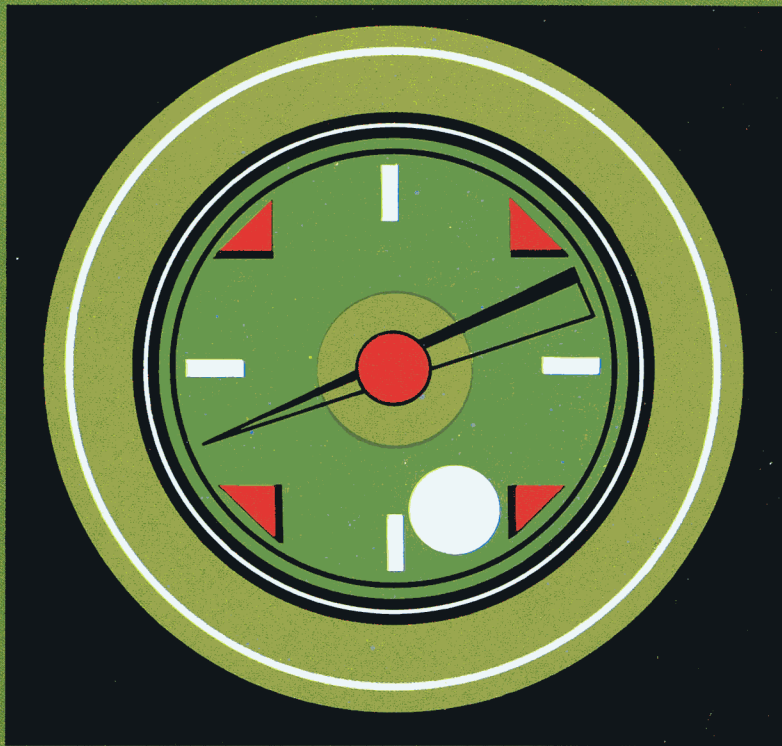


# CPS



## CABLE PRESSURE MONITORING SYSTEM

improve your cable  
integrity and lower  
maintenance costs  
with our new  
computerized pressure  
monitoring system



Western Electric



PRIVATE/Distribution Limited to Bell System Personnel Only



# CPMS

## CABLE PRESSURE MONITORING SYSTEM

- **More efficient and effective means of pressure monitoring**
- **More information to the craftsman**
- **Up-to-date status information as needed**
- **Pinpoint troubles faster than any previous manual method**
- **Major savings in labor and preventive maintenance**

### THE SYSTEM

The Cable Pressure Monitoring System provides a computerized, completely automatic routine for cable upkeep activities. In addition, CPMS gives ready access to current and historical pressure data to the cable maintenance forces.

CPMS consists of a computerized central terminal and a maximum of 150 remote terminals and 50 maintenance centers. Remote terminals are located in wire centers where data is acquired. Remote teletypewriters are located in maintenance centers where data is used. Within each wire center **contact-closure** type status indicators monitor air dryer alarms, pressure contactors and flow alarms. **Flow-monitoring** devices indicate both the total and instantaneous rate of air flow to a pressurized system. Transducers and contactors monitor the pressure level in underground, aerial and buried cable plant.

CPMS is modular in construction. Both remote locations and the number of monitoring devices at each wire center can be expanded.



## CPMS

**Provides an economically and administratively attractive vehicle for maintaining the vast network of pressurized cable. Its automatically generated reports enable more effective management control and upkeep of cable pressure systems.**

### CPMS WILL MONITOR

- pressurized toll facilities
- trunk facilities
- underground exchange cable
- buried exchange cable
- aerial exchange cable
- airpipe

### CPMS WILL REDUCE

- labor costs in the active preventive maintenance of the pressurized cable plant

### CPMS WILL ELIMINATE

- the periodic daily reading of monitoring devices by the Repair Service Bureau, Central Office and Outside Plant personnel.
- false alarm dispatching due to inaccurate and incomplete data.
- all time consuming manual effort required to interpret and to respond to abnormal readings of monitoring devices

### CPMS WILL SAVE

- A.T.&T. has estimated that a model CPMS installation, monitoring 6000 miles of pressurized subscriber cable, will save 300,000 dollars annually.

## SYSTEM OPERATION

The computerized CPMS central terminal controls the operation of the equipment. The system normally operates in an automatic mode, however, an operator can intervene for a specific inquiry or command. Operating in the automatic mode the CPMS software system can measure and analyze approximately 480 pressure transducers or contactors per minute. All monitoring is performed at a time rate relative to their importance within the network.

The central terminal screens data obtained from a wire center by comparing it to old data and preset limits stored in file. Trouble reports are generated the first time that a trouble condition is observed that day. A normal reading will be reported when a previously reported abnormal reading has been corrected. Once a day the system will initiate a report of all existing trouble conditions.

Status indicators are yes/no devices and therefore the trouble report is generated simply on the basis that the indicator has operated.

Readings on all associated transducers are normally taken during one access period and a report will include data on all transducers that appear to be relevant to the problem. A report is generated whenever the pressure drops below a preset minimum pressure level or whenever the nightly reading is one psi lower than was obtained the previous night.

## THE HARDWARE

The hardware at the *central location* is a combination of cabinet-mounted and free-standing equipment. One cabinet is a standard Hewlett-Packard cabinet containing a computer, disc drive and high-speed tape reader. The other cabinet provides mounting space for data facilities which may include as many as 10 data sets, some equipped with 801 Automatic Calling Units. Each unit of free-standing equipment and cabinet requires one standard 115 volt, 60 Hz, 15 amp electrical connection.

The CPMS *remote terminal* would generally be located in a wire center. The remote terminal comes equipped with a factory-installed E2A telemetry module for communication with the central terminal over the DDD network.



Remote Terminal

DDD Network

The central and remote terminals are connected by the DDD network

Remote Terminal

Pressure Transducers

Pressure Contactors

Pipe Alarms

Air Dryer Alarms

Flow Transducers

Maintenance Center

DDD Network

overall system status continuously displayed on CRT with keyboard.

card reader to input file data

teletypewriter facility

minicomputer, disc drive, high-speed tape reader and input-output extender cabinet

CPMS Central Terminal

high speed printer

DDD Network

Remote Terminal

DDD Network

Remote Terminal

Maintenance Center

CPMS

CABLE PRESSURE MONITORING SYSTEM

Standard KS cabinet provides mounting space for data facilities.



The remote terminal hardware is mounted in a standard 23 inch wide by 12 inch deep frame and is available in 7-foot, 9-foot and 11-ft 6-inch bay heights.

The CPMS remote **maintenance centers** require switched teletypewriter facilities to receive reports and bulletins on pressure related troubles.

## THE SOFTWARE

The CPM software system is a real-time system with foreground and background processing. There are four major software partitions. The *operating package* takes care of scheduling tasks, interfaces with I/O devices and performs other supervisory functions. The *file generator/editor package* sets up the various files. The *application package* acquires and screens data and generates reports. The *demand package* permits operator intervention or inquiry.

A Hewlett-Packard 2100 series minicomputer is used to operate and control the system. A data file and several program modules are permanently stored. The core resident program includes the main control program, routines necessary to interface the computer with various peripheral devices, and data needed to access disk files.

The file data associated with the software is peculiar to the particular system installation. This data is obtained from various company records entered on specifically designed forms, key punched on cards and introduced into the system for storage.

## TROUBLE REPORTS

All trouble reports are printed at the central terminal and scheduled for transmission to the cognizant maintenance center. If a report cannot be delivered to a maintenance center after repeated attempts (e.g., because the line is busy) the operator at the central terminal is alerted for manual action if desired.

Each night beginning at 2:00 a.m. reports are scheduled to be sent to each of the remote maintenance centers so that the current status of the pressurized plant is available to the maintenance foreman at the start of the regular shift. Later, that same day, if another sensor indicates an alarm state, a bulletin is generated.

## MANAGEMENT FEEDBACK

Two types of management feedback are provided; an escalation report, and a monthly summary report.

The escalation report is intended to assist management in recognizing troubles that have remained in an alarm state for a length of time considered to be abnormal.

The monthly summary report lists the total number of sensors of each type and priority, the number of sensors that went into alarm during the month, the number that stayed in an alarm state sufficiently long to warrant placement on the escalation report, and the number of devices presently in an alarm state. Also indices are generated for each wire center to provide insight into:

1. amount of activity required of maintenance forces.
2. their ability to react to this activity in a realistic time.
3. level of protection currently afforded by pressure system.

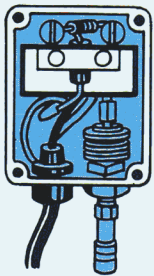
# CPMS



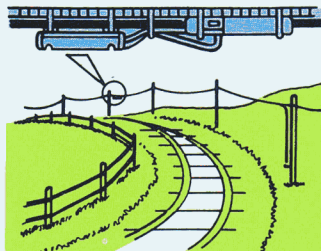
## MONITORING DEVICES

CPMS is compatible with existing monitoring devices. These are designed as binary or analog type for monitoring cable pressure.

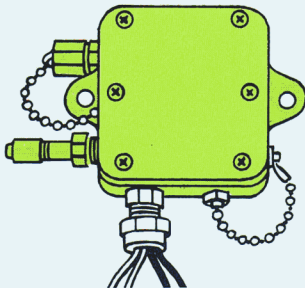
Binary switches provide contact-closure and indicate the status of the pressurized cable plant at various monitoring points. They monitor air dryer alarms, flow alarms and pressure contactors on dedicated alarm pairs.



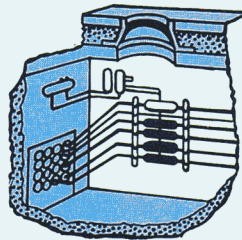
L or M contactor—monitors pressure in aerial subscriber cable.



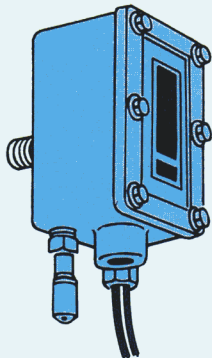
N contactor—monitors continuous air flow.



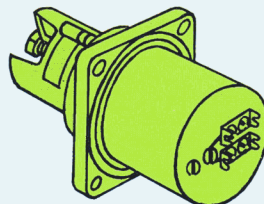
P contactor—monitors cable pressure in buried and underground systems.



Transducer type analog devices measure the actual cable pressure on working subscriber loops at remote points.



C transducer—monitors cable pressure changes in aerial cables.



E transducer—can measure gas pressure in increments of 0.5 pounds per square inch from 0 to 9.5 psi in underground cables.

Two-level resistor type devices on working subscriber loops monitor the existing pressure at remote points. They also indicate the condition of other remotely installed apparatus, such as pole-mounted air dryers.

### CPMS central terminal has the capacity of

- 150 wire centers with monitoring facilities for:
- 10,000 transducers
- 10,000 status indicators
- 2,000 air flow measuring devices

### each remote terminal can indicate the status of

- pressure on subscriber loops
- air dryer alarms
- pipe alarms
- pressure contactors

### each remote terminal can

- measure up to 1918 pressure transducers
- monitor up to 159 alarm pairs
- identify operated contactors by loop resistance measurements
- monitor as many as 48 flow transducers
- determine the total and rate of air flow to a pressurized system



# CPMS

**CPMS WILL HAVE A PROFOUND EFFECT ON THE ADMINISTRATION AND MAINTENANCE OF PRESSURE SYSTEMS. THE ELIMINATION OF TIME CONSUMING MANUAL READINGS OF MONITORING DEVICES WILL REDUCE THE DESK LOAD AND LOWER MAINTENANCE COSTS WHILE THE COMPUTERIZED SUMMARY REPORT WILL ASSIST MANAGEMENT IN BETTER AND MORE EFFICIENT ALLOCATION OF PLANT RESOURCES.**

WESTERN ELECTRIC continues to stand ready to assist you in meeting your requirements for transmission systems of all types. For assistance, please contact the Service Consultant, Transmission Products, serving your State or Region:

Illinois, Indiana, Michigan, Wisconsin  
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Rolling Meadows, Ill. 60008

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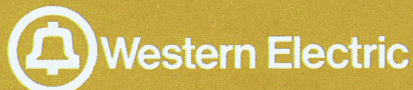
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## REFERENCES:

BSP—637-600-010  
BSP—637-600-050  
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EL—2207  
EL—2247  
EL—2772

Product Engineering Control  
Center:  
Merrimack Valley  
Manufacturing Location:  
North Carolina



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ORGANIZATION

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