

Chapter 1

INTRODUCTION

System Studies Incorporated fully understands the importance that Telephone Operating Companies (telcos) place on their valuable outside plant cables. In fact, it's our business to help you protect your pressurized air core cables. But today, the threat of "losing a cable" no longer pertains just to a service outage caused by moisture/water intrusion. Copper cables, both pressurized and non-pressurized, are being stolen with increasing frequency by thieves looking for a quick payoff.

To help telcos apprehend the individuals who cut and steal lengths of copper cable, System Studies has devised a highly responsive monitoring system. It's comprised of a server grade computer (running the Linux Operating System), CopperWATCH™ and PressureWEB™ software, one or more uM260 Micro Monitors™, and the use of small electrical components, called Cable Section Locators (CSLs), which are installed on two or more designated conductor pairs in each monitored cable. One of the pairs, called a *Detection Pair*, accommodates multiple CSL devices placed at evenly spaced points along the cable. Another dedicated pair in the same cable, called a *Verification Pair*, is equipped with a single CSL at or near the end of the monitored loop.

Note: While it is possible to use CopperWATCH to monitor a cable using only a single dedicated monitoring pair (with one or multiple CSLs installed), doing so does not provide the information necessary for CopperWATCH to issue confirmed cable-theft-in-progress alarming. For this reason it is not a recommended monitoring method.

Functional Overview

The Cable Section Locators provide a 3.0 milliampere (mA) output which CopperWATCH uses to check pair continuity on the Detection and Verification Pairs, detect trouble on either or both pairs, or suggest and/or confirm a cable theft in progress. If the cable is cut, the Detection Pair reading provides information about the approximate location of the cut (for example, if it is between two specified CSL locations or simply past a known location). The Verification Pair provides the confirmation that CopperWATCH needs to generate an immediate four star alarm dispatch.

A maximum of seven (7) CSL devices can be installed on one Detection Pair. The more closely spaced the CSLs are installed, the shorter the identified theft area is for dispatched response personnel (law enforcement officers, private security personnel, etc.). Please note that additional Detection Pairs, each with seven possible CSL devices, can be used in long sections of cable for more precise cable theft detection. In this case, still only one Verification Pair would be required. If one or more cable sheaths branch off from the main cable, however, separate Detection and Verification Pairs will need to be designated for use in those lateral sections.

What makes the uM260 Micro Monitor and CopperWATCH software so valuable in deterring cable theft are their rapid reading and alarming capabilities. The uM260, for example, continually scans each Detection and Verification Pair approximately three times a minute—generating new milliampere readings. If the uM260 detects a value on one of the pairs that deviates from the normal (OK) reading, it issues an alert and sends it to the CopperWATCH software.

The software then determines the severity of the alert and compares the reading with the one from the corresponding Detection or Verification Pair. If the cable has actually been cut, as illustrated in FIGURE 1-1, the Detection Pair provides the location information, and the Verification Pair provides the confirmation necessary for CopperWATCH to issue an alarm. CopperWATCH generates a single, immediate dispatch alarm and routes it to designated Alarm Center locations, telephone company individuals, security personnel, and/or law enforcement officials via email, cell phone text message, etc. A rapid response by these individuals can lead to the capture of thieves while they are still in the process of removing and/or transporting the stolen cable.

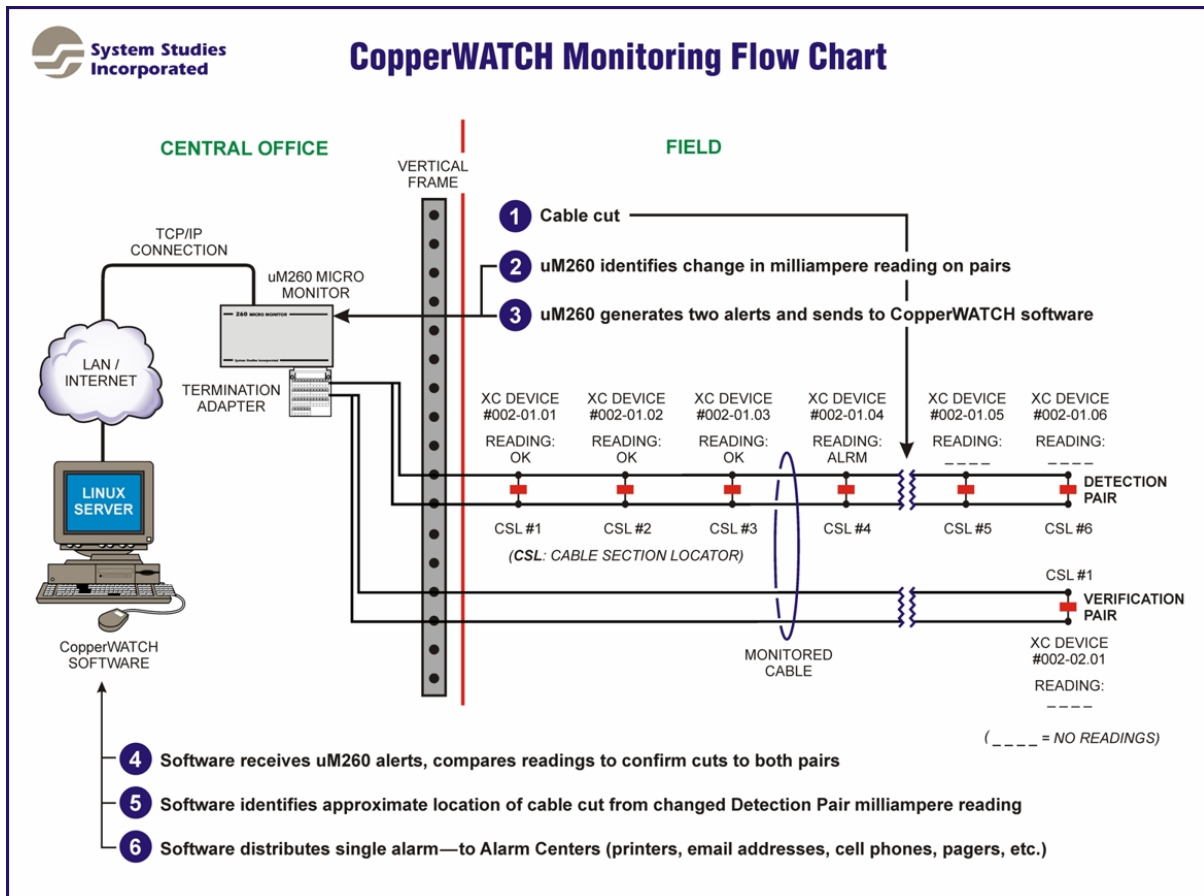


FIGURE 1-1: WIRE CENTER PAIR MONITORING

System Performance

The CopperWATCH software used for this monitoring solution is installed on a telco-supplied computer equipped with the Linux Operating System. The base CopperWATCH license is for 25 uM260 and/or 289H LSS monitors (FIGURE 1-2). With the purchase of individual office licenses, CopperWATCH can be expanded to accommodate a maximum of 250 offices (monitors). The number of monitors required for a particular application depends upon the type of monitor being used, the total cable count that will be monitored, and/or how many monitoring pairs are used for each cable.

By design, one uM260 can monitor up to sixteen (16) device pairs. Because the cable theft monitoring application utilizes at least one Detection Pair and one Verification Pair in each monitored cable sheath, the maximum number of cables that can be monitored by a single uM260 is eight.

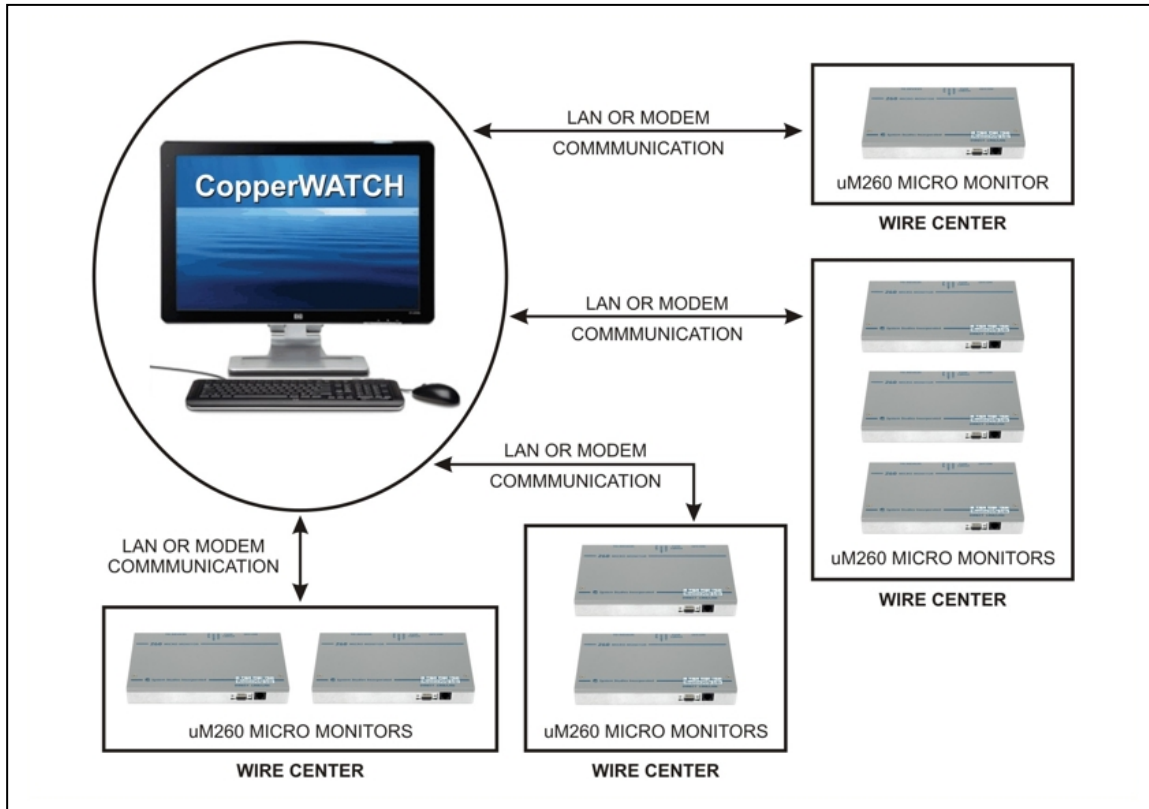


FIGURE 1-2: COPPERWATCH MONITORING MULTIPLE MONITORING CENTERS

ALARM DISTRIBUTION

CopperWATCH provides the ability for users to designate multiple alarm calling times for weekdays, weekends or holidays. Telco personnel can arrange to have alarms sent to a maximum of 72 different Alarm Centers or individuals during a specified calling period. Once a calling time is added to the schedule, all alarms will be distributed to the designated Alarm Centers from the time indicated until the next time entered, or until midnight. Alarms can be sent to printers, individual email accounts, cell phones, etc.

In summary, the CopperWATCH software performs the following key cable theft detection functions:

- Awaits incoming alert information from the monitors
- Identifies the alerting uM260 monitor (defined as an office designation)
- Compares the alert data sent by the monitor with readings from the corresponding Detection or Verification Pair
- Determines if the readings from both pairs indicate a possible cable cut
- If so, identifies the closest CSL device on the monitor side of the cut
- Specifies the section of cable where the cut occurred (between two CSL locations)

- Distributes a single alarm to all Alarm Centers set up to receive them during the current calling time
- Includes a link to a web browser-displayed Google map which highlights the section of cable where the theft is taking place
- Provides emergency responder contact information and directional remarks information (in email alarm format)
- Calls the uM260 monitors every four hours to obtain readings (to update Device History reports and confirm that the equipment is operational)

WEB BROWSER ACCESS TO INFORMATION & REPORTS

The CopperWATCH software requires minimal data entry of system information. This includes setting up an office designation for each uM260 installation, entering specific device information for the monitoring pairs (and for each CSL), and creating Alarm Centers for each monitor. These procedures are described in detail in Section 3 of this documentation.

A CopperWATCH Data Entry Form, supplied with the uM260 shipment, provides a convenient means of organizing data for the data entry process. Once Offices and Alarm Centers have been built into the system, reports and device reading output generated by CopperWATCH can be viewed from a web browser over the Internet through the PressureWEB application. Section 4 identifies the type of PressureWEB information most applicable to your copper cable theft monitoring application.

Purchasing Requirements

In order to implement the Cable Theft Monitoring System, the following hardware and software requirements must be fulfilled:

HARDWARE:

- **PC/Server.** The cable theft monitoring application requires a server grade computer on which to install CopperWATCH. Please note that System Studies does not supply this hardware. When selecting equipment, please conform to the following minimal hardware requirements:
 - Processor—2.40 GHz (gigahertz) Intel® Xeon®
 - Memory—1024 megabyte MEM DDR2
 - Hard disk—300 gigabyte, Serial Attached SCSI (SAS)
 - DVD—20x +/- RW
 - 10/100 Ethernet port with Remote On-LAN Wakeup
 - Onboard SCSI and Video
 - Keyboard and mouse
- **Communications.** Depending upon telco communication requirements, the CopperWATCH computer will communicate with individual wire centers (uM260 monitors) using an Ethernet network connection or multiple 33.6k bps modems. Due to its higher performance capabilities, LAN communications are recommended for CopperWATCH, if possible.

- LAN Application: 10/100 Ethernet TCP/IP is used with CopperWATCH to communicate with the LAN version of the uM260 monitor. Each uM260 requires a static IP address.
- Modem Application: A CopperWATCH system monitoring 25 office monitors, for example, requires a minimum of four (4) modems and one Digi PortServer TS 4 module. This equipment is designated to perform the following functions:
 - ✓ Alarm Receiver Modems: Two (2) Dial-in modems are designated by the program to receive incoming alerts from the uM260 monitors.
 - ✓ Batch Modems: Two (2) Dial-out modems perform the task of collecting data and sending alarms. The primary function is alarm distribution.
- 1. Digi PortServer TS 4: Provides four (4) modem ports for connecting RJ-11 phone line connectors.

Note: Depending upon company monitoring requirements (i.e., the number of installed monitors), additional modems and higher capacity Digi PortServer equipment can be purchased, if desired. In most situations, however, the requirements stated above will satisfy all single-system CopperWATCH monitoring applications.

- **Office Monitor.** Each copper cable theft monitoring application requires a uM260 Micro Monitor, which can detect activity on a maximum of 8 cable sheaths (using both a Detection Pair and Verification Pair). Two options are available for purchase:
 - Part No. 9800-6260L, LAN version
 - or –
 - Part No. 9800-6260M, Modem version
- **Device Termination Equipment.** Three options are available for connecting cable pairs to the uM260 equipment for the CopperWATCH monitoring application:
 1. The simplest method, especially with the uM260 Micro Monitor is to use the 21-Pair Termination Adapter (Part No. 9010-0062). This adapter is equipped with locking jaw terminals for wiring eight Detection Pairs and eight Verification Pairs. It also has an Amphenol connector which plugs directly into the front of the uM260 (Photo 1-1).

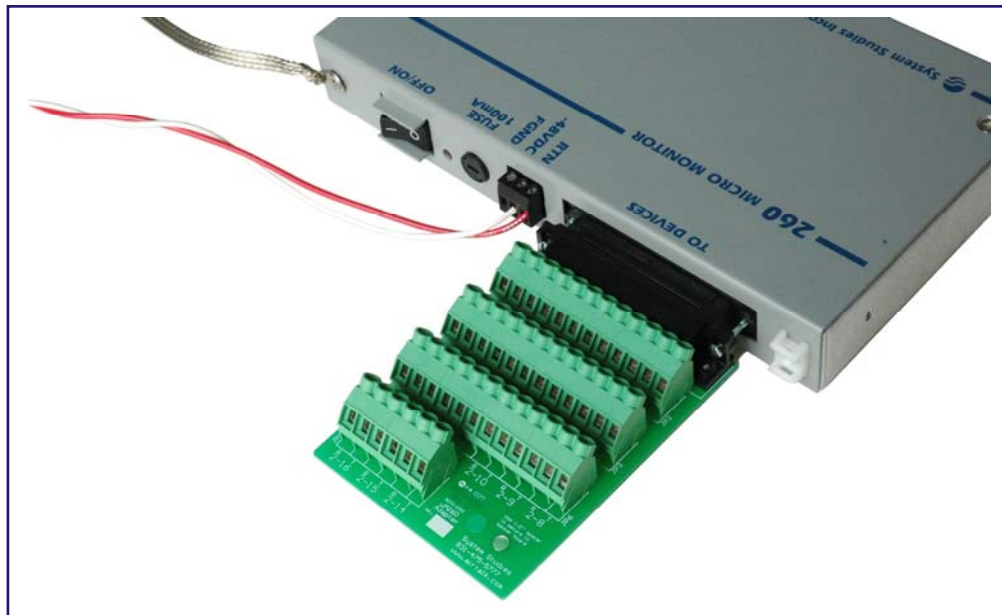


PHOTO 1-1: uM260 & TERMINATION ADAPTER

2. Another option for the uM260 is the rack-mountable Copper Theft Termination Kit (Part No. 9900-6260). This kit contains a 1.75 inch high by 23 inch wide panel face with two cutouts, one of which contains an aluminum enclosure equipped with a 21-Pair uM260 Termination Adapter (Photo 1-2). The kit also contains a three inch, 25-pair cable with Amphenol Connectors. One end of the cable plugs into the forward-facing Termination Adapter connector, the other into the uM260 monitor’s cable connector. (Please note that when ordering a Copper Theft Termination Kit, the uM260 must be ordered separately.) Additional kit components include a nylon cable tie with fasteners to prevent the cable from becoming accidentally dislodged, and mounting machine screws and washers.

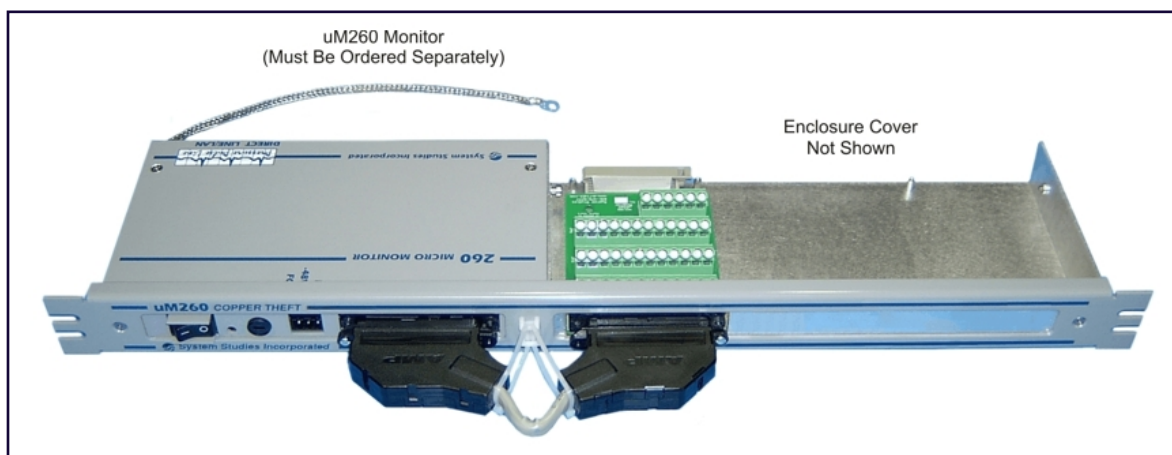


PHOTO 1-2: COPPER THEFT TERMINATION KIT

3. Another way to terminate monitoring pairs is to use a 100-pair dedicated connector block (Part No. 9800-6055). The 100-pair connector block contains abundant wire

wrap termination pins for the measurement pairs. Consequently, it is a practical option for wire centers where multiple uM260s are installed. The block's pins are connected internally to four 25-pair Amphenol cable connectors. Each one used requires a male-to-male connector cable (Part No. 9800-6017-X) to complete the connection to the uM260 equipment. Connector cables are available in lengths from 2 feet (0.61 m) to 100 feet (30.48 m).

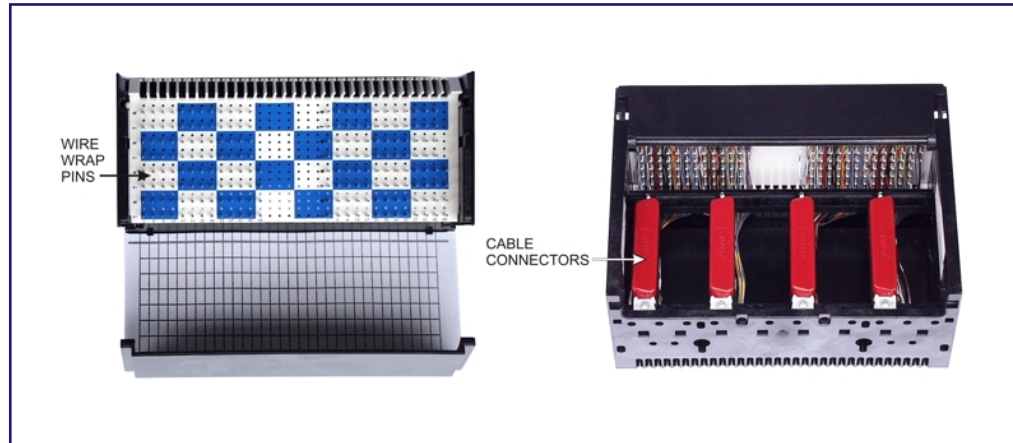


PHOTO 1-3: DEDICATED CONNECTOR BLOCK

- **Field Equipment.** All designated monitoring pairs used in the CopperWATCH monitoring application need to be equipped with one or more *Cable Sector Locators (CSLs)*. These simple electrical devices (Photo 1-4) provide a fixed 3.0 mA output value that is used by CopperWATCH to detect and confirm a cut cable. Each Detection Pair, for example, can have up to seven (7) uniformly spaced CSLs installed in parallel. These CSL installations effectively break the length of a monitored cable section down into manageable sections for better alarm response.

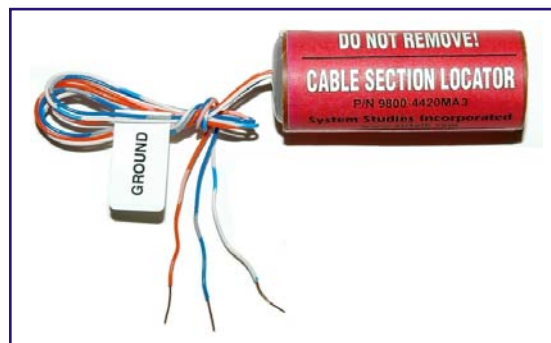


PHOTO 1-4: CABLE SECTION LOCATOR

SOFTWARE:

- CopperWATCH software (Part No. 9800-7541). One application will support up to 250 individual uM260 monitors (using office extender licenses). Software includes both text menu access for data entry and the PressureWEB 3.0 browser interface for html display of information.

- BackupEDGE (Part No. 9800-7560) is an optional third-party application that makes it possible to back up important CopperWATCH office and CLS device information onto a variety of media including electronic tape cartridge, CD/DVD ROM, RAM disk, or remote computer via FTP. Separate installation instructions are provided for BackupEDGE.
- System Status Viewer (requires Apache web server, ActiveState Perl software, and System Status Viewer application). This optional software provides the ability to log onto a web browser and check the operational status of any of the uM260 monitors that have been set up to provide alert information to CopperWATCH.