ORMEC
Modbus TCP Communications

ORMEC's MotionBASIC® Extensions for Modbus TCP Communications adds to the network capability of the ORION® motion controller. Modbus TCP is an provides a fast and low cost method to send and receive application data to any other controller on an Ethernet network installed as a Quantum communication node. The MBX also adds a full list of MotionBASIC® statements to configure, control and monitor Quantum PLC activity.

Features and Benefits

Using Modbus TCP communications provides a number of key advantages:

- ❏ A low cost physical interface to the ORION® controller ... using standard Ethernet cards.
- ❏ Based on standard internet technologies ... TCP/IP protocol layered on a high speed 10base Ethernet network.
- ❏ Enhances the flexibility and performance of message transfers by allowing peer-to-peer connections between network nodes.
- ❏ Provides reliable connectivity to popular HMI packages that use Modbus TCP to transfer of integers, floating point and text string variables as object tags for operator input and output.
- ❏ Based on open standards for effective integration to other third party components.

Overview

Modbus TCP communications extends the MotionBASIC® operating system to provide high speed connectivity between multiple ORION® controllers as well as to third party PLCs and HMI packages that communicate with the Modbus TCP protocol over an Ethernet network. An ORION® controller, with an Ethernet link installed and configured with the MBX software extensions, can open a Modbus TCP connection to send application data to any Modbus TCP server node on the network. The ORION® also has the ability to start a server node that will accept any connection from another Modbus TCP node and receive application data.

ORMEC provides two types of Ethernet installation hardware for the Modbus TCP MBX option.

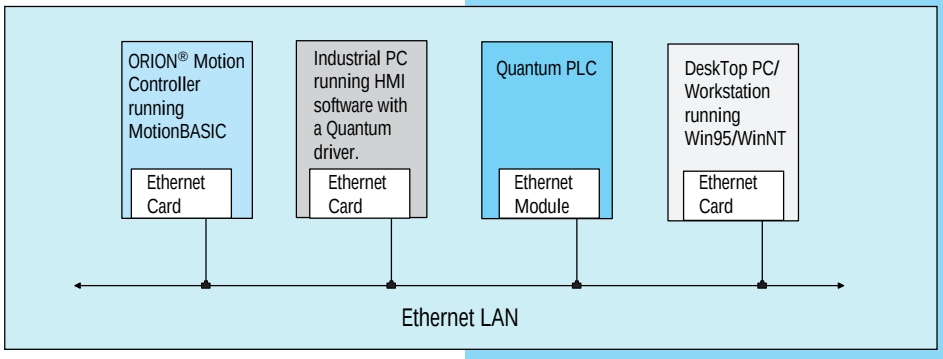
Multiprotocol capability

Software development for a system with multiple ORION® controllers using the full capabilities of Modbus TCP communications can now be performed with one PC. Since Ethernet is a multiprotocol network, any PC connected to the network can establish a TCP/IP connection, communicate to an ORION® and run the MotionDesk™ for program development over the same wire at basically the same time Modbus TCP communications are also going on.

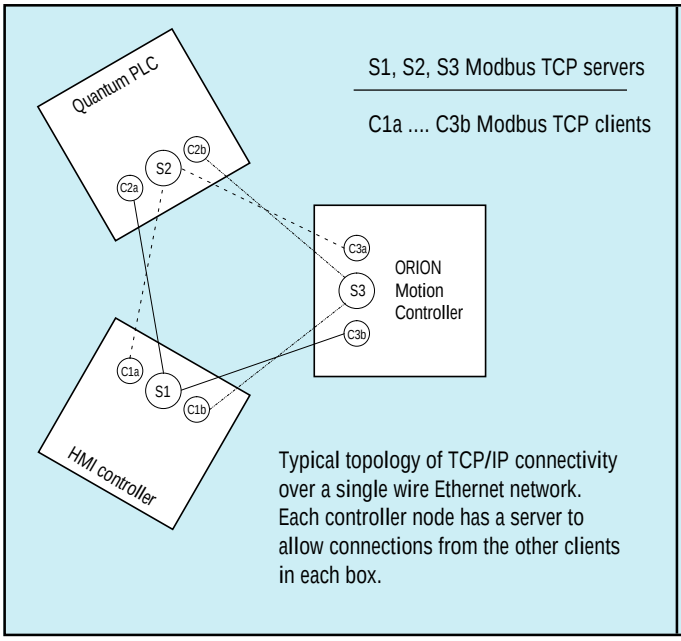
Modbus TCP Architecture

ORION® Modbus TCP consists of a physical layer based on 10baseT, 10base2, or 10base5 type Ethernet communication standards along with a client/server transport protocol (TCP/IP stack) to provide reliable peer-to-peer communications in the ORION® controller. At the application level, the MBX uses the Modbus protocol developed for the PLC industry to transfer register data as messages between controllers. All transfers happen as a background task concurrent with the user's main application program.

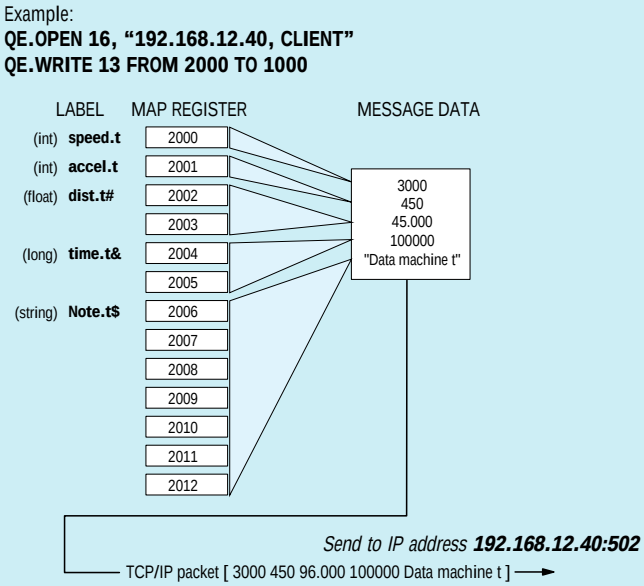
User access at the application programming interface level consists of MotionBASIC® extensions for making the connection to the destination server and the specifying source and destination registers for a read or a write multiple register transfer to that connected server. Concurrent multiple connections can be made to multiple servers on the network for a flexible and efficient arrangement for updating application data between a variety of system components.



Physical layer of the Ethernet connections between multiprotocol network nodes.



ORION® Ethernet connectivity utilizing multiple servers and multiple clients.



Using register mapping, application variables are sent as one message.

For constructing messages, the MBX provides MotionBASIC® mapping capabilities to simplify data organization at the PLC register level for the user.

ORION® Variable Mapping

The ability to map variables provides a way to map PLC register values to any MotionBASIC® variable in the controller. Typically, PLC registers are addressed numerically, but MotionBASIC® uses symbolic labels to address its variables.

With mapping, the symbolic label of the MotionBASIC® variable can be simultaneously defined as a PLC register address value. Register mapping values can range from 0 to 32367. The main purpose of this mapping feature is to allow the MBX to quickly assemble the content of various variables such as integers, floats and strings that reside in different areas of the controller's memory, into an ordered list of data and transferred over the network as one message.

The MBX also provides the ability to monitor the changes in selected variables. Any change in the data contained in the variable selected, can result in an event interrupt. The event interrupt, if enabled, will in turn execute a user defined block of code (subroutine) designed to respond to the changes in the data as a result of receiving the message.

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Modbus TCP MotionBASIC® Extensions

❑ MBX Statements

QE.OPEN <device%>,"ip_adr,CLIENT | SERVER [,TM<timeout>]	Open a Server or a Client connection to a Server
QE.READ [qty of reg(s)] **FROM** <starting src_register> **TO** <starting dest_register>	
QE.WRITE [qty of reg(s)] **FROM** <starting src_register> **TO** <starting dest_register>	
QE.FC coil%**,** state%	Force a single coil to be on or off
QE.CLOSE [<device%>]	Close one connection or all connections

❑ MBX Control functions and access variables

QE@ = ON	Set mapped register access enabled
QE.SOCKOPEN@(device%**)**	Get status of TCP/IP connection
QE.DEST@ = device%	Set destination connection for next client command
QE.MSG@(device%**)**	Get client reply received status
QE.LED@ = <led value**>**	Set MBX to use the front panel MBX LED indicator.
QE.CTR@(ctr%**)**	Get 1 of 32 error status counts of client and server connection activity during data transfers.
QE.STS@(device%**)**	Get the response code for the last exception that occurred.

❑ Diagnostic Commands that display to the Direct Mode window in MotionDesk.

QE.TRACE@= ON	Enable real-time display of message transfer activity.
QE.DUMP	Display the current settings and information for all current connections.
PING <IP address>	Check to make sure that the destination IP address is available and listening on the network.

❑ MBX General MotionBASIC® Mapping Statements

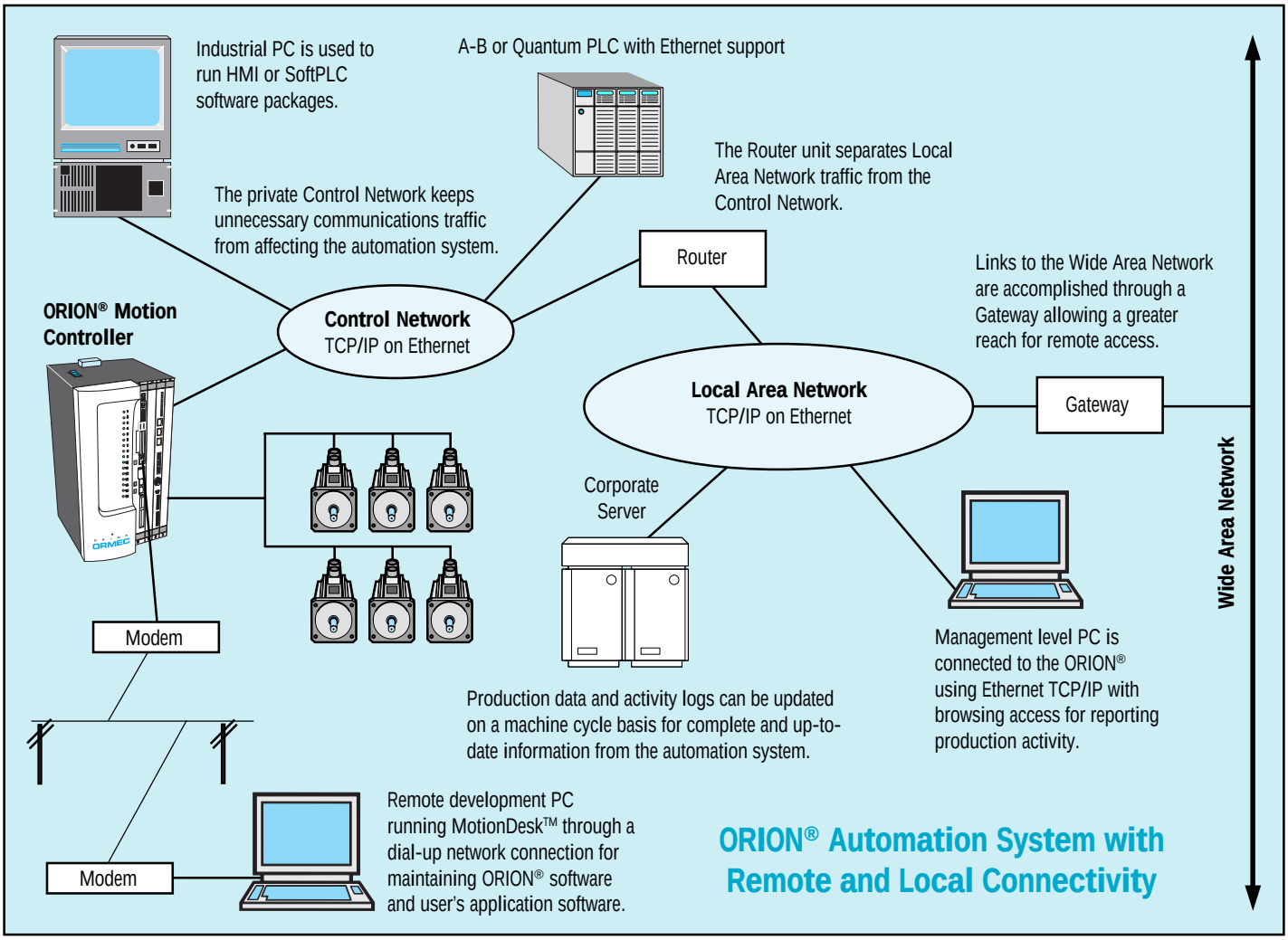
MAP <regnum> TO <variable>	Relate a register number 0 to 32767 to a MotionBASIC variable name.
ON EVENT MAP@(regnum) GOSUB [label]	Call subroutine when value mapped to regnum changed.

ORDERING GUIDE

MotionBASIC® Extension (MBX) and Network Adapters for Modbus TCP communications

ORN-ENE2000	Ethernet ISA Adapter, with RJ45 & BNC connectors
ORN-E3C509B	Ethernet ISA Adapter, with RJ45, BNC & AUI connectors
PCC-E3C589C	Ethernet PC Card Adapter, with extension cable for RJ45 & BNC connectors
MBX-QE-5	MotionBASIC® Extension for ORION® Modbus TCP, peer-to-peer communications. The MBX requires 400 ORION® MotionCredits.

Use utilities provided in the MotionDesk™ development software to assist in the hardware and software installation procedures for an ORION® MBX.



TCP/IP Network Protocol Overview

TCP & IP are two separate protocols that along with others make up what is known as the "Internet Protocol Suite". Because these are the two best known protocols in the collection, people use TCP/IP to refer to the entire collection.

TCP stands for Transfer Control Protocol. It is responsible for breaking up data into packets, called datagrams, to be sent, and then reconstructing the original data at the other end when it is received. It also handles transmission errors, re-sending lost or corrupt packets.

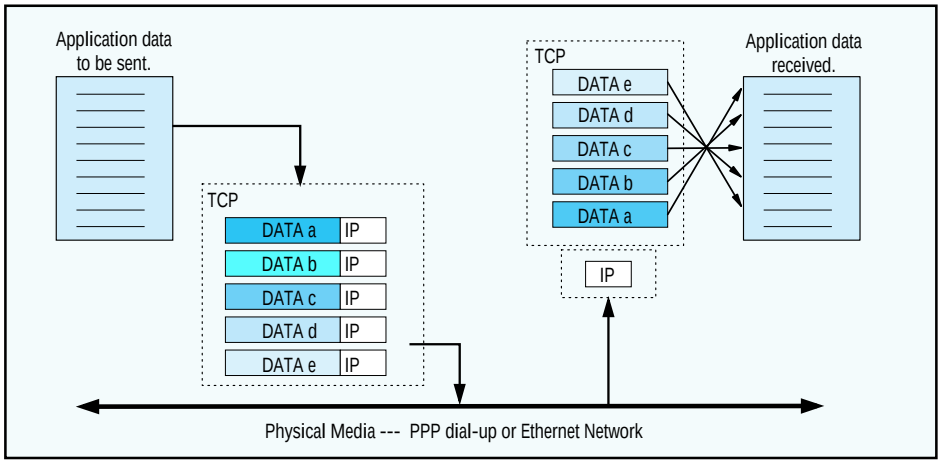
IP stands for Internet Protocol. TCP calls on IP to route datagrams to their correct destinations. TCP supplies IP with the destination address and IP handles all the details of how to get the datagrams through routers, gateways, and other network links ensuring the data will always arrive at the correct location.

Protocols below the IP layer manage the physical media such as the Point-to-Point Protocol (PPP) dial-up service for modem access or networks like Ethernet.

The TCP/IP protocols are "low level" components of the Internet Protocol Suite. The other protocols in the collection deal more with what is being sent and are referred to as "application level" protocols.

The two application protocols that are used by MotionDesk™ to communicate with the ORION® are FTP for file transfers & TELNET to give specific commands. When an A-B Ethernet or Modbus TCP MBX is installed on the ORION®, a new application protocol is added to communicate with either A-B or Quantum controllers. Custom application protocols may be programmed by the user using MotionBASIC® statements that support TCP/IP sockets.

The ORION® controller uses TCP/IP and manages all of these protocols simultaneously providing reliable connections to a variety of different sources.



Open standard protocols ensure reliable peer-to-peer data transfers over multiple media environments.