



**Phoenix
Digital**

MODBUS PLUG-AND-PLAY TOOLS for CONTROL NETWORKS

Phoenix Digital now provides a complete set of Modbus Communication Tools, providing higher thrupt, greater flexibility, improved compatibility, and higher reliability than ever before possible with conventional Modbus communication equipment. Phoenix Digital's Modbus Port Expander Plus (MPE+) product operates as a Modbus Multi-Master Multiplexer, Network Server, and Communication Controller... all in one. Phoenix Digital's Modbus Optical Communication Modules (OCMs) provide Multidrop Fiber Optic Communications for high reliability Modbus communications. The MPE+ and OCMs are available in modular Standalone Panelmount Enclosures and 19" Rackmount/ Panelmount Enclosures. . . with integral 120/220 VAC, 24 VDC, or 125 VDC power supplies.

MODBUS PORT EXPANDER PLUS... FEATURES

- Multi-Master Multiplexer. . .
 Multiplex up to 8 Modbus Masters with a Single MPE+.
 Cascade multiple MPE+ units for additional Modbus Master Multiplexing capability.
- Self Teaching, Real Time Database. . .
 Instantaneous Modbus Response.
 No-Wait Screen Updating.
- Hot Standby, Fail Safe Operation.
- Peer-to-Peer Modbus Communications. . .
 Communicate directly between Modbus Slave devices.
- Host-to-Host Modbus Communications. . .
 Communicate directly between Modbus Host devices.
- Interfaces Dissimilar Modbus Devices. . .
 On-the-fly Conversion of all Modbus Communication Parameters, Including ASCII/RTU.



**Phoenix
Digital**

**TOOLS FOR
MODBUS
COMMUNICATION
NETWORKS**

**MODBUS OPTICAL
COMMUNICATION MODULE**

MODBUS PORT EXPANDER PLUS

MODBUS FIBER OPTIC MODULE... FEATURES

- Fiber Optic Communications. . .
 Noise Immunity, Intrinsically Safe.
- Dependable Data Communications. . .
 On-Line Error Checking, Fault Prediction,
 Fault Tolerant Redundant Fiber Media.
- Network-Wide Diagnostics. . .
 Locates Faults and Impending Faults.
- Short or Long Distance. . .
 6 Feet (2 Meters) to 6 Miles
 (10 Kilometers) Apart - Multimode.
 Over 16 Miles (25 Kilometers)
 Apart - Singlemode Operation.
- Selectable Wavelengths. . .
 850 nm, 1300 nm, 1550 nm.

MODBUS PORT EXPANDER PLUS (MPE+)

MPE+ DESCRIPTION

The Modbus Port Expander Plus provides a wide variety of different Modbus communication tools, for solving the most difficult Modbus communication problems. The MPE+ enables users to overcome virtually all types of performance and compatibility limitations in Modbus communication networks.

MPE+ primary features include:

- 100 % Modbus Compatibility.
- 9 Modbus Ports, Individually Configurable for Master or Slave Devices, at any Baud Rate from 300 baud to 19.2 Kbaud.
- Multiple Modbus Master Multiplexing... with as many as 8 Masters multiplexed on a single Modbus network, and many more when cascading multiple MPE+ units.
- Self Teaching, Real Time Database maintained by the MPE+, providing high speed thruput and instantaneous screen updates.
- Hot Standby, Fail Safe Operation with Multiple MPE+ units.
- Peer-to-Peer Modbus Communication between Slave Devices. (PLCs, etc.)
- Host-to-Host Modbus Communication between Host Devices. (Computers, Operator Interface, etc.)
- Conversion of Modbus Communication Parameters On-The-Fly... Including ASCII/RTU, Baud Rate, Parity, etc.
- Robust Diagnostics Including Message Counters, Error Detectors, Error Counters, Loop Back Test, Software Validity Test, Memory Test, etc.
- Modbus Communication Ports Available with RS-232, 422, or 485 Drivers.
- Handshaking for compatiblilty with Modbus Communication Modems.

Phoenix Digital's MPE+ units may be used to interconnect all types of dissimilar Modbus compatible equipment, in the same physical network, providing protocol compatibility throughout the network.

MPE+ OPERATION

The Modbus Port Expander (MPE+) is fully compatible with the Modbus protocol, and functions with all Modbus compatible devices. The MPE+ provides 9 communication ports, each individually configurable for Master/Slave orientation, ASCII/RTU mode, baud rate, parity, stop bits, time-out, and modem interface. The MPE+ performs conversion of all communication parameters between ports, on-the-fly.

The MPE+ may be used as a Modbus Master Multiplexer, multiplexing as many as 8 Modbus master devices onto one Modbus network. (See Figure on Page 7.) If more Modbus Masters are required then multiple MPE+ units may be cascaded together, providing virtually unlimited Master multiplexing capability.

The MPE+ incorporates Phoenix Digital's exclusive self teaching, real time database, for accelerated Modbus communication thruput. The MPE+ teaches itself Slave address locations (scan list) for its database by memorizing read requests from Master (Host) devices. The MPE+ creates a database image table from this scan list, which it will continually refresh with the latest Slave coil and register information. Master devices receive data instantaneously from this database, thereby eliminating communication and Slave (PLC, etc.) latency times. Thus, the MPE+ drastically reduces the response time to Master devices. The MPE+ automatically self-prioritizes the database update frequency to update data which is most frequently requested by Master devices, at the the highest possible rate. The user may also manually set the database update frequency to allow application

of specific network tuning of the MPE+ database and pass-thru features.

The MPE+ enables Slave devices (PLCs, etc.) to communicate directly with each other via a Peer-to-Peer mailbox architecture. Within each Slave the user simply allocates two mailbox areas in register memory, one for incoming mail and the other for outgoing mail. Incoming mailboxes store data communicated from other Slave devices while outgoing mailboxes store data to be communicated to other Slave devices. The MPE+ continuously reads (polls) the data in the individual outgoing Slave mailboxes and writes (broadcasts) this data to specified Slave incoming mailboxes. Reading and writing of mailbox data by the MPE+ occurs without any special type of programming, and is 100% transparent to Slave control functions. The MPE+ also provides Host-to-Host communication between multiple Modbus Master devices. A “virtual” Slave database is created within the MPE+ for Master (Host) device access, and all references to the designated “virtual” Slave node address will access this database. Data may be read or written to this database via normal Modbus coil and register read/write commands. The powerful combination of Peer-to-Peer and Host-to-Host communication allows any Modbus device to communicate directly with any other device for maximum effective throughput.

The MPE+ automatically converts dissimilar communication parameters such as low and high baud rates, ASCII and RTU data formats, etc., on-the-fly. It also may be ordered with one or more Modbus ports configured for RS-232, RS-422, or RS-485 communication.

The MPE+ provides expanded Modbus diagnostic and troubleshooting capabilities, which are not available with any other Modbus communication device on the market today. The MPE+ enables Modbus users to examine and display individual Slave device communication status information by directly reading Slave communication registers. In addition, the MPE+ provides a communication loopback test for confirmation of valid Modbus communications. The MPE+ also provides self-diagnostics including power monitoring, memory parity, processor fault detection, pass-thru relays for fault tolerant network communications, and fail safe control for hot standby operation. (See Figure on Page 8.)

MPE+ INSTALLATION

The MPE+ is provided in a modular Industrial Enclosure. It includes provisions for panelmounting, mounting on a standard 19” rack, or desk top installation.

MPE+ SPECIFICATIONS

Mounting	: Panelmount, 19” Rackmount, or Desk Top
Connectors	: 25-Pin, Sub-D (female)
Power Supply	: 120/220 VAC, 24 VDC, or 125 VDC.... 30 Watts
Diagnostic Indicators	: Port - Two per port (Transmit, Receive) : System - Power, Run, Parity, Fault
Environmental	
Operating Temperature	: 0° to 60° C (32° to 140° F)
Storage Temperature	: -40° to 85° C (-40° to 185° F)
Relative Humidity	: 0 to 95% RH, non-condensing
Dimensions	: 5.25" H x 19.00" W x 7.90" D (13.34cm H x 48.26cm W x 20.07cm D)

MODBUS OPTICAL COMMUNICATION MODULE (OCM)

OCM DESCRIPTION

Phoenix Digital's family of Optical Communication Modules for Modbus networks provides the most advanced, comprehensive, fiber optic communication capabilities on the market today. Phoenix Digital's OCMs provide optical communication media, transparent to the communication protocol and configurable for distribution by the user in ring, bus, star, tree, or point-to-point network installations. Phoenix Digital's OCMs provide continuous on-line error checking for jitter, pulsewidth distortion, carrier symmetry, and optical signal strength. All of this, together with comprehensive self-test diagnostics, optimizes the overall integrity of Modbus communication networks at-large, providing Dependable Data Communications.

Optical communication network options include features not found in even the most expensive communication network installations:

- On-line Diagnostic Monitoring.
- Self Healing Communication Recovery.
- In-line Signal Monitoring.
- Locates Fault and Impending Fault Conditions.
- Annunciation of Low Signal Level.
- Wavelength Selection.
- Extended Communication Distances.

Phoenix Digital's OCMs may be used together in the same physical network to connect Programmable Logic Controllers (PLCs), Distributed Control Systems (DCS), Host Computers, Workstations, Operator Interface Panels, Modbus Port Expanders, etc.

OCM OPERATION

FAULT PREDICTIVE... Phoenix Digital's OCMs provide fault prediction thru diagnostic

monitoring and detection of impending communication failures resulting from gradual degradation of the communication link itself. The OCM monitors for impending fault conditions by continuously measuring the actual in-line signal strength (optical power) of the data communications at the receive data inputs on the module. The OCM continuously compares these actual in-line measurements to preset optical power reference thresholds. If the actual in-line data communication signal strength degrades below these power thresholds the OCM will detect and annunciate the impending failure condition via indicators on the front of the module. The OCM also provides hardwired diagnostic outputs (discrete and analog) for detecting and locating impending fault conditions, and for on-line optical power measurement. Thus, communication network status is continuously monitored, and impending failure conditions are annunciated and located before the communication failure actually occurs. This enables maintenance personnel to perform Predictive Maintenance on fiber optic Modbus communication networks at-large!

FAULT MANAGEMENT... Phoenix Digital's OCMs provide fault tolerant, self healing communications through diagnostic monitoring of the communication signal waveforms at each node on the network, and ultra-high speed detection and isolation of points of communication failure anywhere on the network. OCM modules self heal around communication failures in ring, bus, star, tree, or point-to-point network configurations. The OCMs automatically redirect network traffic around points of failure until the failure conditions are corrected, and then automatically restore the communication network to its original traffic patterns. Thus, communication continuity is unconditionally maintained by the OCM module in the event of either node or media failure! In addition, the OCM provides diagnostic outputs to locate network fault conditions, enabling maintenance personnel to splice/terminate/replace fiber media, add/delete nodes, etc. on-line,

without disrupting network communications! All of this is transparent to the operation of Modbus communication networks.

INTERACTIVE DIAGNOSTICS... Phoenix Digital’s OCMs provide advanced, system-level interactive diagnostics. These diagnostics may be used to assist in troubleshooting a wide variety of different types of network problems:

- Detect and Locate Fault Conditions Throughout the Network.
- Trap-and-Hold, and Locate Intermittent Communication Failures.
- Detect and Locate Impending Fault Conditions Throughout the Network.

These advanced diagnostics provide the user with a powerful set of tools, greatly simplifying network start-up and on-line maintenance of Modbus communication networks.

EXTENDED DISTANCES... Phoenix Digital’s OCMs provide optional wavelength selection for extended distance applications. The economical 850 nanometer wavelength may be selected for data communication networks with less than 12,000 feet (3,650 meters) between nodes. The higher performance 1300 and 1550 nanometer multimode wavelengths may be selected for longer distance applications,

extending communication distances between nodes to over 6 miles (10 kilometers). The 1300 and 1550 nanometer singlemode wavelengths may be selected for extended distance applications, extending communication distances between nodes to over 16 miles (25 kilometers)!

OCM INSTALLATION

Phoenix Digital’s Modbus Optical Communication Modules are available in modular Panelmount Industrial Enclosures, and in 19” Rackmount/Panelmount/Desk Top Enclosures.

OCMs may be interconnected on the fiber optic network in an active bus configuration, using either multimode or singlemode fiber optic cable. (See Figure on Page 7.) Channel A Receive Data inputs and Transmit Data outputs should be interconnected sequentially from OCM to OCM in one direction, and Channel B Receive and Transmit Data inputs and outputs interconnected sequentially in the opposite direction. This configuration may be made fault tolerant by cross-connecting end-to-end Channel A (Ch A Transmit to Ch A Receive) and Channel B (Ch B Transmit to Ch B Receive) on the OCMs on either end of the active bus. (See Figure on Page 8.) This effectively transforms it into a counter-rotating ring Modbus network configuration without requiring any other action by the user.

SPECIFICATIONS

Fiber Optic Cable Type	: Multimode or Singlemode
Mating Connector	: ST or SMA
Transmit Launch Power	: -15 dbm (Typical, Multimode); -18 dbm (Singlemode)
Receive Sensitivity	: -32 dbm
Power Supply	: 120/220 VAC, 24 VDC, or 125 VDC.... 10 Watts
Environmental	
Operating Temperature	: 0° to 60° C (32° to 140° F)
Storage Temperature	: -40° to 85° C (-40° to 185° F)
Relative Humidity	: 0 to 95% RH, non-condensing
Dimensions	
Modular Panelmount Enclosure (“-P”)	: 10.38" H x 3.50" W x 7.00" D (26.36cm H x 8.90cm W x 17.78cm D)
19” Rackmount/Panelmount/ Desk Top Enclosure (“-E”)	: 3.50" H x 17.00" W x 7.00" D (8.89cm H x 43.18cm W x 17.78cm D)

ORDERING INFORMATION

MODBUS PORT EXPANDER PLUS

Model Number ⁽¹⁾	Description
MPE+	MODBUS PORT EXPANDER PLUS (9 RS-232 Modbus Ports)

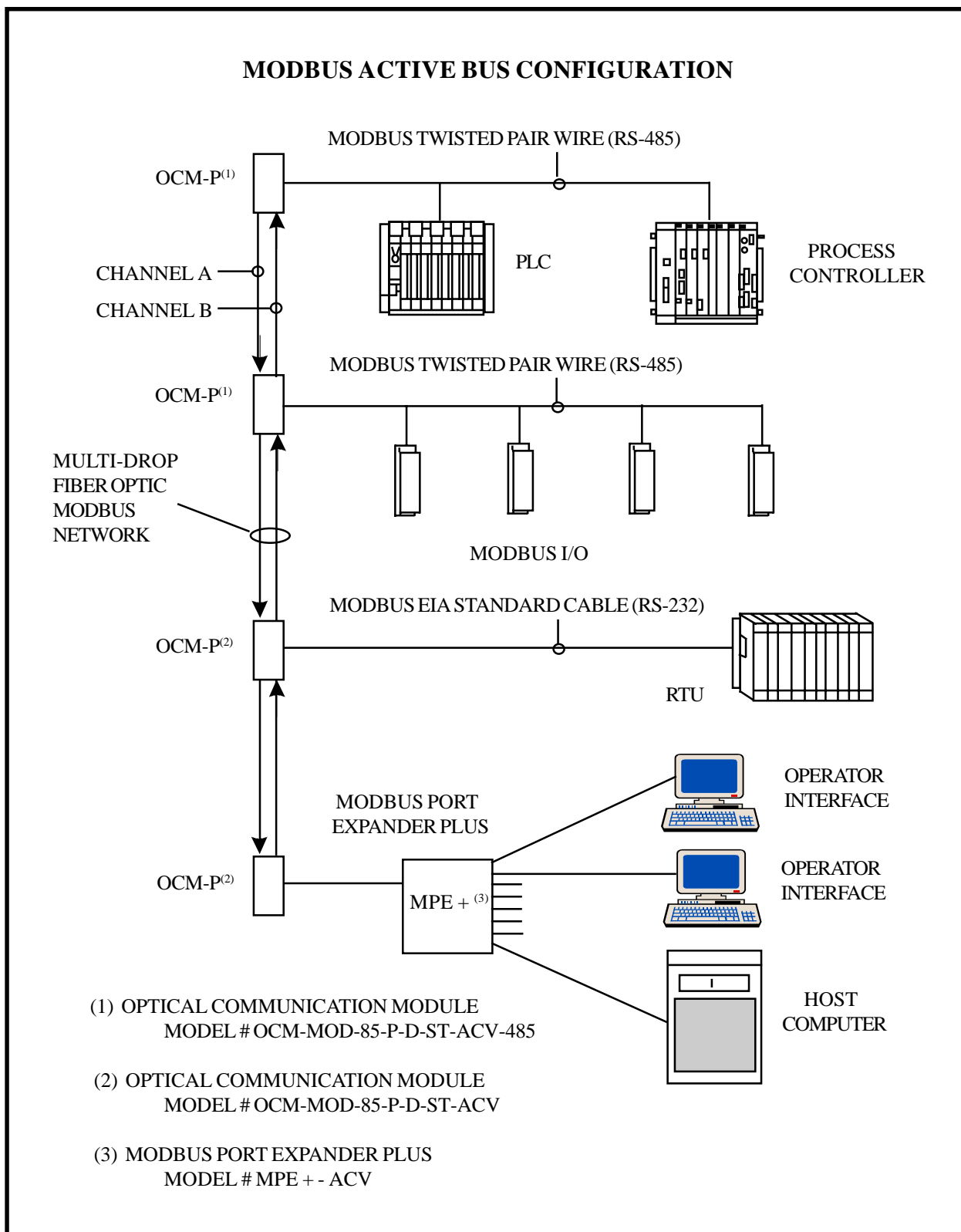
- (1) Add suffix “-24V” for 24 VDC Operation.
 Add suffix “-125V” for 125 VDC Operation.
 Add suffix “-ACV” for 120/220 VAC Operation.
 Add suffix “-422/x” for RS-422 Modbus communications. (Specify “x” for Number of RS-422 Ports, where x = 1 thru 9.)
 Add suffix “-485/x” for RS-485 Modbus communications. (Specify “x” for Number of RS-485 Ports, where x = 1 thru 9.)

MODBUS OPTICAL COMMUNICATION MODULE

Model Number ⁽²⁾	Description
OCM-MOD-85	MODBUS OCM (12,000 feet/3,650 meters between nodes)
OCM-MOD-13	MODBUS OCM (32,000 feet/10 kilometers between nodes)
OCM-MOD-15	MODBUS OCM (43,000 feet/13 kilometers between nodes)

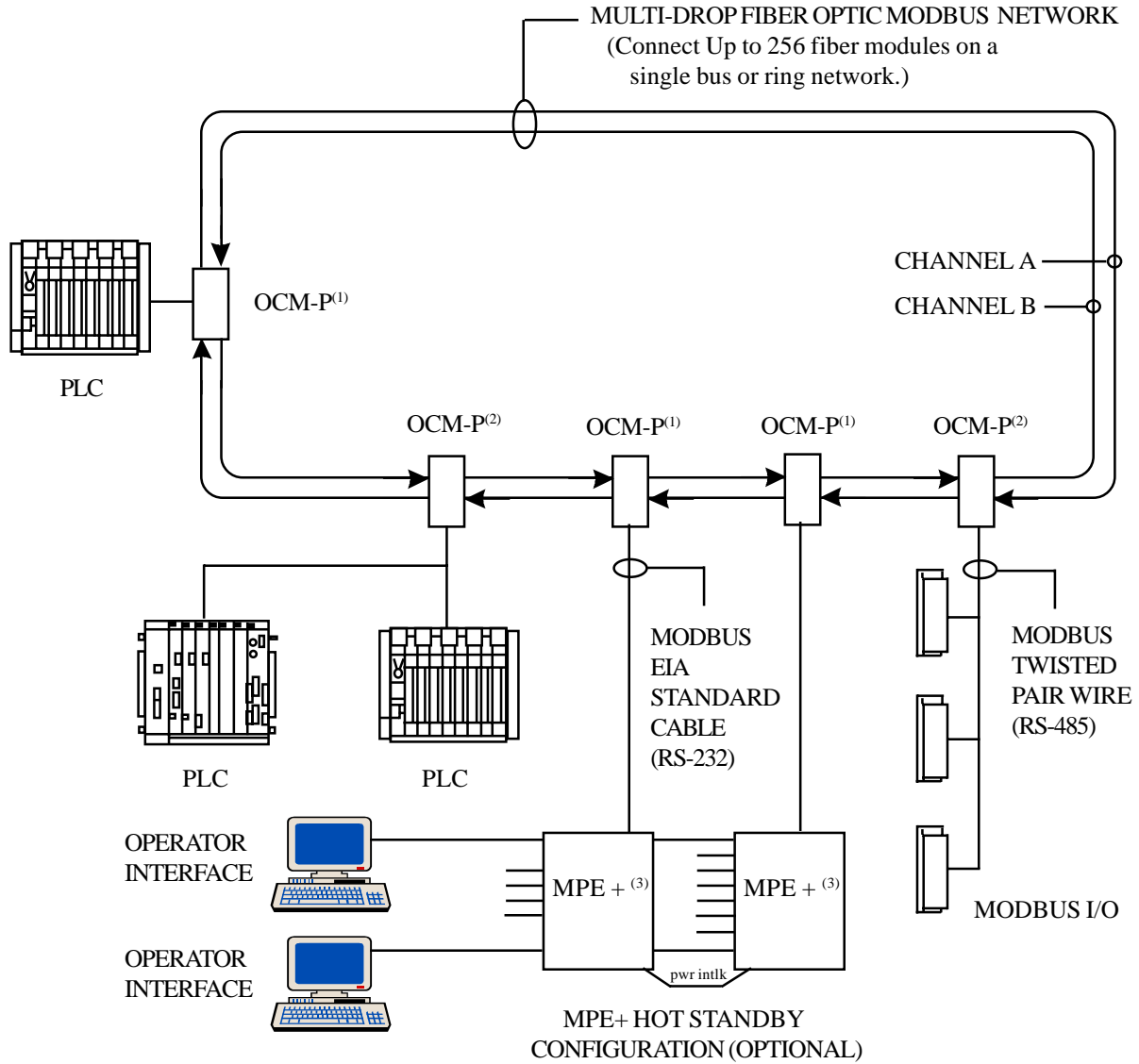
- (2) Add suffix “-P” for Standalone, Panelmount Module Enclosure.
 Add suffix “-E” for 19” Rackmount/Panelmount/Desk Top Module Enclosure.
 Add suffix “-D” to for Real Time Diagnostic Outputs.
 Add suffix “-ST” for ST Fiber Optic Connector Style.
 Add suffix “-SMA” for SMA Fiber Optic Connector Style. (Available with 850 Nanometer Wavelength Only.)
 Add suffix “-24V” for 24 VDC Operation.
 Add suffix “-125V” for 125 VDC Operation.
 Add suffix “-ACV” for 120/220 VAC Operation.
 Add suffix “-SM” to for Singlemode Operation. (Available with 1300 Nanometer Wavelength and ST Connector Options Only.)
 Add suffix “-422” for RS-422 Modbus communications.
 Add suffix “-485” for RS-485 Modbus communications.
 Add suffix “-FD” for full duplex communication. (Handshaking for access control not required.)

Consult factory for additional information on fiber optic modules for other Open Standard Networks (**ETHERNET**... among others); other Open and Proprietary PLC and Process Computer Networks (Rockwell **ControlNet™**, **DH+**, and **RIO**; GE Fanuc **GENIUS™** and **SNP**; Siemens/TI **TIWAY™**, **PEERLINK™**, and **RIO**; Group Schneider **MODBUS PLUS™** and **RIO**... among others); Industrial Fiber Optic Cable (indoor, outdoor, aerial, burial, etc.); termination and splice tool kits; fiber optic video (CCTV) and telephone communications; and on-site installation support, training, and network commissioning services.



TYPICAL MPE+ and OCM INSTALLATION CONFIGURATION

MODBUS DUAL MEDIA RING CONFIGURATION (FAULT TOLERANT)



(1) OPTICAL COMMUNICATION MODULE
MODEL # OCM-MOD-85-P-D-ST-ACV

(2) OPTICAL COMMUNICATION MODULE
MODEL # OCM-MOD-85-P-D-ST-ACV-485

(3) MODBUS PORT EXPANDER PLUS
MODEL # MPE + - ACV

TYPICAL MPE+ and OCM INSTALLATION CONFIGURATION



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