from a distance up to 50 feet (15m).

3.2.3 Remote Status Indication (optional)

The CPS may be equipped with optional isolated single Form C relay contacts. These dry contact terminals are identified as N.O. (normally open), N.C. (normally closed), and COM (common). The Form C contacts may be wired to one or more remote locations to identify a change of status. Check the operation of the Form C relay monitoring contacts by switching the power OFF and back ON. NOTE: Contacts are rated up to 1A/220V AC.

3.2.4 Push-To-Test Feature (optional)

The push-to-test feature is designed to provide users with real time testing of the suppressor's monitoring and diagnostic system. By depressing the test button, the diagnostic system initiates a self test procedure. If the system is fully operational, the self test will activate all indicator lamps, alarms, and contactors.

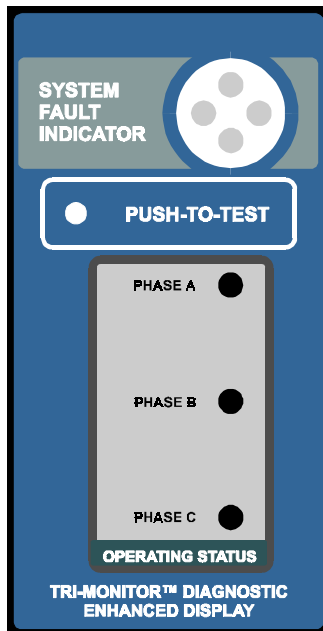
3.2.5 Transient Counter (optional)

The transient counter is an 8 digit LCD display system designed to indicate to the user how many transients have occurred at this location. The event counter triggers each time a significant surge occurs. Note that low level surges suppressed by the filter elements are not counted. A reset button allows the surge counter to be zeroed.

3.2.6 Audible Alarm

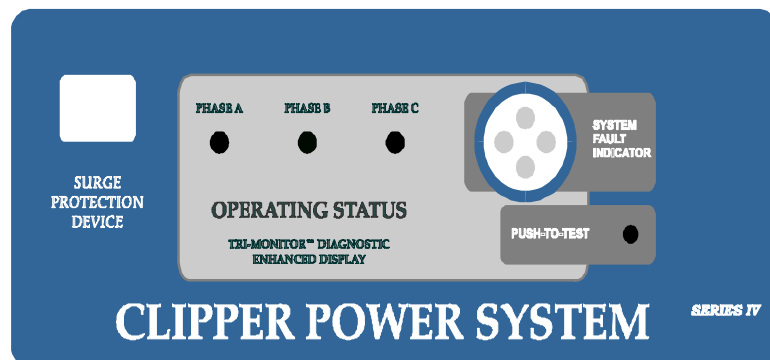
An audible alarm is activated should any fault be detected by the TRI-Monitor™. The audible alarm can be disabled after acknowledgement by pushing the Alarm Reset switch.

Retrofit TRI-Monitor™ Panel



For illustrative purposes, panel shown is ED diagnostic panel.

Integrated TRI-Monitor™ Panel



For illustrative purposes, panel shown is ED diagnostic panel.

SECTION 4 TROUBLESHOOTING GUIDE

SECTION 5 WARRANTY

4.0 Troubleshooting Guide

The CPS suppressor is a rugged suppression device. In the unlikely case that the CPS indicator lights change status, the trouble light flashes, or audible alarm or remote alarms are activated, call the CPS Warranty Department (403) 717-2000 for a replacement unit. The CPS suppressor is warranted for ten years and Cutler-Hammer's standard return policy applies.

Note: the suppression module and filter assembly should not be field repaired.

4.1 Life Expectancy

A properly supplied suppressor is designed to provide over 25 years of life expectancy. These units will not fail due to degradation of internal components, even when exposed to continued high energy induced surges.

CPS unit reliability has been verified by extensive testing at independent lightning laboratories. These tests confirm the suppression circuitry can meet the published Surge current ratings. Note: the CPS unit can withstand repetitive induced lightning surges on the AC powerline. These test levels are significantly higher than IEEE recommended surges (as published by IEEE C62.41).

4.2 What Causes a Suppressor to Fail?

The CPS suppressor is designed and tested to survive thousands of high energy surges. If the unit becomes damaged, the failure is typically due to the following causes:

1. Inadequate Grounding.
2. Temporary Over Voltage (TOV). This rare event occurs when the electrical system experiences a fault that results in RMS overvoltage in one or more phases.

When the voltage rises over 25% above the nominal operating voltage, the internal suppression components are damaged as they attempt to shunt this prolonged multi-cycle overvoltage event.

5.0 Warranty

Cutler-Hammer warrants these products for a period of ten years from the date of delivery to the purchaser to be free from defects in both workmanship and materials. Cutler-Hammer assumes no risk or liability for results of the use of the products purchased from it, including but without limiting the generality of the foregoing: (1) The use in combination with any electrical or electronic components, circuits, systems, assemblies or any other materials or substances; (2) Unsuitability of any product for use in any circuit or assembly. Purchaser's rights under the warranty shall consist solely of requiring Cutler-Hammer to repair, or at Cutler-Hammer's sole discretion, replace, free of charge, F.O.B. factory, and defective items received at said factory within said term determined by Cutler-Hammer to be defective. The giving of or failure to give any advice or recommendations by Cutler-Hammer shall not constitute any warranty by or impose any liability upon Cutler-Hammer. The foregoing constitutes the sole and exclusive remedy of the purchaser and the exclusive liability of

Cutler-Hammer AND IS IN LIEU OF ANY AND ALL OTHER WARRANTIES EXPRESSED, IMPLIED OR STATUTORY AS TO THE MERCHANTABILITY, FITNESS FOR PURPOSE SOLD, DESCRIPTION, QUALITY, PRODUCTIVENESS OR ANY OTHER MATTER. In no event shall Cutler-Hammer be liable for special or consequential damages or for delay in performance of the warranty.

This warranty does not apply if the product has been misused, abused, altered, tampered with, or used in applications other than specified on the nameplate. At the end of the warranty period Cutler-Hammer shall be under no further warranty obligation expressed or implied.

The product covered by this warranty certificate can only be repaired or replaced by the factory. A RETURN PRODUCT NUMBER (R.P.N.) must be obtained by contacting Cutler-Hammer Warranty representative. PH: (403) 717-2000, FX: (403) 717-0567. The Cutler-Hammer representative will require a detailed description of the fault made, as well as your name, address and telephone number. Repair or replacement will be returned to collect. If Cutler-Hammer finds the return to be a manufacturer's defect, the product will be returned prepaid.