

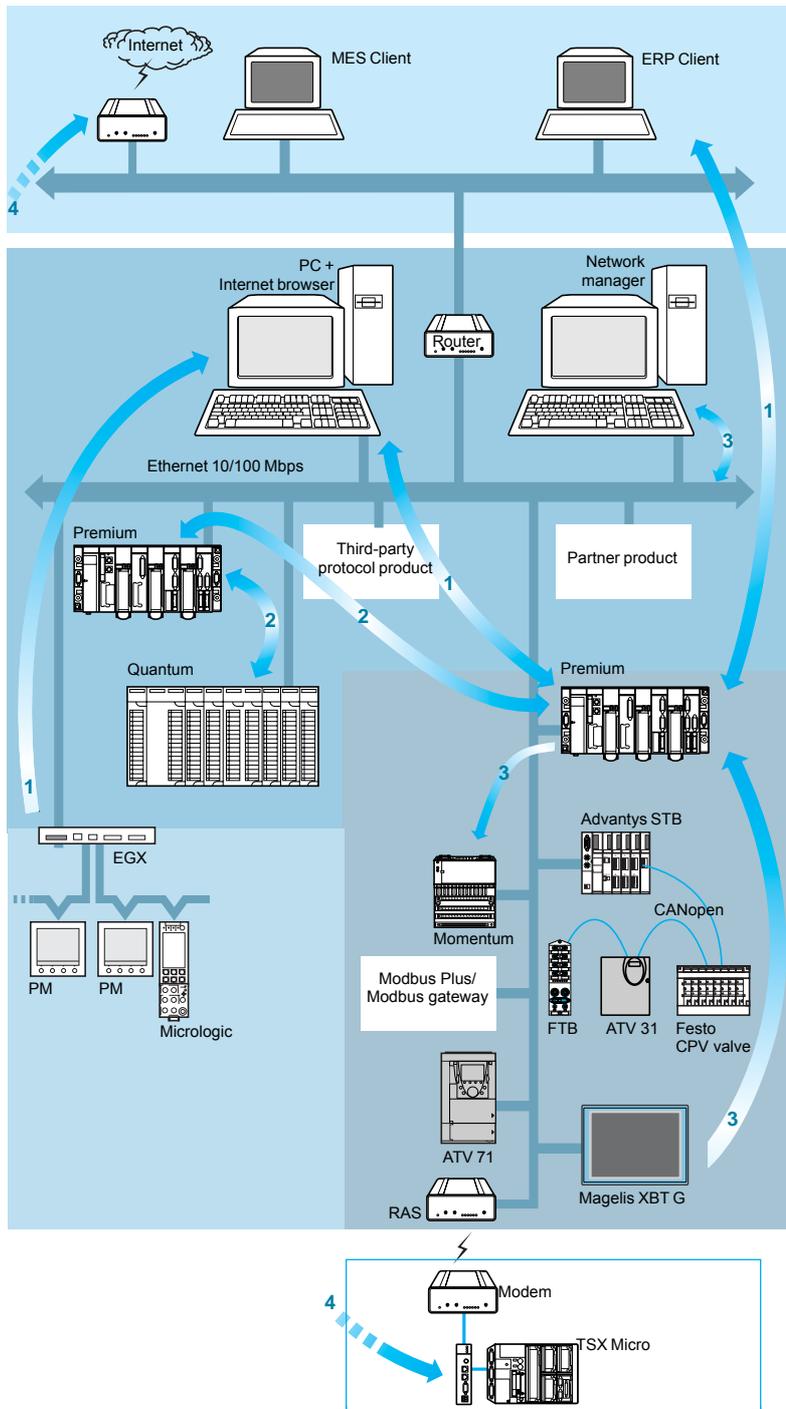
Transparent Ready

System approach

Integration of Transparent Ready products

Presentation of integration into architectures

Transparent Ready industrial products can be integrated into architectures based on the universal Ethernet TCP/IP network, with no need for any interface. The basic architecture below shows the various communication levels and functions required by industrial applications to meet data exchange requirements:



- 1 Company level: Communication between the control system products and the MES (Manufacturing Execution System) or ERP (Enterprise Resource Planning) supervision or information systems.
- 2 Inter-PLC level: Communication to PLCs for programming, diagnostics and data transfer, as well as communication between PLCs for synchronizing applications.
- 3 Field level: Communication between PLCs, PC and field devices.
- 4 Transparent remote communication: Remote communication via the Internet, or via telephone or radio link.

For a complete approach, the following requirements must also be taken into account:

- System diagnostic services
- Interoperability with third-party products or protocols
- Ethernet TCP/IP network security.

The various communication requirements of the architecture are summarized below in order to:

- Present the data exchanges required by each level
- Choose the Transparent Ready services and standard solutions on Ethernet TCP/IP that are most appropriate for each type of communication.

Transparent Ready

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1 Company level

Communication between MES/ERP system and PLCs

The requirements at this level are for communication using standard infrastructure and protocols for exchanging high volumes of data with production management systems. In some cases, the PLC must be able to adapt to the protocol specific to the connected system. Response times are not critical.

The Transparent Ready services used are mainly:

- HTTP communication, displaying data and sending commands via Web pages
- Data exchange using the OPC (OLE for Process Control) standard via an OFS data server
- Modbus TCP/IP messaging
- TCP Open
- E-mail transmission
- Direct publication in relational databases (via the FactoryCast HMI active Web server)
- SOAP/XML web services.

Communication between SCADA systems and PLCs

For this type of communication, it is also necessary to transfer high volumes of data to a group of PLCs.

The required response times are in the region of 0.5 to 2 s.

The following Transparent Ready services are used:

- Mainly data exchanges using the OPC standard via an OFS data server
- Modbus TCP/IP messaging
- TCP Open
- HTTP communication integrated in the supervision system, for displaying Web pages from the field devices in supervision pages.

Communication between HMI application and PLCs/field devices

A basic HMI (Human/Machine Interface) application must allow maintenance personnel to be notified of an event and to view the status of a field device.

The Transparent Ready services used are:

- Notification of events by e-mail
- Display of data and sending commands via Web pages.

2 Inter-PLC level

Communication for data transfer

When data is sent in point-to-point mode according to PLC programming algorithms and the required response times are in the region of 200 ms to 1 s, the main Transparent Ready service to be used is Modbus TCP/IP messaging.

Inter-PLC communication for synchronizing applications

Broadcast communication must enable several applications to be synchronized via real-time exchanges. In this case a low volume of data is exchanged.

The required response times are in the region of 10 to 500 ms.

The Transparent Ready Global Data service is particularly suitable for this type of data exchange.

Transparent Ready

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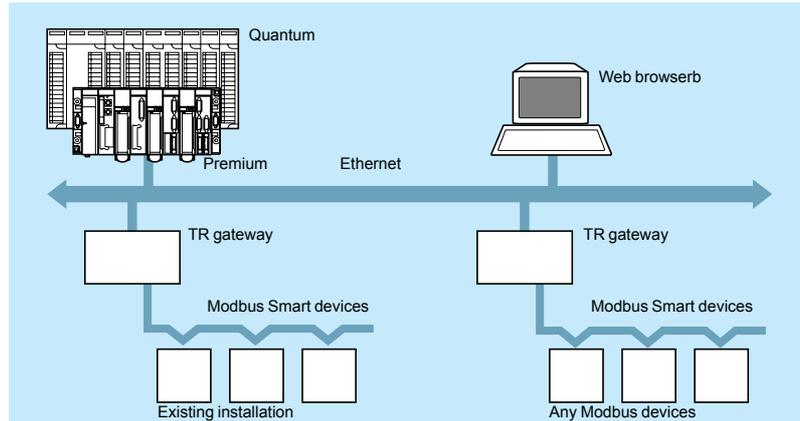
Integration of Transparent Ready products

3 Field level

Communication between PLCs and field devices for controlling the automation process

PLC applications are essentially responsible for controlling the I/O of peripheral devices. Data must be transferred to all devices quickly and repetitively. The required response times are in the region of 10 to 100 ms. The Transparent Ready I/O Scanning service meets these requirements.

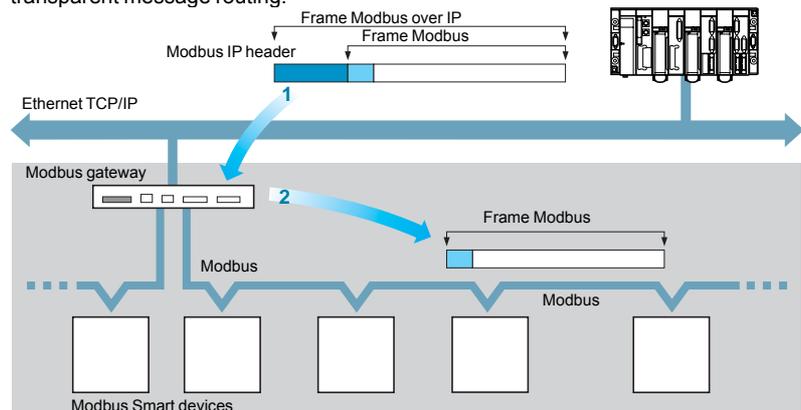
Communication with field products Modbus



Modbus serial line protocol is a world-wide de facto standard. Its simplicity, reliability and low cost enabled it to have today, probably the most important installed base of communicating industrial products. It is still the best technical/cost compromise for products without needs of high end communication performances.

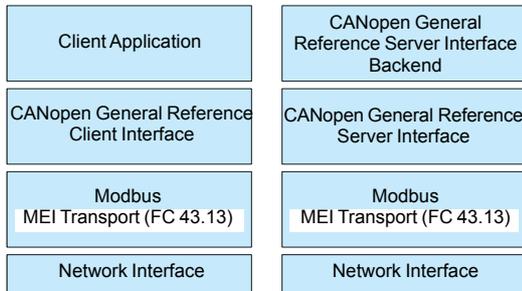
Modbus products connection into Transparent Ready architectures with gateways of Schneider Electric group (see page 48404/2 to 48404/4, 48298/2 and 48298/3), is deliberately easy to manage and provides:

- Large openness capabilities at low cost, to all Modbus compliant devices of the market place
- Connection capabilities to existing applications
- A point of entry into Transparent Ready at an optimised cost
- Same application layer over a serial line than Ethernet TCP/IP, enabling transparent message routing.



Mechanism of transparent data access with Modbus messaging

In case of data access to Modbus devices with Modbus messaging, the gateway adds no more value than the address translation, encapsulation and dencapsulation of Modbus frames, whatever Modbus function code used. This feature is totally transparent for the system, that makes no real difference from an Modbus device connected via a gateway and a device directly connected to Ethernet TCP/IP. The only difference should be performance. Modbus devices connected via a gateway benefit both of Ethernet bandwidth & multi-master feature.



Interfacing CANopen with TCP/IP – Part 2 Modbus TCP/IP Mapping: Device View of Client and Server Modules

3 Field level (continued)

Communication with field products CANopen

Modbus-IDA and CAN in Automation have commonly made the specification CiA DSP 309-2: Interfacing CANopen with TCP/IP Part 2: Modbus/TCP Mapping. CiA DSP 309-2 provides a standardized mapping of CANopen data for transport on Modbus TCP/IP networks. In the specification, Modbus Function Code 43/13 is reserved for this purpose. The function code exclusively reserved for CANopen.

The specification is available in the CAN in Automation (CiA) Web site for CiA members (<http://www.can-cia.org>) and for Modbus-IDA members (see page 48294/2) upon request (headquarters@can-cia.org).

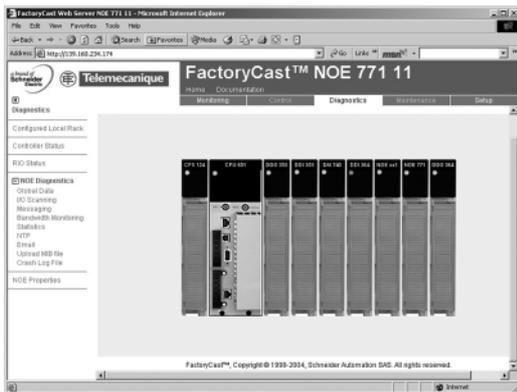
The specification defines mapping services so that CANopen devices can communicate over a Modbus TCP/IP network via a gateway device or through the incorporation of a local Modbus TCP/IP transport layer. Access to the entries of a CANopen object dictionary is supported on both a read and write basis, along with a variety of device control functions.

This specification is the first standard allowing the implementation of an open communication between Modbus/TCP and CANopen. It will leverage the Schneider Electric network solution towards a better integration, diagnostic and configuration in distributed applications. It enables machines and installation to be seamless connected to an Ethernet plant floor combining the advantages of each network in its specific area.

Communication between field PCs or operator terminals, PLCs and field devices

This type of communication is used to configure, monitor and maintain field level devices.

It must be simple so that less qualified personnel can access first level diagnostics from a standard PC. The most suitable Transparent Ready service for this is the display of diagnostic and customized Web pages. See pages 43622/2 to 43623/3. All the functions of Magelis XBT F/XBT G/XBT GT graphic display terminals are also available on Ethernet TCP/IP. The SNMP standard network management protocol can also be used from a network management station to monitor, control and perform diagnostics on all the components of the Ethernet architecture.



Choice of Transparent Ready services

The following table can be used to select the Transparent Ready service according to the required type of communication.

Communication	Company level 1			Inter-PLC level 2		Field level 3		See page
	Communication with MES/ERP	Supervision	Basic HMI application	Inter-PLC communication	Inter-PLC synchronization	Communication with peripherals (I/O)	Diagnostics	
Transparent Ready services								
Modbus TCP/IP								48290/5
Web/FactoryCast servers								43623/2
I/O Scanning								48290/6
Global Data								48290/8
SNMP network management								48290/11
TCP Open								43654/2
OFS server								48297/8
SOAP/XML								48402/2

4 Transparent remote communication

Using remote communication

Transparent remote communication is possible, with no need for any special interface, for programming, diagnostics, data exchanges, viewing and adjustment, in a similar way to connecting to a local area network.

This type of connection is used for remote access to automation products via the PLC programming tool, or by viewing Web pages with a simple Internet browser. Transparent remote access can also be used for the other Transparent Ready services.

Remote communication on the Internet

Transparent remote communication on the Internet is possible without the need for any special interfaces. For this, an Internet connection must be available. If not, contact a local Internet service provider.

This type of connection is used for remotely accessing automation products at a lower communication cost and over very long distances, using:

- The PLC programming tool
- A simple Internet browser for viewing the Web pages of the automation products that have an embedded Web server.

As use of the Internet involves security risks for the system, this type of access must be made secure by a Firewall. The use of a VPN (Virtual Private Network) is also possible. This type of function must be provided by the Firewall or by an additional device.

For further information on remote management services, see “Partnership Program” page 48294/3.

4 Transparent remote communication (continued)

Remote communication via telephone networks

Transparent point-to-point communication on the telephone network is possible using a remote access router or RAS (Remote Access Server). Since TSX ETZ410/510 Ethernet Web server modules for Modicon TSX Micro PLCs incorporate this function themselves, there is no need to use an external server/router.

A modem for wired telephone link or GSM is also necessary for telephone communication.

To access remotely other PLCs, we recommend to use TSX ETG Web gateways (see pages 48404/2 and 48404/3) or W@de Remote Terminal Unit W@de for water applications (see pages 48296/13 and 48296/14).

As with any connection via a telephone network, access must be made secure by identification functions, or filtering by a Firewall, automatic callback by the access server or VPN server.

For further information on remote telephone connections, please consult your Regional Sales Office.

Remote communication by radio

Transparent remote communication by radio is also possible on Ethernet TCP/IP, both for communication between products and for links with HMI terminals which can thus be mobile.

Various types of radio technology are compatible with Ethernet TCP/IP:

- Bluetooth
- Wi-Fi
- Special wireless industrial systems, based on the 2.4 GHz frequency.

Further information on this field, and details of partners supplying these types of technology for use with Transparent Ready products, are given on pages 48294/3 to 48294/23.

Transparent Ready System approach

Integration of Transparent Ready products

Other requirements of Ethernet TCP/IP architectures

Diagnostic services

Diagnostic services are available from the PLC programming tools, which provide in particular:

- Display of the PLC system status
- Diagnostics of the communication services on Ethernet TCP/IP (Modbus TCP/IP messaging, I/O Scanning and Global Data services)
- Display of the Bandwidth in Ethernet TCP/IP modules (module load level)

Similar or additional services are also available using a simple Internet browser by viewing the PLC Web pages:

- “Ready to use” pages for displaying the PLC status, “Rack Viewer” function
- Communication and Ethernet TCP/IP services diagnostics pages (communication statistics, I/O Scanning service and Global Data service)
- Access to the PLC variables and data via the “Data Editor” function
- “Alarm viewer” function for displaying alarms on Modicon Premium and Quantum PLCs
- User Web pages created with the “Graphic Data Editor” function or created using a standard tool, such as Microsoft Frontpage

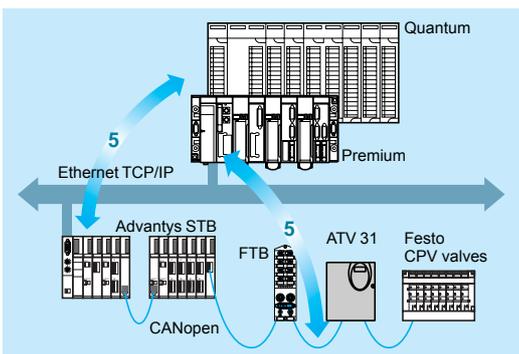
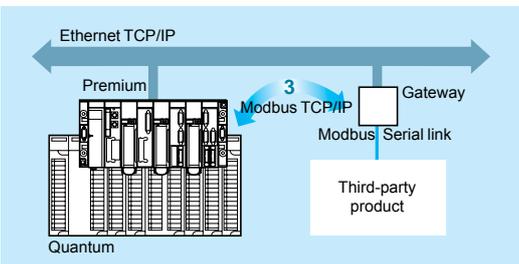
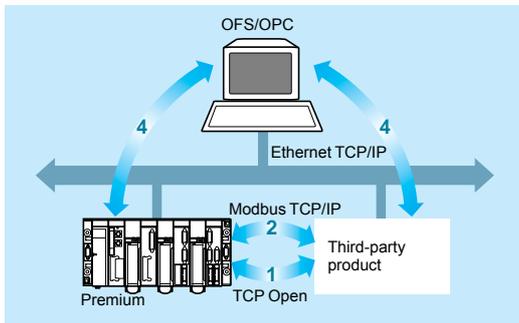
In addition to these diagnostics functions there are also the services provided by the standard SNMP protocol (Simple Network Management Protocol). A network management station can also monitor, control and perform diagnostics on all the components of the Ethernet architecture and can in particular access the objects specific to the Transparent Ready offer contained in the private MIB (Management Information Base) of the PLC communication module.

For more information on Network diagnostic tool see the “Collaborative Automation Partner Program” chapter page 48294/2.

Interoperability with third-party products or protocols

Some applications require communication on Ethernet TCP/IP with products from other suppliers. If these products do not have the Modbus TCP/IP protocol, it is possible to use one of the following 4 solutions:

- 1 Use TCP Open for managing communication with the third-party product directly on the TCP/IP layer in accordance with a specific protocol.
- 2 Develop the Modbus TCP/IP protocol on the third-party product, if it provides open access to the TCP/IP layer. This development is made easy by the simplicity of the Modbus TCP/IP protocol. The specifications are available on the Internet from Modbus-IDA (see page 48294/3).
- 3 If the third-party product has a Modbus serial link, use the gateway to the Modbus protocol on TCP/IP (see pages 48404/2 to 48404/4).
- 4 If the product is compatible with an OPC server, it is possible to create an interface on Ethernet TCP/IP between this product and Telemecanique brand PLCs via an OPC client/server PC (equipped with Telemecanique OFS data server software).
- 5 If the product has a CANopen connection (e.g. variable speed drives, motor starter, pneumatic valves...), connect it to:
 - an Advantys STB automation island (see page 48295/3),
 - a Premium or Twido PLC. The Modbus function code 43/13 access to the entries of a CANopen object dictionary supported on both a read and write basis, along with a variety of device control functions (see page 48289/4). The I/O scanning service will be also available to exchange data with the STB Advantys Ethernet interface.



Other requirements of Ethernet TCP/IP architectures (continued)

Ethernet TCP/IP network security

Security risks on Ethernet TCP/IP are higher than when using proprietary networks, for the following reasons:

- Ethernet TCP/IP is a universal communication network that is familiar and accessible to a huge number of users
- The use of Ethernet TCP/IP for automation products enables external connection without the need for any interfaces.

There are three main risks:

- Multiple "PING" requests with the ICMP protocol to create a denial of service to the module
- Reading/modification of Web server pages with the FTP protocol
- Modification of PLC variables with TCP/IP modems.

Virus risks are extremely limited at control system product level, as they are based on special operating systems.

The risks must be dealt with at each level:

- Company level 1: Possibility of using a router as access manager to the lower levels, by filtering the IP addresses and permitted communication protocols. (Please consult your Regional Sales Office for any additional information)
- Inter-PLC level 2 and field level 3: Set up an internal security policy, ensuring that only authorized people can connect to the network locally. Use the authentication, password and IP address filtering functions available at control system product level
- Transparent remote communication 4 (see page 48289/6).

Use dedicated solutions thanks to partners networking offer (see Collaborative Automation Partner Program, page 48294/2).