Underground Distribution Switchgear

COOPER Power Systems

EMS Digital Control Installation, Programming, and Operation Instructions

S285-35-1

Applicable to the EMS Vacuum Fault Interrupter applications

Figure 1.
Three-phase EMS Digital Control.

Contents

 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, 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 an imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ **WARNING:** Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠ **CAUTION:** Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

CAUTION: Indicates a potentially hazardous situation which, if not avoided, may 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 hazardous voltage will cause death or severe personal injury. Follow all locally approved safety procedures when working around high- and low-voltage lines and equipment. G103.3

⚠ **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. G101.0

⚠ **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. G102.1

⚠ **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. G122.3

PRODUCT INFORMATION

Introduction

This manual provides installation instructions, operation information, and testing procedures for the EMS Digital Control.

These controls are used in conjunction with Edison Modular Switchgear Vacuum Fault Interrupter applications. Refer to Service Information S285-90-1 *Edison Modular Switchgear Installation, Operation, and Maintenance Instructions* packaged with the switchgear for specific information.

> **IMPORTANT:** This hardware/software is subject to the U.S. Export Administration Regulations and other U.S. laws, and may not be exported or re-exported to certain countries (currently, Cuba, Iran, North Korea, Sudan and Syria) or to persons or entities prohibited from receiving U.S. exports (including those (a) on the Bureau of Industry and Security Denied Parties List or Entity List, (b) on the Office of Foreign Assets Control list of Specially Designated Nationals and Blocked Persons, and (c) involved with missile technology or nuclear, chemical or biological weapons).

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 processes 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, contact your Cooper Power Systems sales representative.

Acceptance and Initial Inspection

Each EMS Digital Control is completely assembled, tested, and inspected at the factory. It is carefully calibrated, adjusted and in good condition when accepted by the carrier for shipment.

Upon receipt, inspect the carton for signs of damage. Unpack the control and inspect it thoroughly for damage incurred during shipment. If damage is discovered, file a claim with the carrier immediately.

Handling and Storage

Be careful during handling and storage of the control to minimize the possibility of damage. If the control is to be stored for any length of time prior to installation, provide a clean dry storage area.

Quality Standards

ISO 9001:2000-Certified Quality Management System

Description of Control

The microprocessor-based EMS Digital Control interfaces to a Windows®-based PC via a USB connection. Programming of the control is done with the EMS interface software. Settings include: minimum trip settings for phase and ground, trip blocking for phase and ground, and independent or ganged tripping operation. Up to eight Time-Current Curves (TCCs) can be saved in the control for easy use (others may be downloaded into the control, or edited in TCC Editor). Default EMS control TCCs are F, EF, H, KF, TF, IEC I, IEC II and IEC III. There are three protection profiles in the control for easy configuration. Settings files may be downloaded to the control via the USB interface cable. High Current Trip (HCT) and Cold Load Pickup (CLPU) are included and are fully programmable via the interface software. Three metered phase currents, as well as a calculated residual ground current, are available to be viewed through the interface software. Status LEDs on the face of the control indicate Control Powered / Control OK, Above Minimum Trip, Faulted Phases or Ground Fault, or Control Failure.

Note: As of the time of print of this manual, only the three-phase trip version of the EMS Digital Control is available.

All EMS Digital Controls use integral 1000:1 current transformers (CTs) both to meter line current and to power the control. A minimum of 7.5 A line current is required to power the control. No external power source or battery is required to provide overcurrent protection. The control transitions to USB-powered mode when it is connected to a PC, via the USB interface cable.

Control Interface Cables

Bushing Mount Version

The bushing mount EMS Digital Control has two M12-sized connectors on the top of the control housing. The connector to the left is the 4-pin flux shift tripper connector.

The connector on the right is the communications connector, used for programming and interrogating the control. The EMS Digital Control comes with a USB interface cable to connect the control to a PC. Extension cables that permanently connect to the control are attached to cable ties permanently mounted on the inside of the switchgear cabinet doors (see Figure 2). This provides a remote access point so the user can maintain a comfortable operating distance from energized switchgear. Figure 2 shows two controls inside the switchgear cabinet, with an extension cable for each control. Refer to **Control Programming and Operation**.

Figure 2.
Edison Modular Switchgear/Control Cabinet.

DESCRIPTION OF CONTROL OPERATION

Phase Trip

Controls are powered by system current via the CTs. They require no external voltage supply or battery backup and are not affected by system voltage conditions (such as over-voltage transients).

The line current is monitored by the internally mounted 1000:1 CTs. If the current sensed is greater than the programmed minimum trip level, the control will begin fault timing, and delay the trip signal based on the fault level and a user-selectable Time-Current Curve (TCC). At the completion of the time delay, a trip signal is issued which causes the fault interrupting switchgear to trip open.

Each individual phase has its own trip capacitor, that is monitored by the microprocessor to ensure that enough voltage is present to properly operate the flux shift tripper.

Ganged Trip operation trips all three phases when a fault is detected on any one phase.

> **IMPORTANT:** Do not use the single-phase trip mode on a fault interrupter with three-phase ganged trip mechanism.

- Single-phase trip mode allows the independent tripping of a faulted phase, but only when the fault interrupter is equipped with independent pole operating mechanisms. As of the date of this publication, only three-phase gang trip mechanisms are available. See IMPORTANT note above.

Ground Trip

If the Ground Trip feature is activated, when a phase imbalance exceeds the programmed minimum trip level, the EMS Digital Control begins timing on the selected Ground TCC and issues a trip signal as programmed, causing the switchgear to trip open.

Phase and Ground Minimum Trip

Phase and Ground Minimum-Trip settings are selected via PC through the EMS Digital Control Interface Software.

Phase and Ground current levels are continuously compared to the programmed minimum trip values. However, TCC timing does not start until the measured current is above the programmed minimum trip value.

Cold Load Pickup (CLPU)

Cold Load Pickup allows the user to switch to different overcurrent settings for a programmable amount of time to allow for transformer inrush and cold load currents to subside. If current drops below 3 A on any phase for greater than one second, CLPU will be activated when the current returns to a level above 3 A (CLPU will only be activated if it has been enabled in the EMS Digital Control Interface Software). The CLPU TCC / Overcurrent settings remain active until the user-programmed amount of time has elapsed, at which time the control will revert to its normal protection profile settings.

High Current Trip (HCT)

High Current Trip bypasses the normal TCC time delay associated with overcurrents to provide quicker tripping response to high-magnitude faults. With HCT the fault duration is reduced and coordination with source-side protection is extended through improved system coordination.

Settings accessible through the EMS Digital Control Interface Software allow for changing the multiple of the minimum trip setting at which HCT is activated. Multipliers are available for both ground and phase currents. There is also a user selectable HCT delay in multiples of ¼ cycle. After the HCT is activated, the control will issue a trip signal in the selected number of ¼ cycles or according to the TCC time, which ever is faster.

- Phase HCT and Ground HCT are disabled while in Test Mode.
- Phase HCT is disabled when Phase Trip Blocked is enabled.
- Ground HCT is disabled when Ground Trip Blocked is enabled.

LED Status Indicators

The EMS Digital Control has three multi-color LEDs located on the front of the control housing to indicate the current status of the control. In a three-phase system each LED represents the status of one of the three phases. Depending on the current status of the control, the LEDs will blink a different color and rate. The control must have power for LEDs to illuminate. The LED blinking patterns for each status are described below.

- **Green LED (ON 0.2 seconds, OFF 1.8 seconds)**

  To indicate that the control is operating normally and current is sensed on a particular phase, the control will blink the LED corresponding to the powered-up phase green, with a blink rate of 0.2 seconds ON and 1.8 seconds OFF.

- **Green LED (ON 0.02 seconds, OFF 2.0 seconds)**

  To indicate that the control is operating normally and powered via USB, but no CT current is present, the control will blink all three LEDs green, with a blink rate of 0.02 seconds ON and 2.0 seconds OFF.

The 0.02 second-on blink rate only occurs when CT current is absent. If the control senses CT current on any phase, the appropriate LEDs will blink as previously described.

Note: If a three-phase control is placed in single-phase mode only the center LED will blink green when the control is powered only via the USB connection.

- **Yellow LED (ON 0.2 seconds, OFF 1.8 seconds)**

  To indicate that the current sensed on a particular phase is above the programmed minimum trip level, the control will blink the appropriate LEDs yellow. When the LED is blinking yellow, TCC timing has begun. If the ground current is above minimum trip, all three LEDs will blink yellow until the switch opens. This condition will usually only be witnessed during testing.

  Note: Three yellow LEDs can indicate a ground current above minimum trip status, or that all three phase currents are above minimum trip simultaneously.

- **Blue LED (ON 0.2 seconds, OFF 1.8 seconds)**

  To indicate that a fault target has been set on a particular phase, the control will blink the appropriate LED blue. If auto target reset is enabled, this condition will cease after the programmed target reset time. If auto target reset is disabled, this condition will persist until the targets are manually reset via the EMS Digital Control Interface Software. Refer to the **Control Programming and Operation** section for additional information regarding auto target reset. If a fault has been set on the ground phase, all three LEDs will blink blue.

  Note: Three blue LEDs can indicate a ground fault, or individual faults set on all three phases simultaneously.

- **Red LED (ON 0.2 seconds, OFF 1.8 seconds)**

  To indicate a control failure/error status, the control will blink all three LEDs red (NOTE: In single-phase mode only the center LED will blink). This condition will persist until the failure/error is corrected.

IMPORTANT: The control will also blink the LEDs red if the active profile is using the default factory settings. This condition will cease after at least one setting in each profile and a setting in Cold Load Pickup has been changed. The LEDs may also blink red after a firmware download. This occurs anytime the new firmware results in a database change because a database change causes the control to revert to default settings. For more on downloading new firmware see the 'Download Firmware' section.

Protection Profiles

The EMS Digital Control has three user-programmable protection profiles. Each of these profiles contains a group of settings necessary for control operation. The user can activate any one of these three protection profiles via the EMS Digital Control Interface Software. The profile that the user selects to be active is the only profile that will affect control operation; the other two profiles remain inactive unless selected by the user via the software.

This control also has one Cold Load Pickup (CLPU) profile.

When CLPU is selected, the control will switch to this profile for as long as CLPU is active. This CLPU profile is shared by all three normal protection profiles. Any protection profile that has CLPU enabled will switch to the CLPU profile when it is activated. For additional information on CLPU settings, refer to **Cold Load Pickup** in the **Control Programming and Operation** section.

> **CAUTION:** Unintended operation. Check minimum trip values prior to changing to active profile. Failure to do so may cause unintended operation of the switchgear under load conditions.   T336.0

Time-Current Curve (TCC) Delay

The Time-Current Curve (TCC) is selected by the user. Up to eight curves can be stored in the control's memory. TCC selections are made via the EMS Digital Control Interface Software. Customized TCCs can be created with a separate Cooper Power Systems TCC Editor program and then downloaded to the control via the EMS Digital Control Interface Software as one of the eight stored curves. The TCCs are a digitized table of values that the microprocessor references to determine the time delay before issuing a trip signal. When the current sensed exceeds the set minimum trip value, the time delay is determined by the selected time current characteristic curve.

When the microprocessor determines the TCC delay has expired, it issues a pulse to a low energy actuator (flux shift tripper), which in turn causes the fault interrupting switchgear to open. The trip pulse energy is stored in capacitors, that are also monitored by the microprocessor. The three individual, high-grade trip capacitors, are per phase, and are backed up by a single large reserve capacitor under normal operating conditions.

Tolerance

Response time tolerance is +/-10% on a time basis with +/- 0.01 second minimum, or +/-10% on a current basis with +/- 5A minimum, whichever is greater. This applies to all EMS factory-default curves; F, EF, H, KF, TF, IEC1, IEC2, IEC3.

When the interrupter is closed into fault current greater than 10kA, from a de-energized state, the control requires additional time to arm for a trip operation. The average arming time is less than 35 ms additive to TCC response time at fault currents greater than 10kA.

Settings Files

Settings files store all of the settings present in a particular control (except the eight TCCs). This includes control settings, all three protection profile settings, and the CLPU profile settings. When connected to a control, the user can upload the settings that are currently stored in the control to a settings file via the EMS Digital Control Interface Software. This file can then be downloaded into any EMS Digital Control. After the settings file is downloaded, the control will operate exactly like the control whose settings were uploaded into the file. This is an easy way to configure a control instead of changing all of the settings manually. Setting files are stored in the C:\\Program Files\Cooper Power Systems\EMS Digital Control folder directory with the format *.ems.

> **IMPORTANT:** Whenever a settings file is downloaded into a control, the settings take place immediately.

> **IMPORTANT:** In order for two controls to have identical programming, all eight TCCs must be identical and stored in the same locations. For example, if control #1 has an EF curve stored in the TCC 2 location, then control #2 must have an EF curve stored in the TCC 2 location.

> **CAUTION:** Unintended operation. Before downloading a settings file to the control, verify that the settings are correct for the location and application. Downloading a settings file designed for a different location or application can result in unintended operation of the switchgear.   T337.0

INSTALLATION INFORMATION

Control Installation

⚠ **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 can result in death, severe personal injury, and equipment damage.

G102.1

The control must be programmed with all necessary operating settings and parameters prior to operation using the USB interface cable connected to a PC.

Should installation of a replacement control be necessary refer to **Maintenance Information** Section.

Note: Initial programming of the control is the responsibility of a qualified technician or engineer familiar with control functions and programming parameters required for the EMS installation.

⚠ **WARNING:** Hazardous voltage. Solidly ground all equipment. Failure to comply can result in death, severe personal injury, and equipment damage.

T223.2

⚠ **WARNING:** Hazardous voltage. Verify center CT module is solidly grounded before touching or connecting to programming cable. Failure of high-voltage insulation system could result in electric shock via the programming cable causing death or serious injury.

T339.1

Digital Control Interface Software

Minimum System Requirements

The EMS Software will give optimal performance if run on a computer with the following specifications:

- Windows® 2000 SP4 or Windows® XP Professional Edition SP2 operating system
- Intel® Pentium® IV processor (or equivalent) with a 1.8 GHz minimum speed
- 512 MB of RAM
- 290 MB of free hard-disk storage space
- Monitor screen resolution of 1024 x 768 pixels (or higher). USB: One available type A Host USB 1.1 port capable of supplying at least 100 mA at 5V

These are the minimum PC requirements for this software:

- Microsoft® Windows® 2000 SP4 or Windows XP SP2 operating system
- Intel® Pentium® III processor (or equivalent) with a 500 MHz minimum speed
- 128 MB of RAM
- 290 MB of free hand-disk storage space
- Monitor screen resolution of 800 x 600 pixels. USB: One available type A Host USB 1.1 port capable of supplying at least 100 mA at 5V.

EMS Digital Control Interface Software Installation

IMPORTANT: This hardware/software is subject to the U.S. Export Administration Regulations and other U.S. laws, and may not be exported or re-exported to certain countries (currently, Cuba, Iran, North Korea, Sudan and Syria) or to persons or entities prohibited from receiving U.S. exports (including those (a) on the Bureau of Industry and Security Denied Parties List or Entity List, (b) on the Office of Foreign Assets Control list of Specially Designated Nationals and Blocked Persons, and (c) involved with missile technology or nuclear, chemical or biological weapons).

Installing from a CD-ROM

The EMS Digital Control Interface Software is installed like many other Microsoft® Windows® applications. If you are not familiar with installing Microsoft® Windows® applications, you may want to seek assistance with this installation.

Note: You must have administrative rights to install EMS Digital Control Interface Software on computers with Windows® 2000 or Windows® XP.

Insert the EMS Digital Control Interface Software CD into the drive. The Setup program should start automatically.

Note: If the Setup program doesn't start automatically, complete the following steps:

1. Select RUN from the Start menu.

2. Type d:/setup.exe
   (where d=CD-ROM drive letter)

3. Click OK.

The initial setup screen should be displayed.

The first part of the EMS Digital Control installation is the Microsoft .NET Framework 2.0 install program. The first screen will present the Microsoft .NET Framework 2.0 EULA agreement. In order to properly install the .NET Framework 2.0 program, click Accept.

Note: Installing the .NET Framework 2.0 program may take several minutes based on your computers hardware setup.
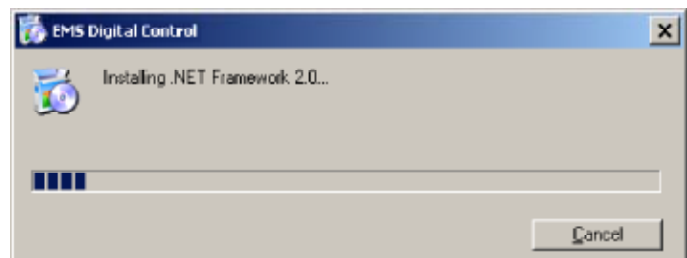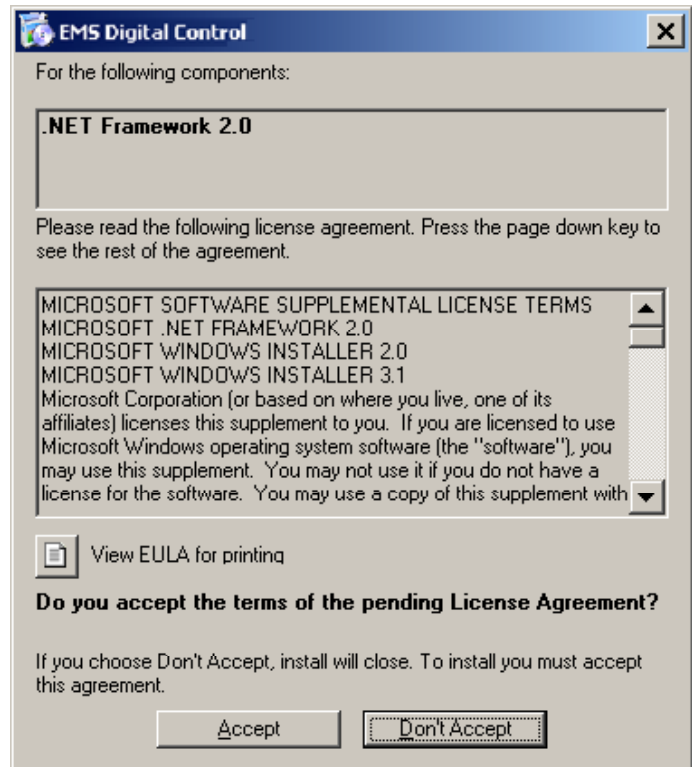
EMS Digital Control Setup

After the .NET Framework 2.0 program has installed, the EMS Digital Control Setup Wizard will start. The first screen that you will see is the Setup Welcome screen.

1. Click on Next> to continue software installation.

Read the Software License Agreement.

2. Click on the I Agree radio button to accept the License Agreement.

3. Click Next> to continue software installation.

The next screen that will display is the EMS Digital Control Information screen. This screen shows important information and limitations for distribution of the EMS Digital Control Software. Please read this information.

4. Click Next> to continue software installation.
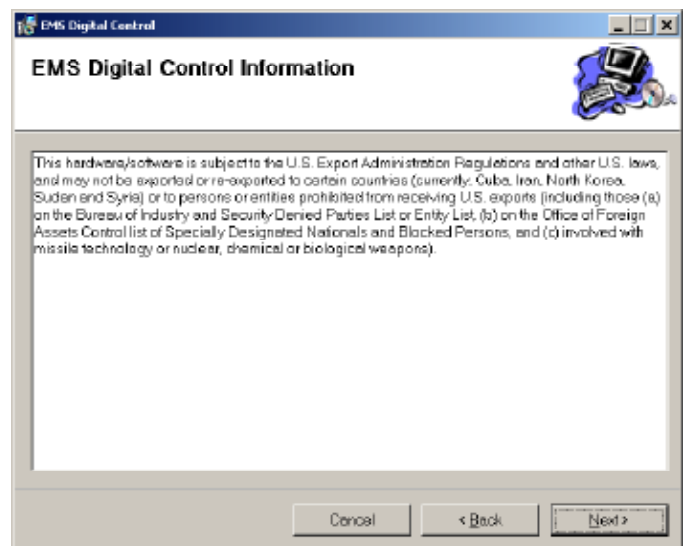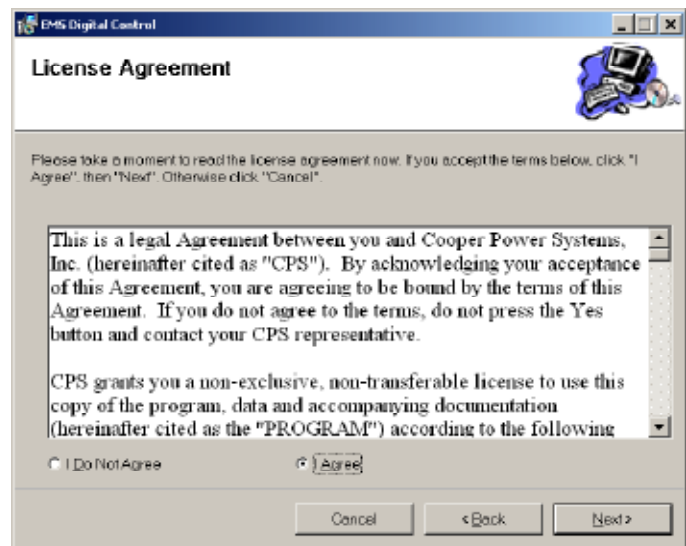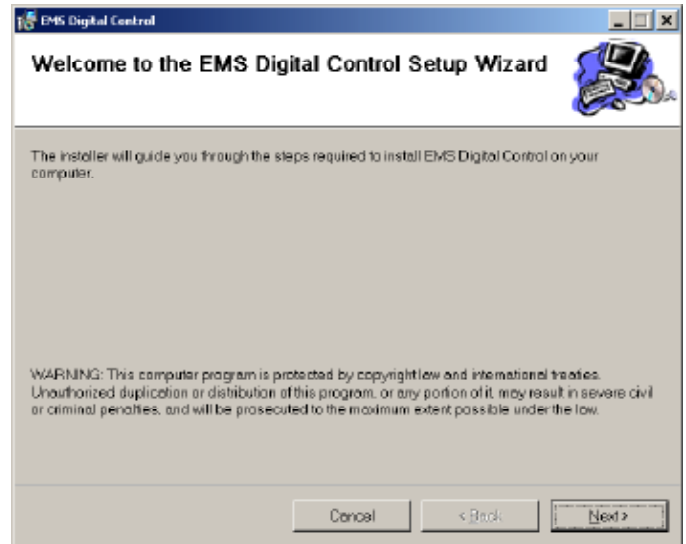
The next screen that you will see is the Select Installation Folder screen. This screen defines the destination folder for the EMS Digital Control software. All components of the software will reside in this folder. If you would like to change the destination directory, type the correct destination folder location or click Browse…

This screen also controls who will have access to the EMS Digital Control software on the local computer. Select the Everyone radio button to allow all users to use the software. Select the Just me radio button to limit software access to the current user ONLY.

5. To accept the default folder C:\Program Files/Cooper Power Systems\EMS Digital Control\ location and allow all users to have access to the EMS Digital Control software click Next>.

6. To confirm the installation click Next>.

Note: During installation of the EMS Digital Control, a DOS activity box will appear. This is normal for the install process and will disappear when installation has been completed.
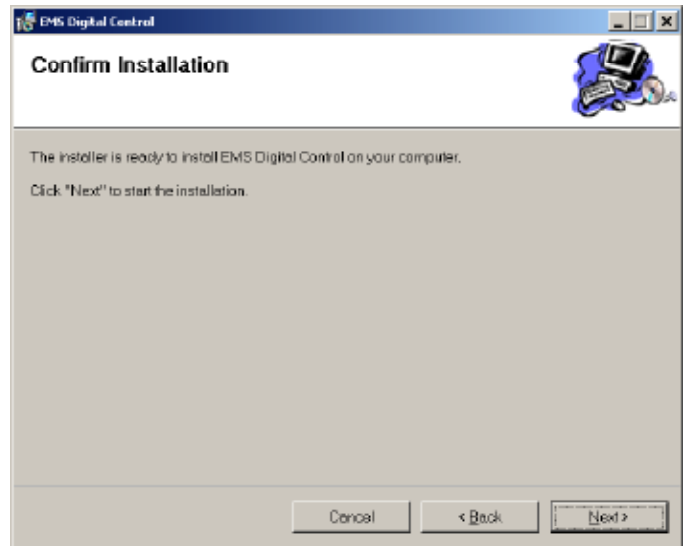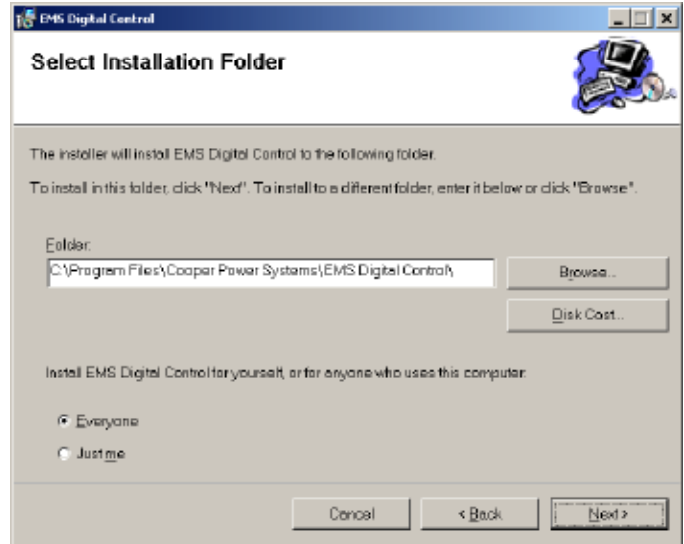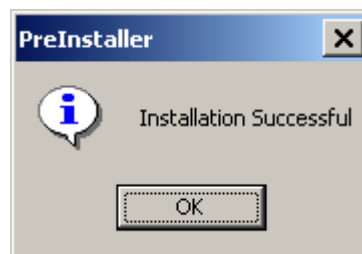
Install the USB to UART Drivers

Following the installation of the EMS Digital Control software, installation of the USB to UART drivers will begin.

The drivers will automatically install to the folder C:\Program Files\SiLabs\MCU\CP210x.

7. Click Install to load the USB to UART drivers.

8. Following driver install, a confirmation dialog box will appear. To continue installation click OK.

Install the TCC Editor (optional)

The final step in the install process is installation of the TCC Editor. The TCC Editor allows creation of custom Time Current Curves that can be input into the EMS Digital Control. This feature provides the flexibility to input almost any operating characteristic into the control. This enables the customer the ability to coordinate with a wide variety of other protective devices.

9. To install the TCC Editor software click Next>. To skip installation click Cancel.
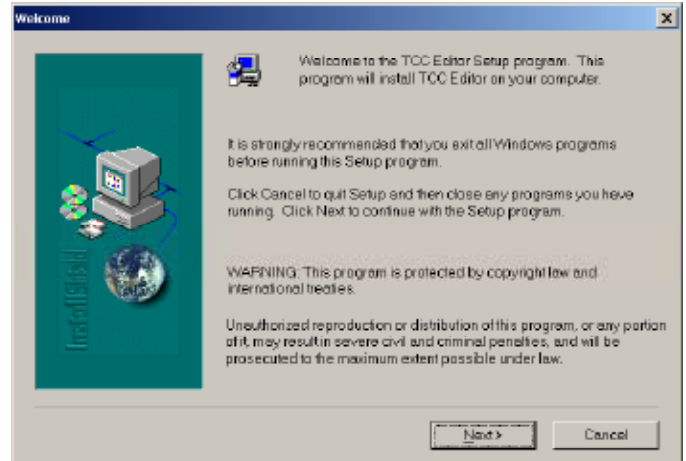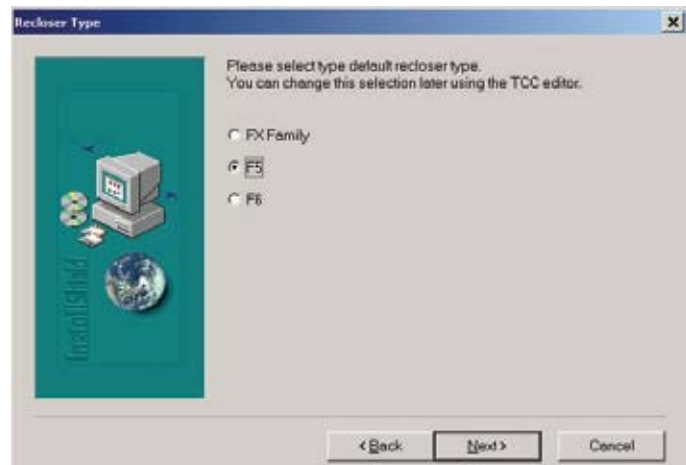
Choose the destination folder for the TCC Editor software.

10. Choose Next> to accept the default destination folder C:\Program Files\Cooper Power Systems\ TccEd32 and continue installation.
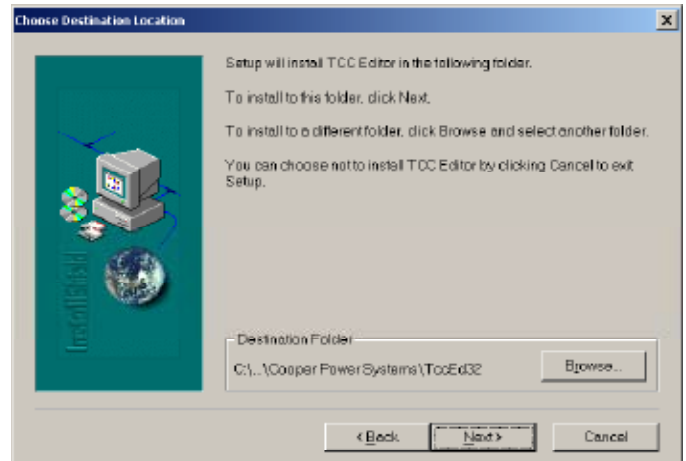
11. Select the F5 radio button as the default recloser type.

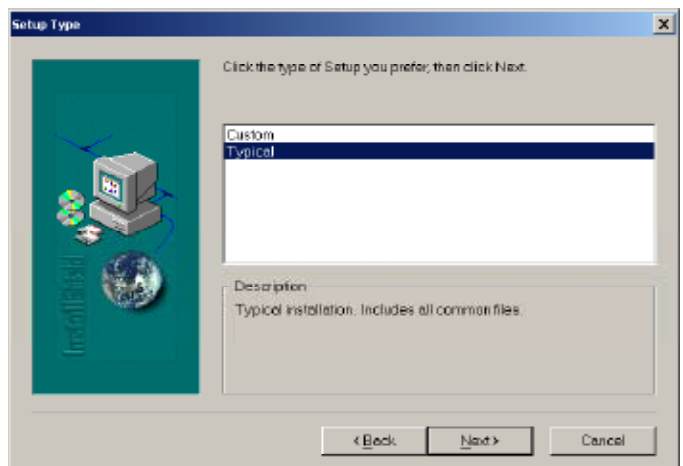**12.** Click Next> to continue software installation.

Select the system frequency for the distribution system that the EMS Digital Control will be used on. For North American applications this is almost always 60 Hertz.

13. Click on the 50 or 60 Hertz radio button to select system frequency.

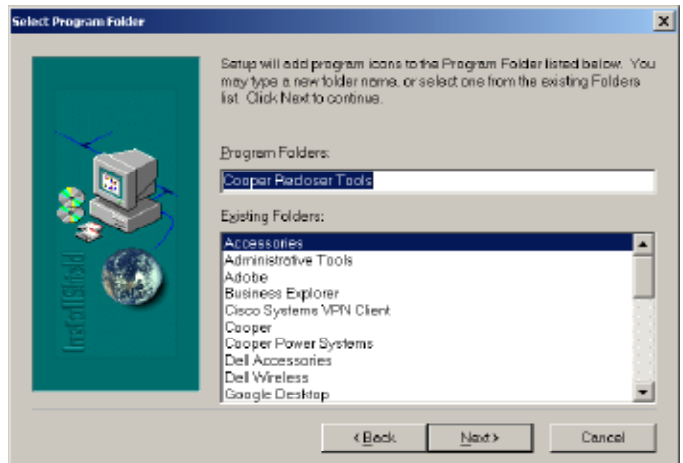**14.** Click on Next> to continue software installation.
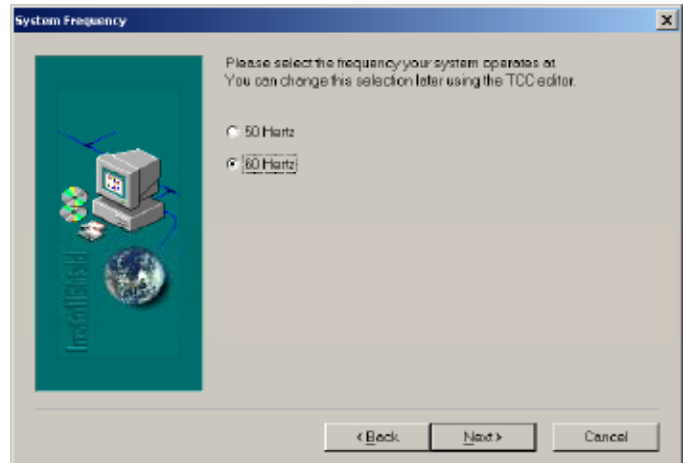
15. Select the Typical setup type for this installation.

16. Click on Next> to continue software installation.

Select the desired program folder location, or keep the default Cooper Recloser Tools folder location.

17. Click on Next> to continue software installation.

Upon completion of the TCC Editor Software setup, the Setup Complete dialog box will appear. You must restart your computer for all the recently installed settings to take affect.
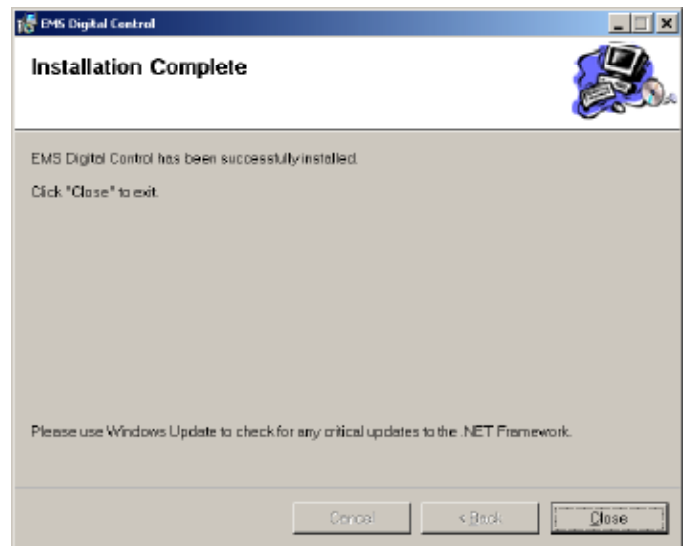
The installation process is now completed.

18. Click on the Yes, I want to restart my computer now radio button.

19. Click on <u>F</u>inish to complete software installation.
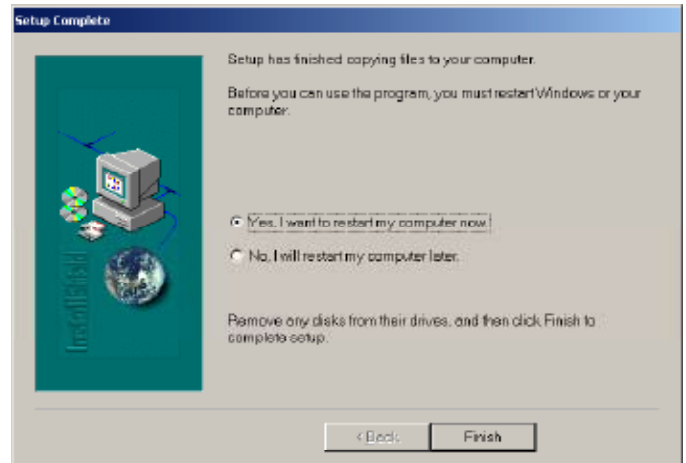
Installation is now complete. Upon installation of all software, you may encounter the EMS Digital Control Installation Complete dialog box.

20. Click <u>C</u>lose to exit the software installation program.

CONTROL PROGRAMMING AND OPERATION

⚠️ **CAUTION:** Equipment misoperation. Do not energize this equipment until all control settings have been properly programmed and verified. Refer to the Control Programming and Operation section of this manual for programming procedures. Failure to comply can result in misoperation (unintended operation), equipment damage and personal injury.   G118.1

CAUTION: Unintended operation. Downloading firmware while the switchgear is energized can cause the control settings to revert back to the default settings. This may cause unintended operation of the switchgear.   T335.0

All changes to the control settings must be made through the EMS Digital Control Interface Software.

Connecting to the Control

⚠️ **WARNING:** Hazardous voltage. Verify control is solidly grounded before touching or connecting to programming cable. Failure of high-voltage insulation system could result in electric shock via the programming cable causing death or serious injury.   T339.0

⚠️ **WARNING:** Hazardous voltage. Remove any connection to programming cable and do not touch programming cable while working on or handling high voltage cable. Accidental contact of high voltage cable to the control or programming cable could result in electric shock via the programming cable causing death or serious injury.   T333.0

Remove the waterproof protective cap(s) from the extension cable(s) on the inside of the switchgear cabinet doors.

1. Connect the USB interface cable to the 8-pin connector on the end of the extension cable. Then connect the USB interface cable to your computer's USB port.

   The computer will auto-detect the EMS Digital Control and activate the CP210x USB to UART driver installation. Once the drivers have been installed, you will be ready to connect via the interface software.

2. Locate and double-click on the EMS Digital Control Interface Software icon on your desktop. The software will be installed under the path C:\Program Files\Cooper Power Systems\EMS Digital Control

   You can also start the program by clicking on *Start> Programs>Cooper>EMS Digital Control* from the start menu.

Logging Into EMS Digital Control Interface Software

1. Click on the drop-down list arrow on the right side of the *Name:* dialog box.

2. Select the name of the appropriate access level.

> **Note:** The EMS Digital Control Interface Software has three different security access levels available to users at the log in screen. Additional usernames can be created that implement one of these security levels. Additional usernames must be created while logged in at the "Modify" level. See the User section of this document for more on usernames and passwords.

Modify: Full rights, no restrictions. A modify level user can change all settings, view all windows, trip the switchgear, download firmware and create other user accounts.

Operate: Users of this level cannot download firmware to a control, download a settings file to a control, add or edit users or edit the TCC library.

Users of this level can make settings changes to a file but may not make them directly to a control or load the settings file to a control. Operate users can issue remote trips and reset fault targets and demand currents.

View: Users of this level cannot download firmware to a control, download a settings file to a control, add or edit users, edit the TCC library or issue remote trips.

Users of this level can make settings changes to a file but may not make them directly to a control or load the settings file to a control. View users can reset fault targets and demand currents.

3. Select the password box.

4. Type in the password. The default password is the same as what you selected in the *Name* box.

   Note: Passwords are case-sensitive. Therefore type the name in the PASSWORD box exactly as it appears in the NAME drop-down list. The password will be disguised with asterisks (*).

5. Click on the *Login* button.

The loading screen will appear briefly.

Following the loading of the EMS Digital Control software, the main application window will be displayed.

You are now ready to connect to the control via the software interface.

Connecting to the EMS Digital Control

1. From the main application menu, click on *Connection>Connect to Network*. An alternate method for connecting to the appropriate network is to click on the Connect button on the main toolbar.
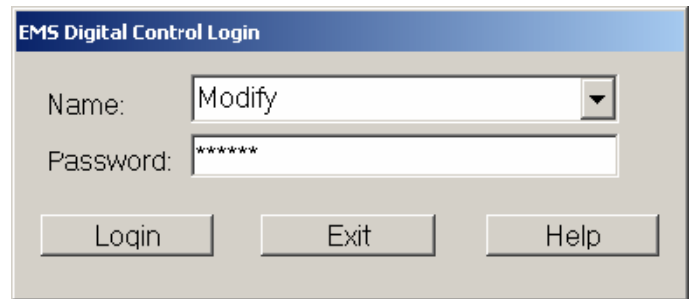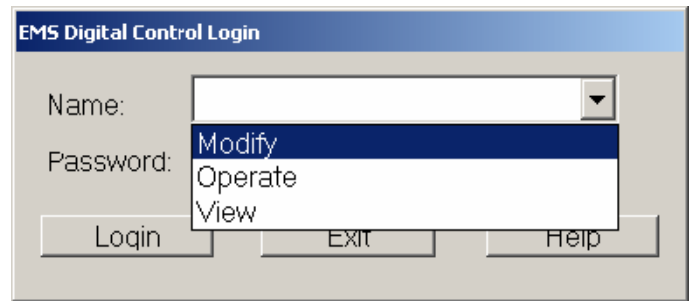
2. Select the appropriate COM port from the list of available communications ports and click *Connect*.

> **Note:** Make sure that the control is plugged into the USB port on the computer. The control must be attached to the PC via the USB interface cable for the COM port to appear (Usually the correct COM port will be the highest number shown).
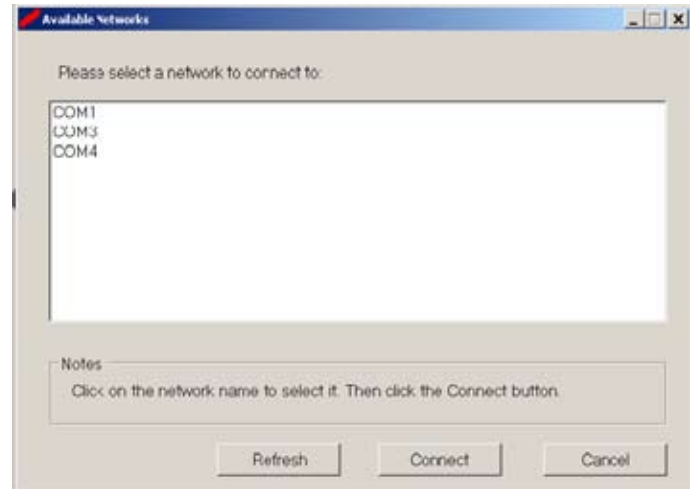
Upon successful opening of the connection between the software and the correct COM port, a dialog box will appear to confirm the connection.

3. Click OK to close the dialog box.

4. From the main menu select *Connection>Connect to the Control*, or click the *Connect* button on the Toolbar to open an active connection to the EMS Digital Control.

5. Select the appropriate controller from the Available controls dialog box by clicking the control's serial number and click *Connect*.

**6.** Click OK on the EMS Digital Control dialog box to complete the connection.

If no controllers show active in the dialog box, check the USB interface cable connection to the control and the USB connection to the computer and click *Refresh*.

If controllers are still not found following Refresh of the list, it is likely that the incorrect COM port was selected. Proceed with the following steps to disconnect from the COM port network and select a new COM port network connection until the controller is found:

A. Click *Cancel* to close the Available controls dialog box.

B. Select *Connection>Disconnect from Network* from the main menu, or click *Disconnect* from the Toolbar.

C. Follow steps 1–6 above to connect to the new COM port and connect to the appropriate EMS Digital Control.
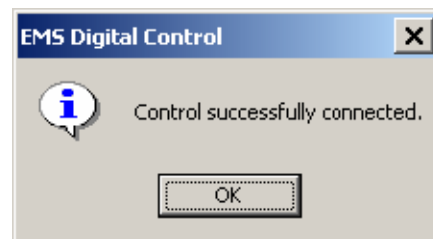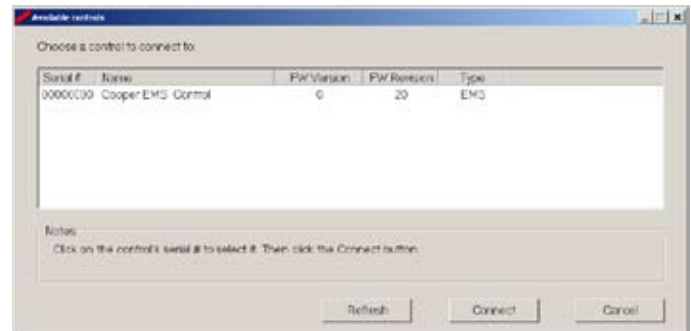
You are now connected to the EMS Digital Control and are ready to view/change settings. The status bar at the bottom of the main application window will now indicate connection status.

Adding/Deleting Users and Changing Passwords

The EMS Digital Control User>Edit drop-down menu opens the User Editor dialog box that is used to add, remove or edit users and change passwords.

Modify level users can access the User Editor screen and can actively change both User Name and Password.

Operate level users can access the User Editor screen and can change the Operate password only.

View level users will not be able to access the User Editor screen in the EMS Digital Control User>Edit drop-down menu.

The above listed users can never be deleted, as they are required to define access levels of the control. Passwords for these users can be modified from the default. If the password for any of these users is forgotten, reinstalling the EMS Digital Control software will reset these default user passwords to the default settings.

Follow this procedure to add a new User (note you must be a Modify level user to add users):

1. Type a new user name in the *Name:* dialog box.

2. Type a password to be associated with the new user name selected in the *Password:* dialog box. Note the password will be disguised with asterisks (*).

3. Select the appropriate access level for the new user from the *Access Level:* drop-down list.

4. Click on the *Add User* button to add the new user to the user list database.

Follow this procedure to change a password:

1. Open the User Editor by selecting *User>Edit* from the main drop-down menu.

2. Select the user for which you want to change the password from the *Name:* drop-down dialog box.

3. Type in the case-sensitive password in the Password: dialog box.

4. Click on the *Set Password* button to make the changes to the user password.
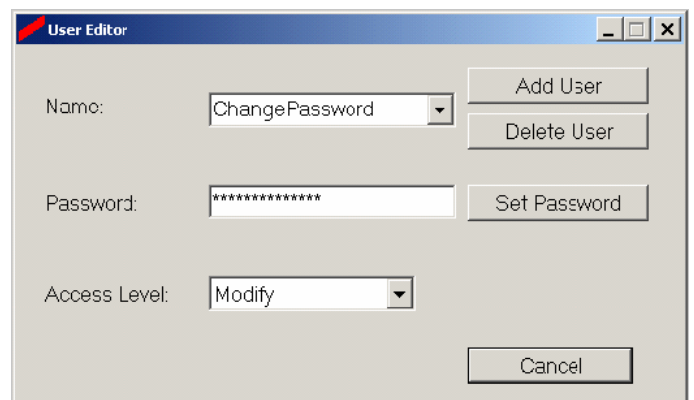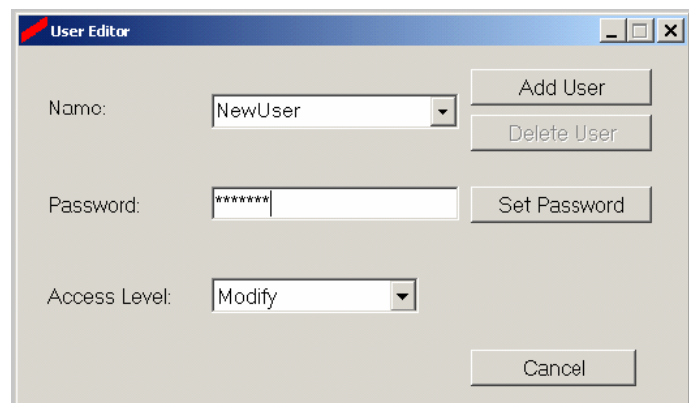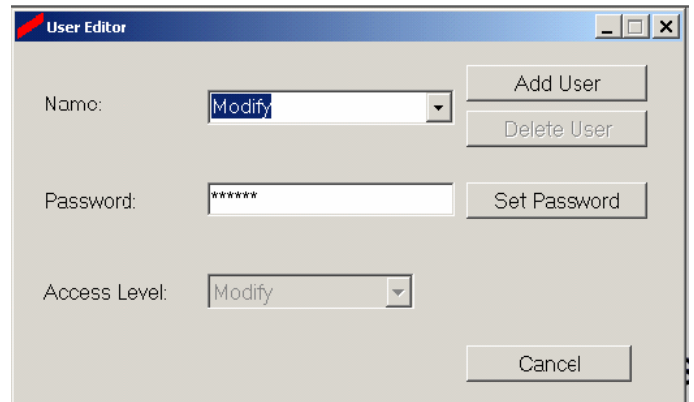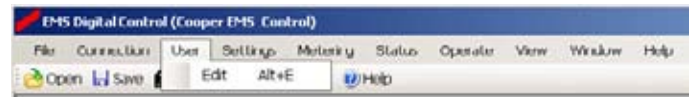
**5.** Click *OK* when the User Editor dialog box appears.
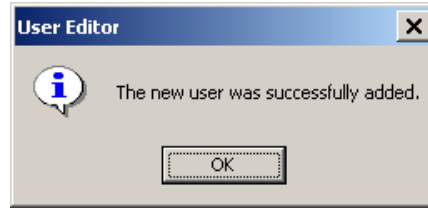
Follow this procedure to delete a user from the user list:

1. Open the User Editor by selecting *User>Edit* from the main drop-down menu.

2. Select the user you want to delete from the *Name:* drop-down dialog box.

3. Click on the *Delete User* button.

4. The User Editor will ask for you to confirm that you want to delete the user. Click on *Yes* to confirm the operation or *No* to cancel.

**5.** Click *OK* when the User Editor dialog box appears.
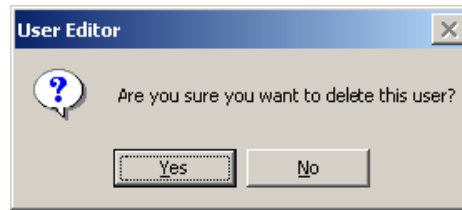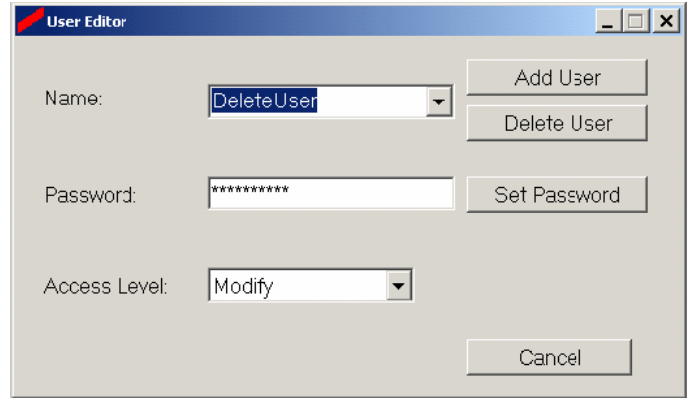
Programming the Control

The following section describes how to use the EMS Digital Control Interface Software to program and interrogate the control. Each section pertains to a specific "screen" of the interface. The path to each screen is noted in each section as Menu Item>Sub-Menu Item.

The EMS Digital Control Interface Software contains the default users "Modify," "Operate," and "View." Each of these usernames has the corresponding access level assigned to it. These users can never be deleted. The default passwords for these users are the username ("Modify" has default password Modify). Because the Modify login has administrative type rights and a default password, change this password after installing the software. Change the Operate password as well. For detailed descriptions of the access levels see the Login Access Levels section above.

Note: When a settings change is made in the software, an asterisk will appear to the right of the dialogue box name. This indicates a settings change has been made but not yet applied.
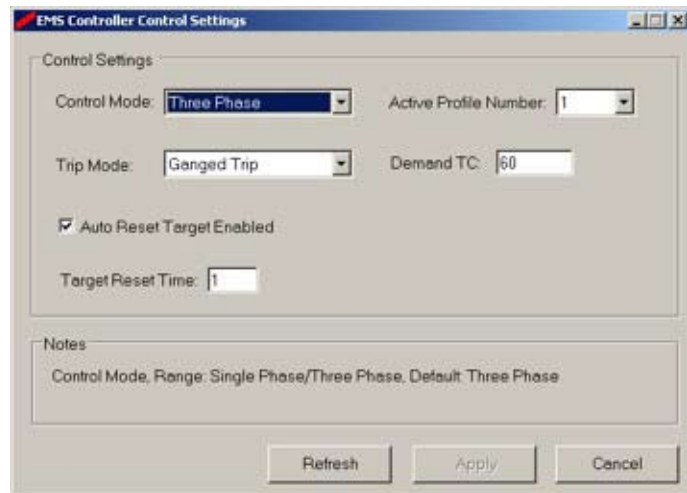
Control Settings (Settings>Control)

The control settings screen contains general settings for the control that are active across all settings profiles and allows the user to select the active profile.

Active Profile Number

This is the protection profile settings that the control follows. Settings in the profiles other than the Active Profile will have no effect on the operation of the control, until that profile is selected to be the active profile.

Range: 1-3

Default: 1

Control Mode

Control mode selects between single-phase and three-phase switchgear. Select single-phase for single-phase switchgear or three-phase for three-phase switchgear.

Range: Single-Phase or Three-Phase

Default: Three-Phase

Note: Do not use the single-phase control mode option with three-phase switchgear. Only the three-phase control mode option should be used with the current switchgear. If single-phase control mode is selected, only current on the center phase will cause an over-current trip.

Trip Mode

Trip mode selects between single-phase and three-phase ganged trip operation. Select Ganged Trip to trip all three phases of the switchgear simultaneously or Single Trip to trip individual phases.

Range: Ganged Trip or Single Trip

Default: Ganged Trip

Note: Do not use the single-phase trip mode option with three-phase mechanically ganged switchgear. Only the three-phase mechanically ganged switchgear is available at this time. Attempting to trip a single phase on a piece of three-phase switchgear could result in an opening time variation between the three phases. Selecting single-phase trip mode on three-phase switchgear will result in operator confusion. If a three-phase control is placed in single-phase mode only the center LED will blink green when the control is powered only via the USB connection.

Demand Time Constant

The Demand Time Constant is used for the Demand Current Metering Screen. Select the demand interval in minutes. For a step function change in metered current, the displayed Demand Current will reach 90% of its final value in one time constant.

Range: 1-60 minutes

Default: 60 minutes

Auto Reset Target Enabled

Check to enable the automatic clearing of fault targets from the control memory and the control LEDs after the specified time. If this is left unchecked, the fault targets will
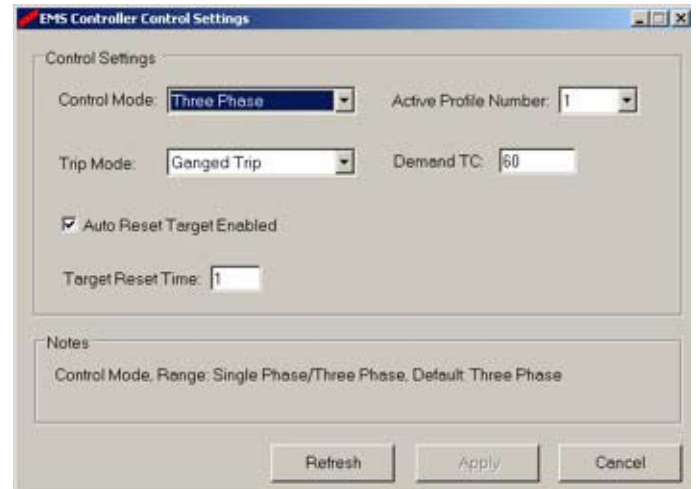
remain until the switch is subjected to another fault, or until manually reset.

Range: Enabled or Disabled

Default: Enabled

Target Reset Time

When the control is set to automatically clear the targets (see Auto Target Reset Enabled), this time specifies the duration that the targets will be active before being reset. This timer begins after CT or USB power has been restored to the control.

Range: 0-255 minutes

Default: 1 minute

Overcurrent Settings (Settings>Overcurrent)

The overcurrent settings page allows for changing the overcurrent settings in each settings profile.

Note: Upon clicking "APPLY" while making settings changes, changes will take place immediately.

Edit Profile Number

Select the overcurrent profile you intend to edit. You can edit any of the three, but only the profile that is set to active will immediately affect operation upon clicking Apply. To change the active profile go to Settings>Control.

Range: 1-3

Default: 1

Phase Minimum Trip

Defines the phase current magnitude where TCC timing is initiated.

Range: 20-1280 A

Default: 200 A

Phase Time-Current Characteristic Curve

Select the phase Time-Current Characteristic Curve.

Range: 1-8

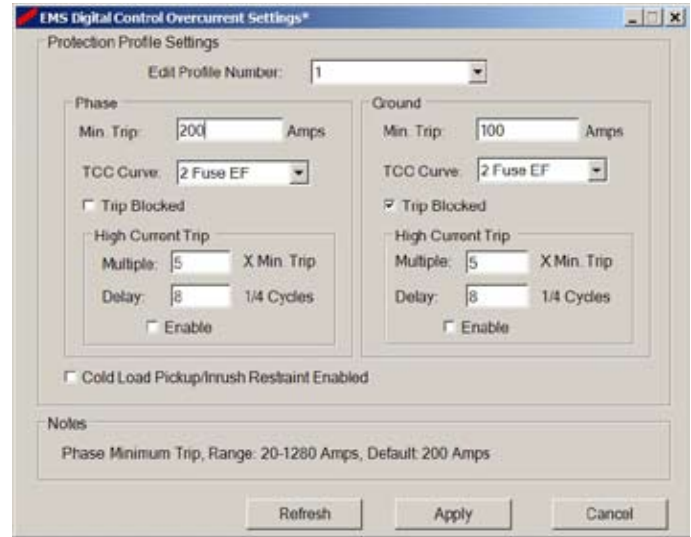*Default: #2 (EF curve)*

Note: Refer to Settings>TCC Library for TCC number key.

Phase Trip Block

Check to enable phase trip blocking.

Range: Blocked (enabled) or Unblocked (disabled)

Default: Unblocked (disabled)

EMS Digital Control Overcurrent Settings.

Phase High Current Trip (HCT) Multiple

This selects the phase HCT multiple to use. When the phase current level reaches the multiple times the phase minimum trip setting, the control will ignore TCC timing and trip according to the high current trip delay setting.

Range: 2X-30X

Default: 5X

Phase High Current Trip (HCT) Delay

Enter the number of ¼ cycles the control will wait after Phase HCT is activated before sending a trip signal to the mechanism (for a 60 Hz system ¼ cycle = 4.167 ms).

Range: 8-250 ¼ cycles

Default: 8 ¼ cycles

Phase High Current Trip Enable

Check to enable high current trip.

Range: Enabled or Disabled

Default: Disabled

Ground Minimum Trip

Defines the ground current magnitude where TCC timing is initiated. This value must be less than or equal to the phase minimum trip.

Range: 10-640 A

Default: 100 A

Ground Time-Current Characteristic Curve

Select the Ground Time-Current Characteristic Curve.

Range: 1-8

Default: #2 (EF curve)

Note: Refer to Settings>TCC Library for TCC number key.

Ground Trip Block

Check to enable ground trip blocking.

Range: Blocked (enabled) or Unblocked (disabled)

Default: Blocked (enabled)

Ground High Current Trip (HCT) Multiple

This selects the Ground HCT multiple to use. When the ground current level reaches the multiple times the ground minimum trip setting, the control will ignore TCC timing and trip according to the high current trip delay setting.

Range: 2X-30X

Default: 5X

EMS Digital Control Overcurrent Settings.

Ground High Current Trip (HCT) Delay

Enter the number of ¼ cycles the control will wait after Ground HCT is activated before sending a trip signal to the mechanism. (for a 60 Hz system ¼ cycle = 4.167 ms.)

Range: 8-250 ¼ cycles

Default: 8 ¼ cycles

Ground High Current Trip (HCT) Enable

Check to enable ground high current trip.

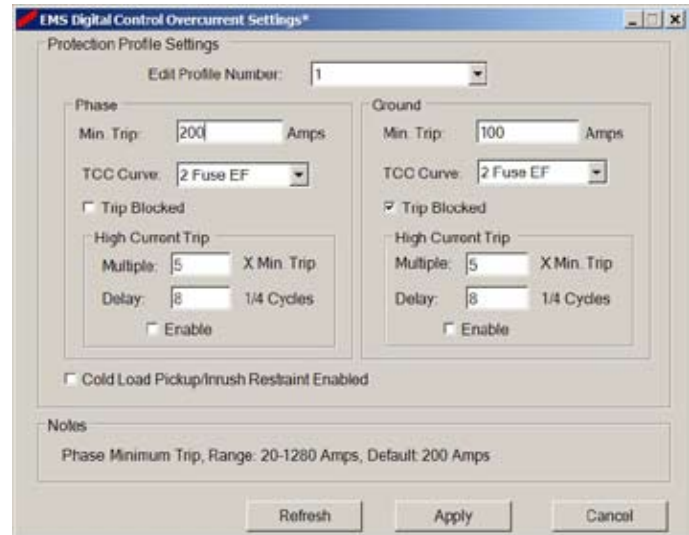*Range: Enabled or Disabled*

Default: Enabled

Cold Load Pickup (CLPU) Enabled

Check to enable CLPU.

Range: Enabled or Disabled

Default: Disabled

Note: See Settings>Cold Load Pickup to adjust the CLPU parameters.

EMS Digital Control Overcurrent Settings.

Cold Load Pickup / Inrush Restraint (CLPU) (Settings>Cold Load Pickup)

Contains all the settings for the Cold Load Pickup.

Note: There is only one CLPU profile. When CLPU is activated, these settings will be applied regardless of which profile is active. There IS NOT a separate CLPU profile for each of the three normal settings profiles.

Cold load pickup is used to prevent inadvertent trips from occurring during pickup of load current. The Cold Load Pickup dialogue box enables you to program the EMS Digital Control with sittings associated with the specific curve characteristics when CLPU is active.

Cold Load Pickup (CLPU) Phase Minimum Trip

Enter the phase minimum trip level.

Range: 20-1280 A

Default: 400 A
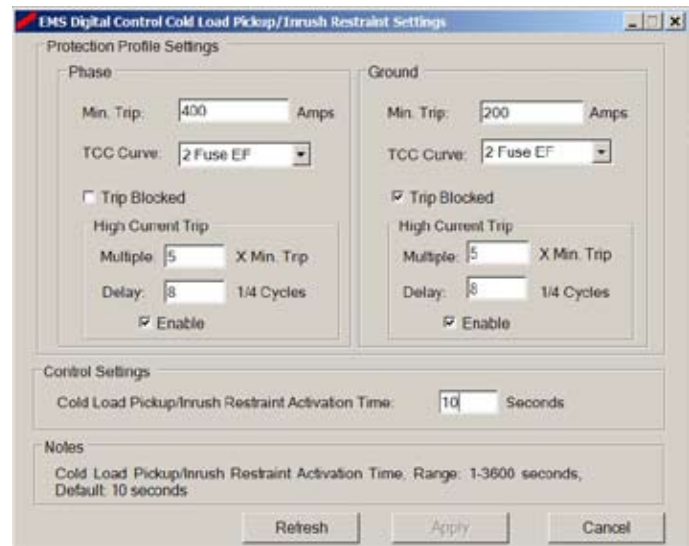
Cold Load Pickup (CLPU) Phase Time-Current Curve

Select the Phase Time-Current Curve.

Range: 1-8

Default: #2 (EF curve)

Note: See Settings>TCC Library for TCC number key.

EMS Digital Control Cold Load Pickup Settings.

Cold Load Pickup (CLPU) Phase Trip Block

Check this box to block all phase tripping. When the box is checked, all phase tripping is disabled during CPLU conditions until the activation time expires.

Range: Blocked (enabled) or Unblocked (disabled)

Default: Unblocked (disabled)

Cold Load Pickup (CLPU) Phase High Current Trip (HCT) Multiple

Enter the multiplier of the phase minimum trip at which you wish the CPLU HCT to activate. If Cold Load Pickup phase HCT is enabled, the shape of the TCC at points beyond the HCT setting is definite time as defined by the HCT time delay.

Range: 2X-30X

Default: 5X

Cold Load Pickup (CLPU) Phase High Current Trip (HCT) Delay

Enter the number of ¼ cycles the control will wait after CLPU HCT is activated before sending a trip signal to the mechanism (for a 60 Hz system ¼ cycle = 4.167 ms).

Range: 8-250 ¼ cycles

Default: 8 ¼ cycles

Cold Load Pickup (CLPU) Phase High Current Trip (HCT) Enable

Check to enable phase high current trip during cold load pickup conditions.

Range: Enabled or Disabled

Default: Disabled

Cold Load Pickup (CLPU) Ground Minimum Trip

Enter the ground minimum trip level. This value must be less than or equal to the CLPU phase minimum trip.

Range: 10-640 A

Default: 200 A

Cold Load Pickup (CLPU) Ground Time-Current Curve

Select the Ground Time-Current Curve.

Range: 1-8.

Default: #2 (EF curve)

Note: See Settings>TCC Library for TCC number key.

Cold Load Pickup (CLPU) Ground Trip Block

Check to block all ground tripping. When checked all ground tripping is disabled during CLPU conditions until the activation time expires.

Range: Blocked (enabled) or Unblocked (disabled)

Default: Blocked (enabled)

EMS Digital Control Cold Load Pickup Settings.

**Cold Load Pickup (CLPU) Ground
High Current Trip (HCT) Multiple**

Enter the multiplier of the ground minimum trip at which you wish the HCT to activate.

Range: 2X-30X

Default: 5X

**Cold Load Pickup (CLPU) Ground
High Current Trip (HCT) Delay**

Enter the number of ¼ cycles the control will wait after HCT is activated before sending a trip signal to the mechanism (for a 60 Hz system ¼ cycle = 4.167 ms).

Range: 8-250 ¼ cycles

Default: 8 ¼ cycles

**Cold Load Pickup (CLPU)
Ground High Current Trip (HCT) Enable**

Check to enable ground high current trip during CLPU conditions.

Range: Enabled/Disabled

Default: Enabled

Cold Load Pickup (CLPU) Activation Time

Set the number of seconds for CLPU to be active upon re-energization before returning to normal overcurrent protection settings.

Note: CLPU must be enabled in the overcurrent settings screen to activate upon re-energization.

Range: 1-3600 Seconds

Default: 10 Seconds

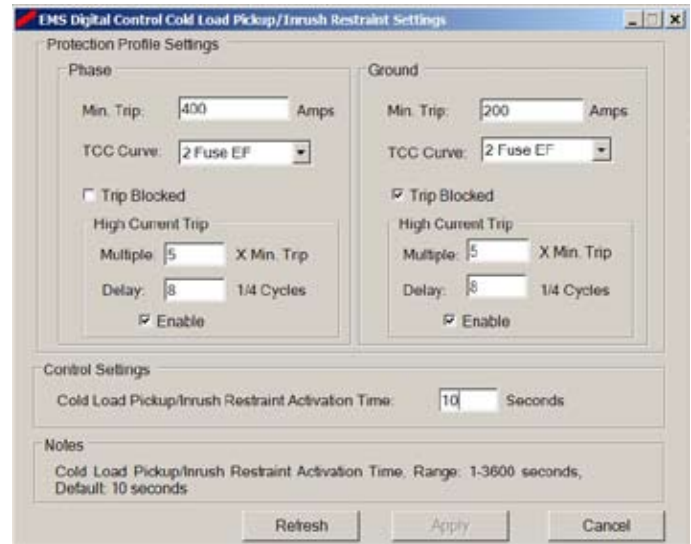**Control Name (Settings>Control Name)**

Allows the user to change the name of the control. Range is 1-40 characters.

TCC Library (Settings>TCC Library)

Default EMS control TCCs are F, EF, H, KF, TF, IEC I, IEC II and IEC III. This screen is used to change the TCCs stored in the control. Click on 'Update' next to the TCC you want to change. After the instruction dialog box pops up, click OK. Enter the name you would like to identify the new TCC by and click 'Update' again. When the file dialog box appears, locate the TCC to download into the control and click 'Open'. TCC files are created using the TCC editor program and must be made of the file type *.tc5

TCC Editor allows creation of custom curves and modification of existing TCCs including Kyle Curves 101-202, IEC Inverse, Very Inverse and Extremely Inverse Curves and ANSI Inverse, Very Inverse and Extremely Inverse Curves.

> **IMPORTANT:** Do not use TCCs with trip times lower than the default TCCs as this could result in the control not tripping per the selected curve.

EMS Digital Control Cold Load Pickup Settings.
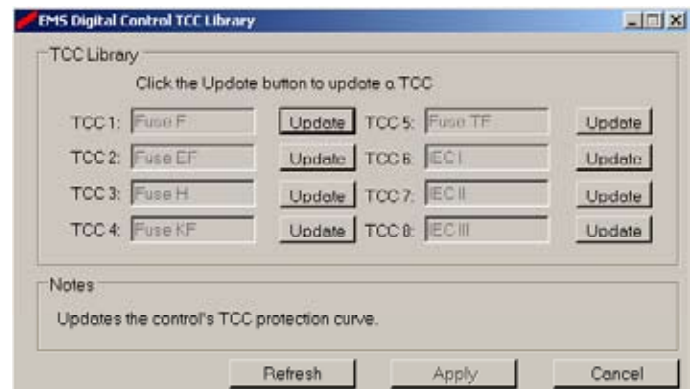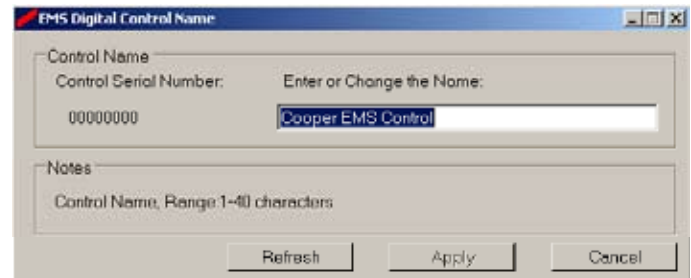
**Upload Settings
(Settings>Upload Settings)**

Select the location and name for the file to save the control settings to the PC. Settings files contain all the settings across all three profiles and CLPU. Metering and fault target data is not saved in the settings files. They also do not contain actual TCCs stored in the control – they reference only the index of the selected TCC (ie TCC1, TCC2, etc).

**Download Settings
(Settings>Download Settings)**

Brings up a file dialog box. Select the location and name of the settings file to load into the control from the PC. The profile that is set to active when the file was saved to the PC will remain the active profile when it is loaded back to the control.

> **IMPORTANT:** Active profile settings take effect immediately when loaded.

> **CAUTION:** Unintended operation. Before downloading a settings file to the control, verify that the settings are correct for the location and application. Downloading a settings file designed for a different location or application can result in unintended operation of the switchgear.
>
> T337.0

View Settings (Settings>View Settings)

This menu item provides a summary of the settings in all three of the protection profiles, the CLPU profile, and the control settings active across all profiles. Click the 'Print' button to print all of these settings.

> **IMPORTANT:** Whenever a settings file is downloaded into a control, the settings take place immediately.

> **IMPORTANT:** In order for two controls to have identical programming, all eight TCCs must be identical and stored in the same locations. For example, if control #1 has an EF curve stored in the TCC 2 location, then control #2 must have an EF curve stored in the TCC 2 location.

Procedure to Create a Settings File

To create a settings file select Settings>Upload Settings from Control from the menu. This will bring up a window that allows you to choose the location and name for this file. Click Save and all of the settings from the control (excluding fault information and TCC settings) will be stored in this settings file. The file can then be downloaded to other controls or can be modified or viewed when not connected to a control. This can be done by clicking the Open button on the toolbar or selecting File>Open from the menu (clicking Open while connected to a control will disconnect the control). To download a settings file to a control select Settings>Download Settings to Control from the menu. This will open a file dialog and allow you to select the desired settings file. When a settings file is saved, the active profile number is saved and will remain the active profile number when that file is loaded to a control.

Metering (Metering>View Metering)

When actively connected to an EMS Digital Control, users can access the EMS Digital Control Metering screen. Instantaneous current, demand and peak metering will be displayed and updated continuously while connected.

While the control is connected, the Update field in the lower left of the EMS Digital Control Metering screen will update every second to provide visual indication of an active connection.

Follow this procedure to reset the demand metering:

1. Open the EMS Digital Control Metering screen by clicking on *Metering>View Metering* on the main menu.

2. Click on the *Reset* button on the right side of the EMS Digital Control Metering screen dialog box.

3. The Metering Viewer dialog box will appear to confirm that demand metering was successfully reset. Click *OK* to close the dialog box.

4. Click the *Cancel* button to exit the EMS Digital Control Metering screen.
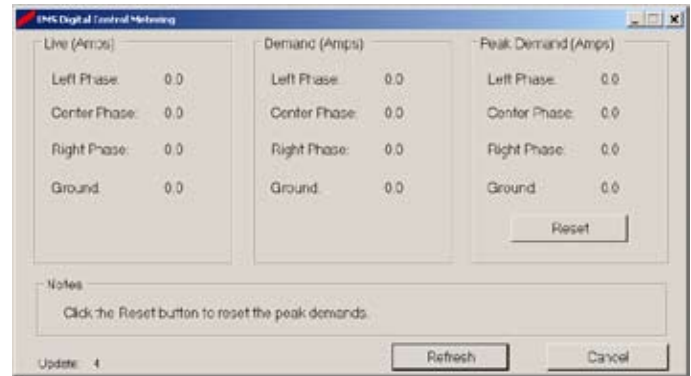
Control Details

Clicking on the menu path *Status>Control Details* opens the EMS Digital Control Details dialog box. This dialog box provides useful information about the control that is actively connected to the PC.

These details include:

• Control Serial Number

• Control Name

• Control Status (OK/ERROR)

• Control Type

• Test Mode Status (On/Off)

• Above Minimum Trip (Yes/No)

• Firmware Version

• Firmware Revision

• Database Version
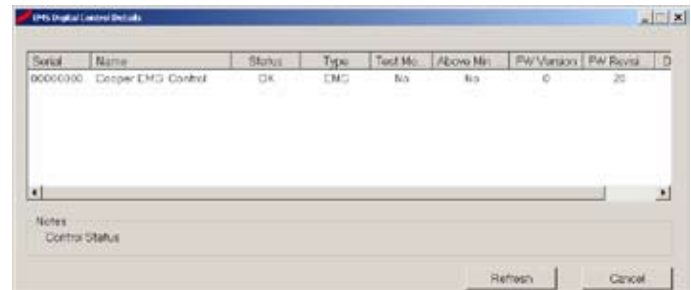
Control Status

This gives information on the current status of the control. It tells the user which (if any) phases have current present, if any of the channels (phase and/or ground) are above minimum trip, whether any of the channels (phase and/or ground) have set a fault target, and the current magnitude (in amps) for each channel at the time of the last fault. The user has the option to reset the fault target and current magnitude information manually.

Follow this procedure to reset the trip targets:

1. Open the EMS Digital Control Status dialog box by selecting *Status>Control Status* from the main menu.

2. Click on the *Reset* button in the EMS Digital Control Status dialog box.

3. Click OK when Targets Viewer dialog box appears.

If trip targets are not reset manually and auto-target reset is enabled, the fault targets and current magnitudes will be reset after the auto-target reset time has elapsed. Refer to **Control Settings** in the **Programming the Control** section for additional information.

If auto-target reset is disabled the Trip Targets and Fault Current values will be overwritten when the next overcurrent trip occurs.

Test Mode (Operate>Test Mode)

> ⚠️ **CAUTION:** Temporary loss of protection. While the control is in Test Mode, overcurrent protection is disabled. Safe operating practices must be observed while the control is in Test Mode. Loss of protection can result in personal injury and equipment damage. T338.0

Note: If the control is in Test Mode the *Operate>Download Firmware* selection is grayed out and is not available. Refer to **Testing Procedures** for more details on **Test Mode**.

Allows the control to be put into Test Mode. Click the button to enter or exit Test Mode. While in Test Mode the background of the main screen fills up with the words "Test Mode" written in a diagonal pattern. In addition the upper and lower status bars and the Test Mode dialog box display "(Test: xx:xx)" where xx:xx is the time remaining in Test Mode using the minutes: seconds format. The Test Mode dialog box also has a "Reset Test Mode Timer" button. After 20 minutes of entering Test Mode or pressing the "Reset Test Mode Timer" button the control will automatically exit Test Mode. It will also exit Test Mode if the USB programming cable is removed (USB interface cable is unplugged). Refer to the **Testing Procedures** section for additional information.

> **IMPORTANT:** While the control is in Test Mode, any overcurrent faults will be indicated via blue LEDs on the control housing, but a Trip signal will not be sent to the mechanism. Test Mode will exit automatically after 20 minutes or if the USB Programming cable is removed.
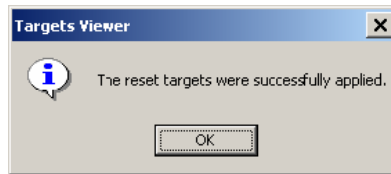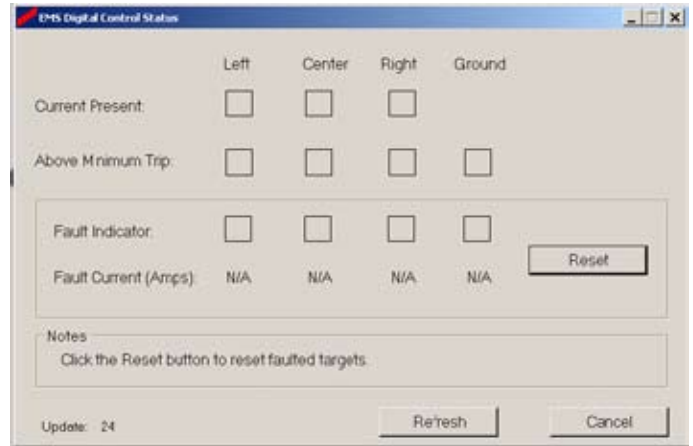
Manually Tripping the VFI Switchgear

The EMS Digital Control allows the user to manually trip the VFI switchgear from the EMS Digital Control Software program. When manually activated, the EMS Digital Control will send a trip pulse to the VFI flux shift tripper mechanism to physically trip the vacuum interrupter.

Follow this procedure to manually send a trip signal to one of the VFI interrupter modules:

1. Select *Operate>Trip Mechanism* from the main menu screen.

2. The EMS Digital Control Trip Mechanism screen will appear. Select the phase or phases that you want to trip by clicking on the check box that corresponds to the phase.

Note: Do not use the single-phase mode option with the switchgear. Only the three-phase control ganged trip mode option is available with the hardware at this time.

IMPORTANT: If the control is in "Ganged Trip Mode" selecting any of the three phases and clicking the "Trip" button will cause all three phases to trip open.

It is not necessary to enter Trip Mode to test the Trip function. Clicking the Trip button will cause the switchgear to Trip open.

Note: When in Test Mode, selecting the Operate> Mechanism>Trip will not cause the switchgear to trip open.

3. Click on the *Trip* button to send the trip signal from the control to the selected phase VFI flux shift tripper mechanism.

4. The Trip Manager confirmation dialog box will appear. Click *Yes* to confirm the tripping operation or *No* to cancel the operation.
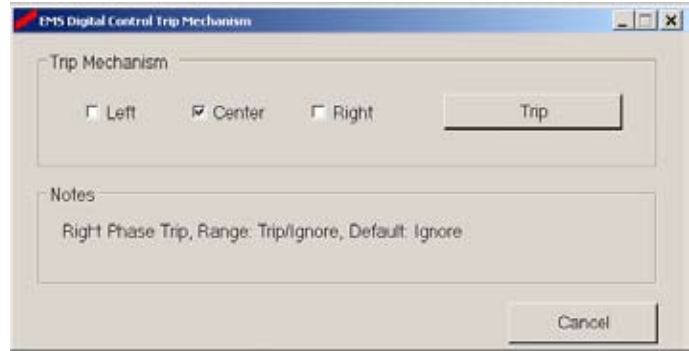
Downloading Firmware to the Control

> ⚠️ **CAUTION:** Temporary loss of protection. The process of downloading new firmware will cause a temporary loss of protection by the switchgear until the download is complete. Loss of protection can result in personal injury and equipment damage.   T334.0

> **CAUTION:** Unintended operation. Downloading firmware while the switchgear is energized can cause the control settings to revert back to the default settings. This may cause unintended operation of the switchgear.   T335.0

EMS Digital Control firmware can be easily updated from the latest version of EMS Digital Control Software.

Follow this procedure to update the EMS Digital Control Firmware:

1. Open the Firmware Downloader by selecting *Operate>Download Firmware* from the main drop-down menu.

   Note: If the control is in Test Mode the *Operate>Download Firmware* selection is grayed out and is not available. Refer to **Testing Procedures** for more details on **Test Mode**.

2. The Firmware Downloader dialog box will appear. Click *Yes* to proceed with firmware download, or click *No* to cancel the operation.

   Note: This message box warns the user that the default database may be loaded into the EMS Digital Control, which may cause an unwanted tripping of the control.

3. The Firmware Downloader file section dialog box will appear. Select the appropriate firmware file to download to the control. Appropriate firmware files have a .sre file extension.

4. Click *Open* to begin the install process.

   Note: During firmware download the center phase LED will illuminate solid blue. DO NOT DISCONNECT THE PROGRAMMING CABLE UNTIL THE SOLID BLUE LED CHANGES BACK TO FLASHING GREEN AND THE SOFTWARE HAS INDICATED THE DOWNLOAD WAS SUCCESSFUL.

5. When firmware download is completed, the EMS Digital Control dialog box will appear to indicate the process has been completed. Click *OK* to complete the download process.
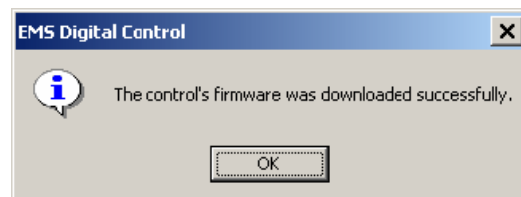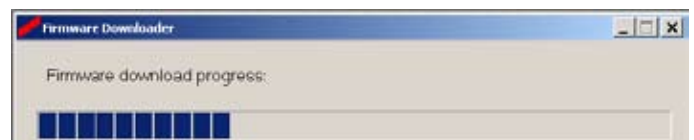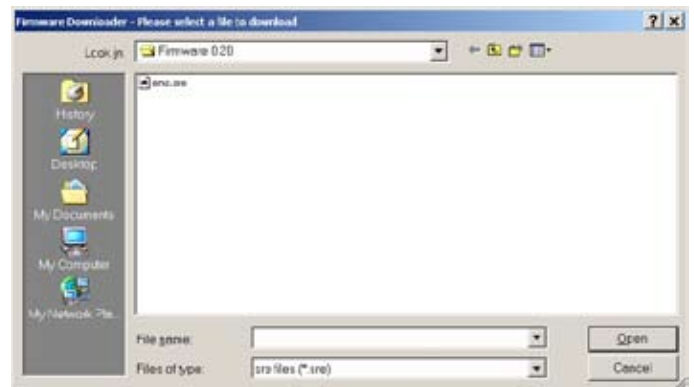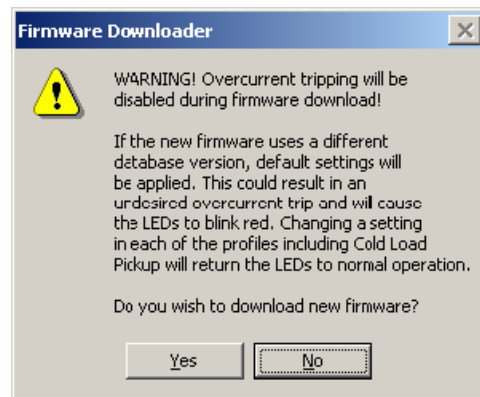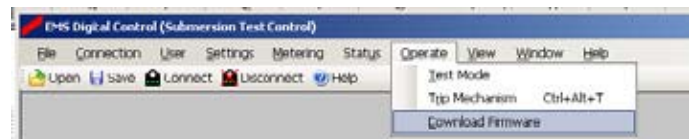
TESTING PROCEDURES

Test Mode

The Test Mode feature has been created to facilitate testing of the control without having to de-energize the control. When test mode is active, the following is true:

- Test mode allows testing of the control but blocks trip signals from being sent to the flux-shift tripper on the VFI mechanism.

- Selecting *Operate>Trip Mechanism>*Trip will not cause the switchgear to Trip open.

- All control and profile settings may be changed. They will not be saved upon exiting test mode.

- Any settings changed while in Test Mode will remain active as long as the control is in Test Mode. Upon exit of Test Mode all values will revert to the normal active profile settings.

- All fault targets are cleared when Test Mode is exited. This includes any targets present before entering Test Mode.

- While in Test Mode the background of the main screen fills up with the words "Test Mode" written in a diagonal pattern. In addition, the upper and lower status bars and the Test Mode dialog box display "(Test: xx:xx)" where xx:xx is the time remaining in Test Mode using the minutes: seconds format. During testing, care should be taken to ensure that the control is in Test Mode to prevent inadvertent tripping of the switchgear VFI mechanism.

- After 20 minutes of entering Test Mode or pressing the "Reset Test Mode Timer" button the control will automatically exit Test Mode.

- The control will also exit Test Mode if the USB power is removed from the control at any time (i.e. unplugging the USB interface cable).

- The *Operate>Download Firmware* selection is grayed out and is not available while in Test Mode.

Test Mode provides a means to test settings to ensure that they will not cause an unintended operation when applied outside Test Mode, and to verify that the control is operating normally.

> ⚠️ **CAUTION:** Temporary loss of protection. While the control is in Test Mode, overcurrent protection is disabled. Safe operating practices must be observed while the control is in Test Mode. Loss of protection can result in personal injury and equipment damage. T338.0

> **IMPORTANT:** While the control is in Test Mode, any overcurrent faults will be indicated via blue LEDs on the control housing, but a Trip signal will not be sent to the mechanism. Test Mode will exit automatically after 20 minutes or if the Programming cable is removed.

Follow this Procedure to Place the EMS Digital Control into Test Mode:

1. Open the EMS Digital Control Test Mode dialog box by selecting *Operate>Test Mode* from the main menu.

2. Click on the *Enter Test Mode* button to place the control into test mode.

   The Test Manager Warning box will appear indicating that Test Mode will disable overcurrent tripping.

3. Click *Yes* to confirm Test Mode or *No* to cancel Test Mode.

4. A dialogue box will appear confirming you have successfully entered Test Mode. Click OK to close the dialogue box.

Test Mode Procedure
(switchgear remains energized)

This test verifies the functionality of the control.

1. Connect to the control via the USB interface cable, and connect to the control using the EMS Digital Control Interface Software. This connection verifies that the USB communications are working correctly.

2. Check the metering in the program and verify that it is correct on each phase (compare to a clamp-on meter). This verifies the control is metering correctly.

3. Place the control in Test Mode.

4. With the control in Test Mode, lower the minimum trip setting on the active profile to a value below the "Live" current level. This will cause the control to "trip" upon clicking Apply, but because it is in Test Mode the switchgear will not trip.

This step allows you to observe several things. First, immediately after applying the new minimum trip setting you should see the LED blink yellow indicating the control is now above minimum trip. You will then see the LED blink blue indicating that the control has detected a faulted system condition and would have issued a trip signal if it were not in Test Mode. This means that the TCC timing delay has elapsed. It also means that the microprocessor sensed there was sufficient voltage on the trip capacitors to issue a valid trip signal. (No signal was sent to the switchgear because the control is in Test Mode.) This verifies the integrity of the capacitors and the control's ability to send the trip signal.

5. Reset the fault targets.

6. Exit Test Mode.

7. Select Connection>Disconnect from Control. Remove the USB interface cable connection. Removing the USB interface cable from the PC will cause the control to exit Test Mode immediately.

8. Screw the protective cap securely back on the extension cable.

> **CAUTION:** Equipment damage. Ensure protective caps and/or waterproof cables are securely attached to all connectors of the control and programming cable. Failure to do so can result in corrosion of contacts and subsequent equipment damage. T340.0

All the active settings resident to the control prior to entering Test Mode will again be active and the control is now functioning normally. All the basic functions of the control have been tested without ever de-energizing the switchgear.
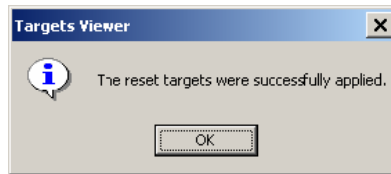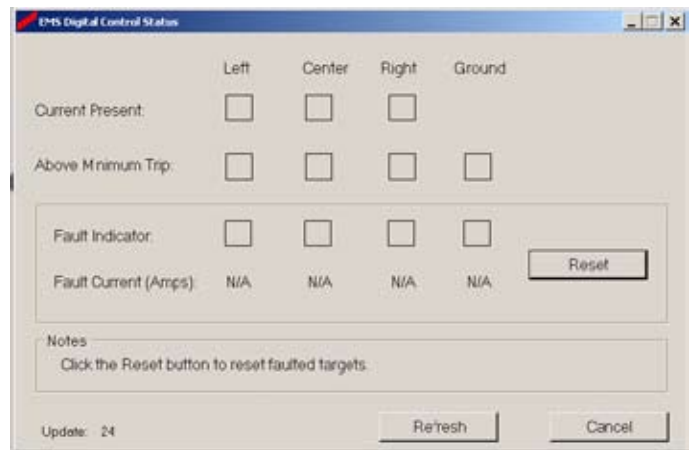
DISCONNECTION PROCEDURE

Always disconnect from both the control and the network.

> **IMPORTANT:** Always follow these procedures to properly disconnect from the control and from the network. If the USB cable is disconnected without first following these procedures, you may have to restart the software in order to re-connect a control.

Disconnecting from the EMS Digital Control

1. Click on Connection>Disconnect from Control in the main application menu.

   Alternate Method: Click the Disconnect button on the main toolbar.

2. Upon successful disconnection from the control, a dialog will appear and confirm the disconnection.

Disconnecting from the Network

1. Click on Connection >Disconnect from Network in the main application menu.

   Alternate Method: Click the Disconnect button on the main toolbar.

2. Upon successful disconnection from the network, a dialog will appear and confirm the disconnection.

MAINTENANCE INFORMATION

The EMS Control is designed to be a maintenance free device. The control firmware can be replaced or upgraded in the field using the EMS Digital Control Interface Software. Should a control require a firmware upgrade or replacement, contact your Cooper Power Systems sales representative.

If installation of a replacement control is needed, the following are the steps required:

1. De-energize the switchgear and remove it from service.

2. Remove the old control, slide the new control over the bushings and secure the metal bracket to the switchgear using the control restraint clamps.

3. Ensure that the bushing is centered in the CT hole for best results. Also, check to make sure that the cables between CT housings are out of the way of the switchgear trip handles.

4. Connect the tripper cable to the control and to the switchgear tank ensuring that the locking nuts are tight and the cable is all the way in to prevent moisture ingress.

5. Connect a suitable ground to the control ground lug and tighten.

6. Finally, replace cable elbows and energize.

> **CAUTION:** Equipment damage. Ensure protective caps and/or waterproof cables are securely attached to all connectors of the control and programming cable. Failure to do so can result in corrosion of contacts and subsequent equipment damage. T340.0

COOPER Power Systems