ADVANCED ENERGY®

INTERFACE CARD ETHERNET/IP

FOR THYRO-P AND THYRO-P MC

July 2014 EN - V2

ETHERNET/IP-SPECIFIC SECTION OF THE USER DOCUMENTATION

Index

LIST OF TABLES AND FIGURES

LIST OF ABBREVIATIONS

In this description, the following specific abbreviations are used:

dASM	Digital mains load optimization, dynamic
ASM	Automatic synchronization in multiple power controller applications (dynamic mains load optimization, not for new installations)
LBA -2	Local operating and display unit with touch display
MC	Multichannel
Thyro-P MC	Thyro-P Multichannel
PID	PID controller structure
SSC	Spread Spectrum Clocking
TAKT	Pulse full cycle

1. SAFETY INSTRUCTIONS

The safety instructions and operating manual are to be read carefully prior to installation and commissioning.

1.1 OBLIGATION TO GIVE INSTRUCTIONS

The following safety and operating instructions must be carefully read before assembly, installation and commissioning of Thyro-P EtherNet/IP Card by those persons working with or on Thyro-P EtherNet/IP Card. These operating instructions are part of the Thyro-P EtherNet/IP Card and of Thyro-P operating instructions.
The operator of this device is obligated to provide these operating instructions to all persons transporting, commissioning, maintaining or performing other work on the Thyro-P without any restrictions.
In accordance with the Product Liability Act, the manufacturer of a product has an obligation to provide explanations and warnings as regards:
- the use of the product other than for the intended use,
- the residual product risk and
- operating error and its consequences.

The information given below must be understood in this respect. It is to warn the product user and protect him and his systems.

1.2 PROPER USE

- The Thyro-P EtherNet/IP Card is an interface component which may only be used in connection with Thyro-P.
- As a component the Thyro-P EtherNet/IP Card is unable to operate alone and must be projected for its intended use to minimize residual risks.
- The Thyro-P EtherNet/IP Card may only be operated in the sense of its intended use; otherwise, personal hazards (for instance electrical shock, burns) and hazards for systems (for instance overload) may be caused.
- Any unauthorized reconstructions and modification of the device, use of spare and exchange parts not approved by Advanced Energy as well as any other use of the device is not allowed
- The manufacturer warranty applies only under acceptance and compliance of these operating instructions.
- The Thyro-P EtherNet/IP Card combines Thyro-P with a master.
- Within this device multiple interface cards can be used.
- The power supply of the interface card results from the Thyro-P.

1.3 RESIDUAL HAZARDS OF THE PRODUCT

Even in case of proper use, in case of fault, it is possible that control of currents, voltages and power is no longer performed in the load circuit by the Thyristor Power Controller.
In case of destruction of the power components (for instance breakdown or high resistance), the following situations are possible: power interruption, continuous power flow.
If such a situation occurs, then load voltages and currents are produced from the physical dimensions of the overall power circuit. It must be ensured by system design that no uncontrolled large currents, voltages or power results.
It is not possible to totally exclude that during operation of Thyristor power controllers other loads show abnormal behaviour. The physically determined network reactions, depending on the operating mode, must be considered.

1.4 MALOPERATION AND ITS RESULTS

With maloperation, it is possible that power, voltage or current levels which are higher than planned reach the Thyro-P EtherNet/IP Card, the Thyro-P or load. On principle, this can lead to the Thyro-P EtherNet/IP Card, the Power Controller or load being damaged.
It is important that preset parameters are not adjusted in any way that may cause the Thyro-P EtherNet/IP Card to overload.

1.5 SCOPE OF SUPPLY

The package consists of the following parts:
- Thyro-P EtherNet Interface Card
- Operating instructions

1.6 STORING

The devices are only allowed to be stored in original packaging in dry, vented spaces.
- Approvable temperature: -25°C up to +55°C
- Approvable comparative air humidity: max. 85%

For sustainable storage the devices should be sealed airtight by using commercial desiccant and being vacuumed within foil.

1.7 INSTALLATION

- If stored in a cold environment: ensure that the device is absolutely dry. (Allow the device a period of at least two hours to acclimatize before commissioning)

- Ensure sufficient ventilation of the cabinet if mounted in a cabinet.
- Observe minimum spacing.
- Ensure that the device cannot be heated up by heat sources below it.
- Ground the device in accordance with local regulations.
- Connect the device in accordance with the connection diagrams.

For further details please see chapter "6. Installation"

1.8 CONNECTION

Prior to connection, it must be ensured that the voltage information on the type plate corresponds with the mains voltage.
The electrical connection is carried out at the designated points with the required cross section and the appropriate screw cross sections.

1.9 OPERATION

The Thyro-P EtherNet/IP Card may only be connected to the mains voltage if it has been ensured that any hazard to people and system, especially in the load section, has been eliminated.

- Protect the device from dust and moisture.
- Do not block vents.

1.10 MAINTENANCE, SERVICE, MALFUNCTIONS

The icons used below are explained in the chapter safety regulations.
In order to avoid personal and material damages, the user must observe before all work the following:

- Secure the device against accidentally being switched back on.
- Use suitable measuring instruments and check that there is no voltage present.
- Ground and short circuit the device.
- Provide protection by covers or barriers for any neighboring live parts.
- The device may only be serviced and repaired by trained electro-technical personnel.

CAUTION
Should fume, odorant or fire occur the power controller must be disconnected immediately from the mains.

CAUTION
For maintenance and repair work, the power controller must be disconnected from all external voltage sources and protected against restarting. Make sure to wait minimum of two minutes after switch-off due to the discharge time of the attenuation capacitors. The voltagefree state is to be determined by means of suitable measuring instruments. The unit is to be grounded and short-circuited. Cover or shield any adjacent live parts. This work is only to be carried out by a skilled electrician. The electrical regulations which are locally valid are to be adhered.

CAUTION
The thyristor power controller contains hazardous voltages. Repairs may generally only be performed by qualified and trained maintenance personnel.

CAUTION
Hazard of electrical shock. Even after disconnection from the mains voltage, capacitors may still contain a dangerously high power level.

CAUTION
Hazard of electrical shock. Even when the thyristor power controller is not triggered, the load circuit is not disconnected from the mains.

ATTENTION
Different components in the power section are screwed in place using exact torques. For safety reasons, power components repairs must be performed by Advanced Energy.

1.11 DECOMMISSIONING AND REMOVAL

In case of a decommissioning and the disassembly of the unit due to relocation or disposal the following safety regulations have to be ensured at the beginning of any work:

CAUTION MAINS VOLTAGE!
Safety regulations for working on electrical systems:
1. switch voltage-free
2. secure against switching on
3. determine if it is voltage-free
4. ground and short-circuit it
5. Cover or shield any adjacent live parts

For removal please observe the following rules:
1. Disconnect the unit from the main power supply 230 VAC as well as 110 VAC.
2. Disconnect all further connections.

The electrical connections are to be removed and after that the unit can be removed from the DIN rail.

2. SAFETY REGULATIONS

2.1 IMPORTANT INSTRUCTIONS AND EXPLANATIONS

Operation and maintenance according to regulation as well as observance of the listed safety regulations are required for protection of the staff and to preserve readiness to operate.
Personnel installing/uninstalling the device, commissioning them, maintaining them must know and observe these safety regulations. All work may only be performed by specialist personnel trained for this purpose using the tools, devices, test instruments and consumables provided for this purpose and in good shape.
In these operating instructions are warnings of dangerous actions. These warnings are divided into the following danger categories:

DANGER
Dangers that can lead to serious injuries or fatal injuries.

WARNING
Dangers that can lead to serious injuries or considerable damages to property.

CAUTION
Dangers that can lead to injuries and damages to property.

CAUTION
Dangers that can lead to minor damage to property

The warnings can also be supplemented with a special danger symbol (e.g. „Electric current“ or „Hot parts“), e.g.

Risk of electric current or Risk of burns

In addition to the warnings, there is also a general note for useful information.

NOTE
Content of note

2.2 ACCIDENT PREVENTION RULES

DANGER
Electric current
Risks that can lead to serious injuries or fatal injuries.

DANGER
Electric current
Risk of injury from current carrying parts / danger of damaging the plug-in card.
Never operate the device without the covering.

DANGER
Hot device

Risk of burns from heat sinks and neighboring plastic parts (> 70°C possible)
Do not touch the hot parts of the device.
Affix the “Risk of burns” warning symbol in the immediate vicinity of the device.

DANGER
Dangers during installation

Nonobservance of the safety instructions in these operating instructions of the used power controllers causes risk of injury/risk of damage of the device and accordingly the system.

DANGER
Unsafe system due to incorrect installation
The plant cannot be operated safely and poses a threat to persons.
- Only install the device in accordance to chapter "6. Installation".
- Ensure that the device cannot be heated up by heat sources below it.
- Ground the device in accordance with local regulations (grounding screw / nut for protective conductor connection to fixing adapter). Grounding also serves for EMC means (Y capacitor 4.7 nF).

CAUTION
Use of incorrect connection cables
Incorrect connection cables can lead to malfunctions. Use shielded control conductors to connect the control signals.
For use in UL conditions: Only use 60 °C or 75 °C copper conductors for power connections (as indicated in the technical data).

2.3 QUALIFIED PERSONNEL

Only qualified electro-technical personnel who are familiar with the pertinent safety and installation regulations may perform the following:

- Transport
- Installation
- Connection
- Commissioning
- Maintenance
- Testing
- Operation

These operating instructions must be read carefully by all persons working with or on the equipment prior to installation and initial start-up.

2.4 OPERATOR REQUIREMENTS

The person responsible for the system must ensure that:

- The safety regulations and operating instructions are available and are observed.
- The operating conditions and restrictions resulting from the technical data are observed.
- The safety devices are used.
- Should abnormal voltages, noises, increased temperatures, vibration or similar occur, the device is immediately to put out of operation and the maintenance personnel is informed.
- The accident prevention regulations valid in the respective country of use and the general safety regulations are observed.
- All safety devices (covers, warning signs etc.) are present, in perfect condition and are used correctly.
- The national and regional safety regulations are observed.
- The personnel have access to the operating instructions and safety regulations at all times.

2.5 INTENDED USE

CAUTION

The intended use of the Thyro-P Ethernet Interface card is to operate as an interface card of Thyro-P so that Thyro-P can be connected to the EtherNet/IP bus system. The Thyro-P EtherNet/IP Card may only be used for the purpose for which it was intended as persons may otherwise be exposed to dangers (e.g. electric shock, burns) and plants also (e.g. overload).

Any unauthorized reconstructions and modification of Thyro-P EtherNet/IP Card, use of spare and exchange parts not approved by Advanced Energy as well as any other use of Thyro-P EtherNet/IP Card is not allowed.

These operating instructions contain all information required by specialists for use of Thyro-P EtherNet/IP Card. Additional information and hints for unqualified persons and for use of Thyro-P EtherNet/IP Card outside of industrial installations are not contained in these operating instructions.
The warranty obligation of the manufacturer applies only if these operating instructions are observed.
The device is a component that cannot operate alone.
Project planning must account for the proper use of the device.

2.6 LIABILITY

In case of use of Thyro-P EtherNet/IP Card for applications not provided for by the manufacturer, no liability is assumed. The responsibility for required measures to avoid hazards to persons and property is borne by the operator respectively the user. In case of complaints,
please immediately notify us stating:

- type name
- production number
- objection
- duration of use
- ambient conditions
- operating mode

2.7 GUIDELINES

The devices of the type range Thyro-P, Thyro-P EtherNet/IP Card is a part of these, conform to the currently applicable EN 50178 and EN 60146-1-1.
The CE mark on the device confirms observation of the general EG guidelines for 2006/95/EG - low voltage and for 2004/108/EG – electromagnet compatibility, if the instructions on installation and commissioning described in the operating instructions are observed.
Regulations and definitions for qualified personnel are contained in DIN 57105/VDE 0105 Part 1.
Safe isolation according to VDE 0160 (EN 50178 Chapter 3).

3. REMARKS ON THE PRESENT OPERATING INSTRUCTIONS

3.1 VALIDITY

These operating instructions refer to latest technical specification of Thyro-P EtherNet/IP Card at the time of publication and are for information purpose only. Every effort has been taken to ensure the accuracy of this specification, however, in order to maintain our technological lead and for product enhancement, Advanced Energy is continually improving their products which could, without notice, result in amendments or omissions to this specification. Advanced Energy cannot accept responsibility for damage, injury, loss or expenses resulting therefrom.
The operating instructions serve only in conjunction with and as an addition to the operating instructions of the Advanced Energy Thyro-P power controllers in the versions of the types indicated on the covering page. The safety instructions contained therein are to be observed in particular. If you have not got any available operating instructions of Thyro-P, please contact your supplier immediately.

3.2 HANDLING

These operating instructions for Thyro-P EtherNet/IP Card are organized in a way that all work required for commissioning, maintenance and repair may be performed by corresponding specialist personnel.
If hazards to personnel and property cannot be excluded for certain work, then this work is marked using certain icons. The meaning of these icons may be found in the prior chapter "2. Safety regulations".

3.3 WARRANTY

Customer shall provide written particulars, enclosing the delivery note, within 8 working days to Advanced Energy on becoming aware of any defects in the goods during the warranty period and shall use its best endeavors to provide Advanced Energy with all necessary access, facilities and information to enable Advanced Energy to ascertain or verify the nature and cause of the defect and carry out its warranty obligations.
If goods are found not to be defective or if any defect is attributable to customer's design or material in operation of the goods, Advanced Energywill levy a testing charge and where relevant will return the goods to customer at customer's expense, and shall be entitled to payment in advance if the whole

testing and transport charge before such return.

Advanced Energy accepts no liability for defects caused by the Customer's design or installation of the goods; or if the goods have been modified or repaired otherwise than as authorized in writing by Advanced Energy; or if the defect arises because of the fitting of the goods to unsuitable equipment. Advanced Energy will cancel all possible obligations incurred by Advanced Energy and its dealers, such as warranty commitments, service agreements, etc., without prior notice if other than original Advanced Energy spare parts or spare parts purchased from Advanced Energy are used for maintenance or repair.

3.4 COPYRIGHT

3.5 COPYRIGHT NOTICE

4. CONTACT INFORMATION

4.1 TECHNICAL QUERIES

Do you have any technical queries regarding the subjects dealt with in these operating instructions?
If so, please get in touch with our team for power controllers:
Phone +49 (0) 2902 763-520

4.2 COMMERCIAL QUERIES

Do you have any commercial queries on power controllers?
If so, please get in touch with our team for power controllers.
Phone +49 (0) 2902 763-558

4.3 SERVICE

Advanced Energy Industries GmbH
Branch Office Warstein-Belecke
Emil-Siepmann-Straße 32
D-59581 Warstein
Phone +49 (0) 2902 763-0

4.4 INTERNET

Further information on our company or our products can be found on the Internet under:
http://www.advanced-energy.com

5. INTRODUCTION

The operating instructions below serve only in conjunction with and as an addition to the operating instructions of the Advanced Energy Thyro-P power controllers in the versions of the types indicated on the cover page. The safety instructions contained therein are to be observed in particular. If you have not got any available operating instructions of Thyro-P, please contact your supplier immediately.
The EtherNet/IP Card connects a Thyro-P or Thyro-P MC with a master.
The Thyro-P Ethernet Interface Card is supplied by the Thyro-P power supply.

5.1 SPECIAL FEATURES

- The EtherNet/IP Card connects the devices to different structures of EtherNet bus systems. By setting the "Protocol" switch to 2, the EtherNet/IP Card becomes a EtherNet/IP IO-Device.
- Function control via LED
- 3 free digital inputs
- Local set point operation

5.2 TYPE DESIGNATION

The order number of Thyro-P Ethernet Interface Card is 2000 000 396.

6. INSTALLATION

DANGER
Danger during installation
Danger of injury / danger of damaging the device or system.
Adhere to all safety stipulations in the 1. and 2. chapters.

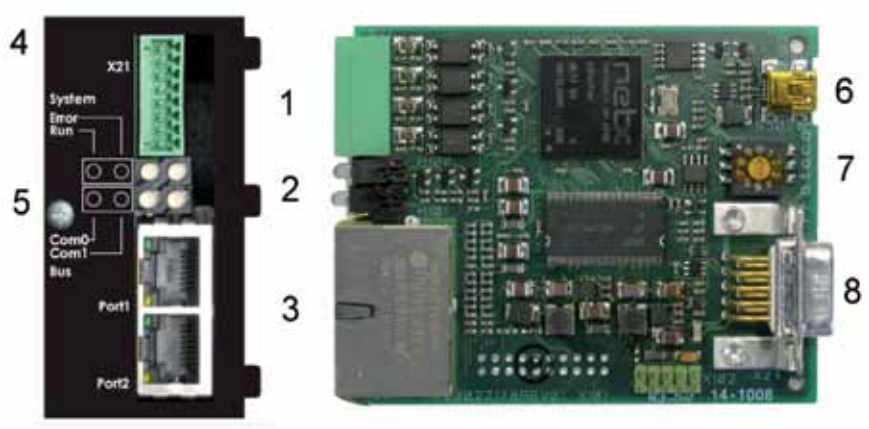


FIG. 1: HARDWARE STRUCTURE

1 Terminal X21 digital inputs
2 System and Bus LEDs
3 Ethernet Port 1 & 2
4 Front cover
5 Fastening screw
6 USB (Softwareupdate)
7 Switch "Protocol"
8 Connection to Thyro-P (SSC, 5V)

6.1 SETTING THE PROTOCOL

The EtherNet/IP Card supports various real time Ethernet bus systems. The desired system can be selected using the rotary switch "Protocol". For EtherNet/IP this needs to be set to 2.

The rotary switch protocols are:

POSITION	PROTOCOL
0	PROFINET
1	Modbus TCP
2	Ethernet IP
9	Set all default

When position 9 is active the card will be reset to factory defaults for settings and address.

6.2 INSTALLATION OF THE PLUG-IN CARD

The EtherNet/IP Card is connected to the 9 pole SUB-D connector X24 of the Thyro-P. It is inserted into the front side of the controlling device and is ready to operate immediately following parameterization using the bus system.

CAUTION
The installation of the plug-in card is to be carried out without current.

6.3 CONNECTING THE ETHERNET/IP CARD TO THE MASTER

The Ethernet plug-in card has two Ethernet ports which are equipped with a switch functionality which allows a line topology to be constructed.
A standard patch cable is required for connecting with a switch. For a direct connection (line topology) a cross-over cable is required.

7. DIGITAL INPUTS

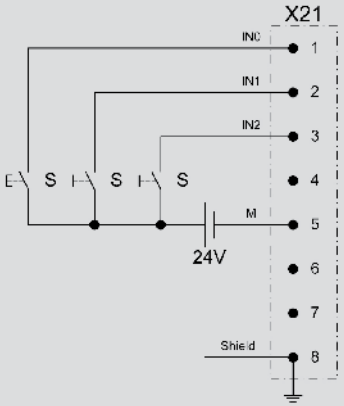
The EtherNet/IP Card provides 3 digital inputs as well as an input for activating local operation (see chapter 8) via the 8 pole terminal (X21). The status of the inputs can be requested using the "digital inputs" parameter (see chapter 11.2 Actual value).

PIN	NAME	FUNCTION
1	IN 0	input 0
2	IN 1	input 1
3	IN 2	input 2
4	Loc	input 3
5	M	ground for IN 0-3
6	+24	+24V / internal 24V supply
7	M24	ground / internal 24V supply
8	ground	ground

TAB. 1: TERMINAL CONFIGURATION X21

Inputs 0-3 always correlate to the ground (M). To connect simple indicators such as limit switches or similar ones for these is also an additional 24V supply available. As such the following connection options are available:

Connection with electrical isolation



Switch connection without electrical isolation

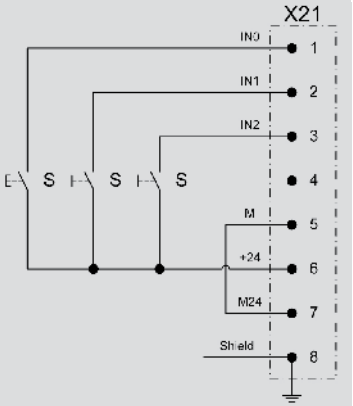


FIG. 2: EXAMPLE FOR INPUT CONNECTIONS

8. LOCAL CONTROL OF A SET POINT

In certain situations, such as the Ethernet failing, it may be necessary to change the set point quickly. In fact this can be done by using the local operating and display unit with touch display (LBA-2), however, this may be too time consuming in certain cases. As an alternative a local operation of the set point was created. The local operation can be activated via the input Loc (Pin 4). It is then possible to switch the set point SW_ACTIV between remote (open) and local (closed) via input IN0 (Pin 1).

Regarding remote and local the active set points can be set by using the start configuration (see chapter 11). These configurations are saved on the EtherNet/IP card so that all previous adjustments are available even after the failure of the Ethernet. If the local set point motor potentiometer was selected in a channel, then the motor potentiometer set point can be altered via inputs IN1 and IN2. When the switch is pressed the set point will change in accordance to Fig. 3 For example, the set point is increased by 30% if the Up button is pressed for 10 seconds. When simultaneously activating the Up and Down buttons the set point is reduced.

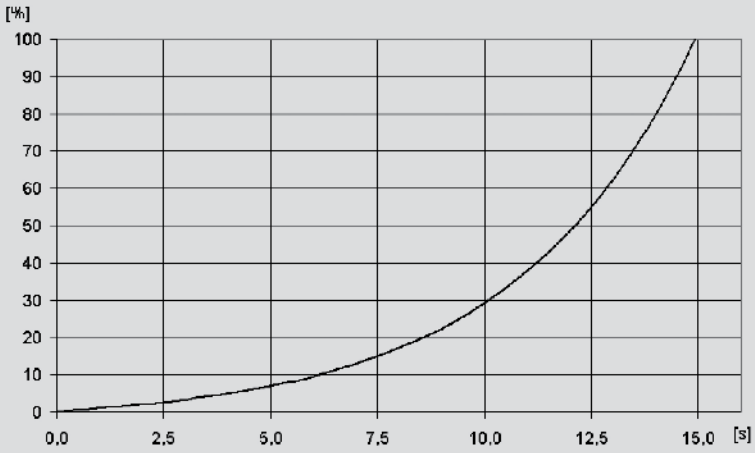


FIG. 3: RELATIVE ALTERATION OF THE MOTOR POTENTIOMETER SET POINT OVER THE TIME

For local operation terminal X21 is to be connected as follows.

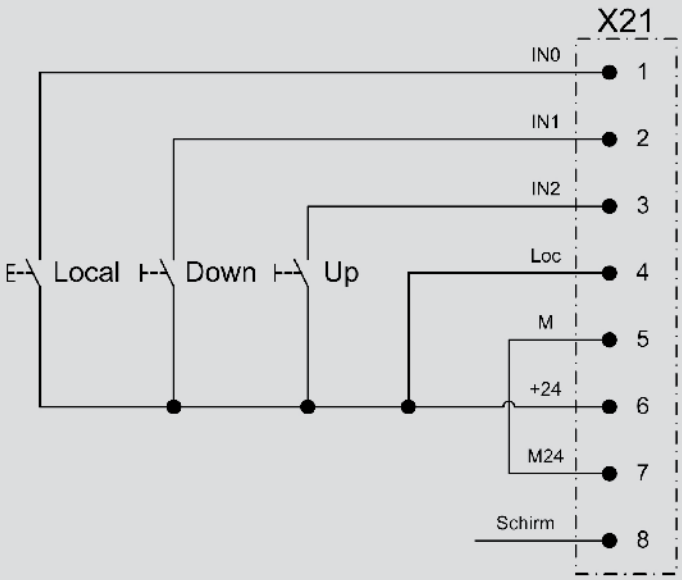


FIG. 4: LOCAL OPERATION OF THE MOTOR POTENTIOMETER SET POINT

ATTENTION: When using local operation please be aware of the following points:

1. To avoid a volatile alteration of the set point when switching from remote to local, please activate the function "motor potentiometer = master" (see chapter 11.2 Actual values)
2. In the case of the "local" switch being closed ("4 digital inputs" bit 0 = 0) the process controller is to be deactivated and the "master set point" set to be the same as the "total set point" to enable a non-volatile switch from local to remote. To do this the total of the set point is to be transferred cyclically.
3. When switching from local to remote the process controller is to be initialized with the total set point and then activated. The above configurations then result in the following process diagram. (see Fig. 5).

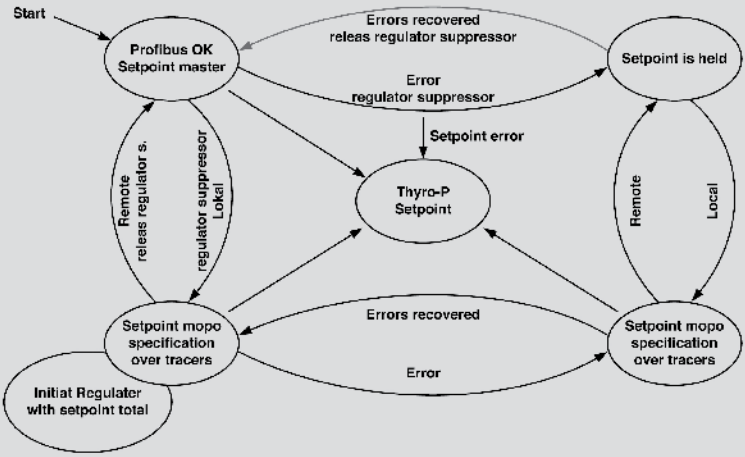


FIG. 5 STATE DIAGRAM

9. EtherNet/IP COMMUNICATION MODEL

With the EtherNet/IP protocol the Ethernet is augmented by the common industrial protocol (CIP) at the user level.
CIP (common industrial protocol) is a network independent, connection-oriented user protocol which is based upon an object-oriented model for describing the characteristics of devices and which uses the classic object-oriented terms such as objects, classes, instances, attributes, data types, services etc. EtherNet/IP uses the usual Ethernet and TCP/IP technology to transmit CIP communication reports. By using encapsulation the actual CIP messages from the application layer are packaged as payload into the TCP segment and sent to another application via the Ethernet.

9.1 OBJECT SPECIFICATION

Communication and application are depicted in the case of CIP in an object model. An object is the abstract depiction of a device component (part functionality of the device). A class describes a series of objects, which represent identical device components. Objects which belong to the same class are called instances. The instance is the physical representation of an object (see illustration of the 3 channels of the Thyro MC). Data elements within the object are called attributes (variables). The attributes describe visible characteristics of an object, e.g. status or configuration information. The attributes can be addressed with the help of class, instance and attribute labels. This address information is called EPATH and has a structured format. The EPATH of a parameter is 20 [Class ID] 24 [Instance ID] 30 [Attr. ID].
Example: the parameter address of the set point master float for Thyro-P is: 20 64 24 01 30 03. The parameters are hexadecimal and have the following meaning: Class ID = 0x64, Instance ID = 0x01, Attribute ID = 0x03.
EtherNet/IP defines common classes, which are obligatory for every device, and user-specific classes, which describe the actual functionality of the device.
Services are explicit tasks which an object carries out. They can be assigned to a specific instance or to the class itself, which then affects all instances in the class. Among the general services are:
• Get_Attribute_Single (Reading an attribute)
• Set_Attribute_Single (Writing an attribute)
• Get_Attributes_All (Reading all attributes of an instance), etc.

CIP provides so called "implicit messaging" and "explicit messaging" for the exchange of messages.

For cyclical data exchange (transmission of I/O data such as, for example, process data) the CIP uses so called "implicit messaging". An I/O message consists of a connection ID and data. The end points know the format of the I/O telegram, which means the participants involved know which data are expected. As such the data transfer is more efficient, because the data are known in advance and as such little overhead is transmitted. The transmission is time controlled

or triggered through parameter alteration. The I/O connection can be "point to point" or "multicast". The multicast connection enables several participants to receive simultaneously a telegram which has been sent.
Acyclical data (configuration data, parameter data etc) are exchanged via the typical "request – response" mechanism and use "explicit messaging". The data portion of the telegram uses an explicit message transmission protocol, whereby additional information (overhead) is
transmitted.

In the following chapters the classes implemented in the Thyro-P/Thyro-P MC are described in more detail.

9.2 DATA TYPES

The following data types are supported by the Thyro-P/Thyro-P MC:

DATA TYPE	CODE	NAME	RANGE
SINT	0xC2	short integer	-128 to 127
INT	0xC3	integer	-32768 to 32767
DINT	0xC4	double integer	-2^{31} to $2^{31}-1$
LINT	0xC5	long integer	-2^{63} to $2^{63}-1$
USINT	0xC6	unsigned short integer	0 to 255
UINT	0xC7	unsigned integer	0 to 65535
UDINT	0xC8	unsigned double integer	0 to $2^{31}-1$
ULINT	0xC9	unsigned long integer	0 to $2^{63}-1$
REAL	0xCA	float	
STRING	0xD0	character string (1 byte per character)	
BYTE	0xD1	bit-string 8 Bits	
WORD	0xD2	bit-string 16 Bits	
DWORD	0xD3	bit-string 32 Bits	
EPATH	0xDC	CIP path segments	
SHORT STRING	0xDA	character string (1 byte per character, 1 byte length indicator)	

TAB. 2: DATA TYPES

Multi-byte variables are transmitted to the bus in EtherNet/IP in “little-endian“ format (LSB byte first).

10. EtherNet/IP COMMON CLASSES

This chapter describes the "mandatory" objects which are implemented in every EtherNet/IP device.

10.1 IDENTITY OBJECT (CLASS CODE 0X01)

This object identifies the device and makes general information about it available. The Identity Object contains the following obligatory device characteristics as attributes:

ATTR ID	ACCESS RULE	NAME	DATA TYPE	DESCRIPTION OF ATTRIBUTE	DEFAULT PARAMETER
1	Get	Vendor ID	UINT	Manufacturer identification number	1017
2	Get	Device Type	UINT	Detail of general product type. This device is a communication adapter.	12
3	Get	Product Code	UINT	Identification of a particular product of a manufacturer.	1001, 1301
4	Get	Revision	STRUCT	Revision of the Identity Object.	
		Major revision	USINT	Major revision is restricted to 7 bits.	
		Minor revision	USINT	Minor revision is presented as a 3 figure number (with a leading 0 if necessary).	
5	Get	Status	WORD	Shows the current status of the device	
6	Get	Serial Number	UDINT	Serial number of the device	
7	Get	Product Name	SHORT	Short text description of the product	
			STRING	(max. 32 ASCII characters)	
8	Get	State	USINT	Current status of the device according to the status machine: 0 = Nonexistent 1 = Device Self Testing 2 = Standby 3 = Operational 4 = Major Recoverable Fault 5 = Major Unrecoverable Fault 6 – 254 = Reserved 255 = Default for Get_Attributes_All service	
9	Get	Configuration Consistency Value	UINT	Shows alterations in the device configuration	

TAB. 3: 0X01 IDENTITY OBJECT

The production code is for Thyro-P = 1001, for Thyro-P MC = 1301. The serial number of the device results of the last 3 bytes of the MAC address.
The identity object attributes are "Read Only" parameters.
The identity object supports the services: Get_Attribute_Single, Get_Attribute_All and Reset.
The Reset service causes the device to restart (emulates Power Off/On). Only Reset with service parameter 0 (Power On/Off) is supported.

10.2 MESSAGE ROUTER OBJECT (CLASS CODE 0X02)

The message router is implemented as an object which, at first glance, displays no recognizable attributes or services. It incorporates only operative behavior. Its function is to distribute the request messages to the corresponding application objects.

10.3 CONNECTION MANAGER OBJECT (CLASS CODE 0X06)

This object administers the internal resources for cyclical (implicit) and acyclical (explicit) communication.

10.4 TCP/IP INTERFACE OBJECT (CLASS CODE 0XF5)

The TCP/IP Interface Object (class code = 0xF5) provides the mechanism for configuring the TCP/IP network interface of the device, e.g. IP address, network mask, gateway address. The device supports one instance per TCP/IP interface. The object defines the following obligatory attributes:

ATTR ID	ACCESS RULE	NAME	DATA TYPE	DESCRIPTION OF ATTRIBUTE	DEFAULT PARAMETER
1	Get	Status	DWORD	TCP/IP Network Interface Status Bits 0..3: 0 – Interface not configured 1 – Interface configured via DHCP, BOOTP or saved remanently	
2	Get	Configuration Capability	DWORD	Interface flags, which describe the possible types of configuration: Bits: 0 – BOOTP Client 1 – DNS Client 2 – DHCP Client 3 – DHCP-DNS Update 4 – Configuration is settable	4
3	Get, Set	Configuration Control	DWORD	Defines the TCP/IP configuration of the device after the first restart: Bits 0..3 Startup Configuration: 0 – uses the saved configuration, 1 – configuration via BOOTP 2 – configuration via DHCP - DNS Enable 5-31 reserved	4
4	Get	Physical Link Object	STRUCT:	Logical path to the physical link object e.g.	
		Path Size	UINT	Size in Little Endian Format	02 00
		Path	EPATH (Padded)	Class ID = 0xF6 EtherNet Link Object Instance ID = 1	20 F6 24 01
5	Get	Interface Configuration	STRUCT:	TCP/IP configuration	
		IP Address	UDINT	IP address	
		Network mask	UDINT	network mask	
		Gateway Address	UDINT	Standard Gateway Address	
		Name Server	UDINT	Primary Name Server	
		Name Server 2	UDINT	Secondary Name Server	
		Domain Name	STRING	Standard Domain Name	
6		Host Name	STRING	Host Name, size = 0 means that no name is configured	0

TAB. 4: 0XF5 TCP/IP INTERFACE OBJECT

10.5 ETHERNET/IP LINK OBJECT (CLASS CODE 0XF6)

The "EtherNet/IP Link Object" contains link-specific meter and status information for a communication interface of type IEEE 802.3. The device supports one entity per IEEE 802.3 communication interface. The following attributes and services are supported:

ATTR ID	ACCESS RULE	NAME	DATA TYPE	DESCRIPTION OF ATTRIBUTE	DEFAULT PARAMETER
1	Get	Interface Speed	UDINT	Current transmission speed:: 0 – not defined 10 Mbps, 100 Mbps, etc	
2	Get	Interface Flags	DWORD	Interface configuration/status information Bit 0: link status Bit 1: half/full duplex Bit 2 – 4: recognition status Bit 5: manual inputs, requires Reset Bit 6: local hardware error Bit 7 – 31: reserved	4
3	Get	Physical Address	ARRAY of 6 USINTS	MAC address	0

TAB. 5: 0XF6 ETHERNET/IP LINK OBJECT

11. USER-DEFINED OBJECT DEVICE PARAMETERS (CLASS CODE 0X64)

This class incorporates all parameters which determine the functionality of the Thyro-P/Thyro-P MC. Thyro-P and Thyro-P MC have the same parameters which come under class 0x64 in different instances. Thyro-P has only one instance of this object (instance 1). All Thyro-P device parameters are specified as attributes in instance 1 of the user-defined object (Class Code 0x64). The attributes are in the range from 1 to 244 (0xF4). Thyro-P MC contains 3 instances of the object with Class ID 0x64. The attributes of Thyro-P MC are compiled in instances 2, 3 and 4 correspondingly for channel 1, 2 and 3, and are in the range from 1 to 244 (0xF4) for the respective instance. The attributes for both device types are divided up into the following parameter groups:

11.1 SET POINTS

ATTR ID	PARAMETER NAME	SYMBOL	DATA TYPE	VALUE RANGE	UNIT/Me ANING	RW	DEFAULT
1	Set point master	AD_SW_MASTER	UINT		16363 == 100[%]	r/w	0
2	Set point master error	AD_SW_MASTER_ERROR	UINT		16363 == 100[%]	r/w	0
3	Set point master float	AD_SW_MASTER_FLOAT	REAL		[A,V,W, %]	r/w	0
4	Set point master error float	AD_SW_MASTER_ERR OR_FLOAT	REAL		[A,V,W, %]	r/w	0
5*	Function	AD_FUNCTION	UINT	0..65535		r/w	0

TAB. 6: OBJECT DEVICE PARAMETERS (0X64): SET POINTS

* Additional information of Attr. ID 5: Function

BIT	STATIC FUNCTIONS
0	Control lock
1	Modbus TCP
…	Ext. fault indication
BIT	RISING EDGE CONTROLLED
8	Acknowledge error
9	Reset
10	Save
11	Reset Energy Indication
…	

Bit 0 Control lock is the software based pulse inhibit for the regulator. Bit 1 Ext. fault indication is for the detection of a broken or internally disconnected card. Thyro-P notices the fault and a fall back solutions can be done for this case.

11.2 ACTUAL VALUES

ATTR ID	NAME	SYMBOL	DATA TYPE	VALUE RANGE	UNIT/Meaning	RW	DEFAULT
6	Power L1	AD_IW_P_EFF_LSB_H_1	REAL		W	r	
7	Load voltage L1	AD_IW_U_EFF_LSB_1	REAL		V	r	
8	Current L1	AD_IW_I_EFF_LSB_1	REAL		A	r	
9	Conductance L1	AD_IW_G_IST_L1	REAL		S	r	
10	Supply voltage L1	AD_SW_PUE_L1	UINT		V	r	
11	Load temperature L1	AD_IW_TEMP_LAST_1	UINT		°C	r	
12	Power L2	AD_IW_P_EFF_LSB_H_2	REAL		W	r	
13	Load voltage L2	AD_IW_U_EFF_LSB_2	REAL		V	r	
14	Current L2	AD_IW_I_EFF_LSB_2	REAL		A	r	
15	Conductance L2	AD_IW_G_IST_L2	REAL		S	r	
16	Supply voltage L2	AD_SW_PUE_L2	UINT		V	r	
17	Load temperature L2	AD_IW_TEMP_LAST_2	UINT		°C	r	
18	Power L3	AD_IW_P_EFF_LSB_H_3	REAL		W	r	
19	Load voltage L3	AD_IW_U_EFF_LSB_3	REAL		V	r	
20	Current L3	AD_IW_I_EFF_LSB_3	REAL		A	r	
21	Conductance L3	AD_IW_G_IST_L3	REAL		S	r	
22	Supply voltage L3	AD_SW_PUE_L3	UINT		V	r	
23	Load temperature L3	AD_IW_TEMP_LAST_3	UINT		°C	r	
24	Total power	AD_IW_P_EFF_LSB_H_GES	REAL		W	r	
25	Temperature	AD_IW_TEMP	REAL		°C	r	
26	Total set point float	AD_SW_SUMME_FLOAT	REAL		[A,V,W,%]	r	
27	Set point motor potentiometer float	AD_SW_MOPO_FLOAT	REAL		[A,V,W,%]	r	
28	Total set point	AD_SW_SUMME	UINT		%	r	
29	Set point motor potentiometer	AD_SW_MOPO	UINT		%	r	
30	Set point terminal 10	AD_SW_REGLER	UINT		%	r	
31	Set point terminal 11	AD_SW_POTI	UINT		%	r	
32	On-angle alpha	AD_IW_ALPHA	UINT		°el	r	
33	On-time value	AD_IW_TS	UINT		period	r	
34	Periodic time	AD_IW_FREQUENZ	UINT		µs	r	
35*	LED & relays state	AD_P_LED_REL_CURRENT	WORD	bitstring	r		
36*	Digital input	AD_DIGITAL_IN	WORD	bitstring	r		
37	Status	AD_IW_STOER	WORD		see table 8	r	
38	Operating hour	AD_IW_BETRIEBSSTD_H	REAL		h	r	
39	Energy	AD_IW_ARBEIT_WORT_3	REAL		Ws	r	

TAB. 7: OBJECT DEVICE PARAMETERS (0X64): ACTUAL VALUES

* Additional information of:

Attr. ID 35: LED & relay state

BIT	STATE
0	LED control
1	LED limit
2	LED pulse lock
3	LED fault
4	LED overheat
5	Relay K1
6	Relay K2
7	Relay K3

Attr. ID 36: Digital input

BIT	STATE 1==OPEN, 0==CLOSED
0	IN0 (input 0 from Ethernet card)
1	IN1(input 1 from Ethernet card)
2	IN2(input 2 from Ethernet card)
3	LOC (input 3 from Ethernet card)

VALUE	STATUS
0	SSC fault
1	res
2	Sensor breakage or short circuit
3	Pulse switch-off
4	P limit
5	I limit
6	U limit
7	Limit
8	Overtemperature
9	Regulator suppressor
10	Undercurrent in load circuit
11	Overcurrent in load circuit
12	Undervoltage in mains
13	Overvoltage in mains
14	SYNC fault
15	MOSI in peak current limitation

TAB. 8: STATUS MESSAGES

11.3 OPERATING PARAMETERS

ATTR ID	NAME	SYMBOL	DATA TYPE	VALUE RANGE	UNIT/MeANING	RW	DEFAULT
40	Operating mode	AD_P_BETR	UINT	0..2	TAKT VAR SSSD	r/w	0 (TAKT)
41	Op. of molybdenum silicide rods	AD_P_MOSI	UINT	0..2	Off Ramp Stell	r/w	0 (Off)
42	Service mode	AD_P_SEB	UINT	0..1	Off, On	r/w	0 (Off)
43	ASM	AD_P_ASM	UINT	0..1	Off,On	r	0 (Off)
44	ASM total current	AD_P_ASM_I_SUMME	UINT		A	r/w	220
45	ASM threshold	AD_P_ASM_SCHWELLE	UINT	1..65535		r/w	200
46	ASM tolerance	AD_P_ASM_TOLERANZ	UINT	1..65535		r/w	100
47	ASM time constant	AD_P_ASM_SCHNELLER_MITTELWERT	UINT	1..65535		r/w	100
48	ASM delay	AD_P_ASM_WARTEZEIT	UINT	1..65535		r/w	1
49	Number of controlled phases	AD_P_TYP	UINT	1..3		r/w	1
50	Directly grounded conductor	AD_P_NULLLEITER	UINT	0..1	Off,On	r/w	0
51	Re-ignitions	AD_P_NACHIMPULS	UINT	0..1	Off,On	r/w	0
52	Phase shift	PHASENSCHWENK_synchron	UINT	0..1	Off,On	r/w	0
53	Phase shift polarity	AD_P_POL_PHASENSCHW	UINT	0..1	Plus Minus		0 (Plus)
54	Phase shift L1	AD_P_SCHW_L1	UINT	0...360°el	0.01 °el	r/w	0
55	Phase shift L2	AD_P_SCHW_L2	UINT	0...360°el	0.01 °el	r/w	0
56	Phase shift L3	AD_P_SCHW_L3	UINT	0...360°el	0.01 °el	r/w	0
57	Number of sync voltages	AD_P_TYP_SYNC	UINT	1..3		r/w	1
58	Rotating field	AD_P_SYNC_RICHTUNG	UINT	0..1	Right Left	r/w	0 (Right)
59	Canal-separation	AD_P_KANALTRENNUNG	UINT	0..1	Off,On	r/w	1 (On)

TAB. 9: OBJECT DEVICE PARAMETERS (0X64):
OPERATING PARAMETERS

11.4 TIMES

ATTR ID	NAME	SYMBOL	DATA TYPE	VALUE RANGE	UNIT/MeANING	RW	DEFAULT
60	Phase angle of the 1st halfwave	AD_P_AN1	UINT	0..180 °el	0.01 °el	r/w	6000
61	Soft-start time (setting)	AD_P_SST	UINT	0..499	period	r/w	15
62	Soft-down time (setting)	AD_P_SDN	UINT	0..499	period	r/w	15
63	Cycle period	AD_P_T0TI	UINT	1..65535	period	r/w	50
64	Max. cycle period	AD_P_T0MA	UINT	1..65535	period	r/w	250
65	Limits the max. operating duration	AD_P_TSMA	UINT	0..65535	period	r/w	50
66	Minimum cycle on-time	AD_P_TSMI	UINT	0..65535	period	r/w	0
67	Minimum pause	AD_P_MP	UINT	0..10	period	r/w	3
68	Synchronous cycle	AD_P_SYNC_EXT	UINT	0..1	Internal external	r/w	0 (internal)
69	Synchronous cycle address	AD_P_SYNC_ADR	UINT	0..65535	Period/2	r/w	

TAB. 10: OBJECT DEVICE PARAMETERS (0X64): TIMES

11.5 REGULATION

ATTR ID	NAME	SYMBOL	DATA TYPE	VALUE RANGE	UNIT	RW	DEFAULT
70	Regulation	AD_P_REGELUNG	UINT	0..8		r/w	0
71	Standard regulator	AD_P_STD_RE	UINT	0..1	Off,On	r/w	1
72	PID-regulator, I-part	AD_P_TI_1	UINT	0..65535		r/w	800
73	PID-regulator, P-part	AD_P_KP_1	UINT	1..65535		r/w	160
74	PID-regulator, counter Ppart	AD_P_KR_1	UINT	0..65535		r/w	1
75	PID-regulator, D-part	AD_P_TD_1	UINT	0..65535		r/w	0
76	PID-regulator, I-part, default value	AD_P_TI_1_STD	UINT	0..65535		r	800
77	PID-regulator, P-part, default value	AD_P_KP_1_STD	UINT	0..65535		r	160
78	PID-regulator, counter Ppart, default value	AD_P_KR_1_STD	UINT	0..65535		r/	1
79	PID-regulator, D-part, default value	AD_P_TD_1_STD	UINT	0..65535		r	0
80	Limit PID-regulator, I-part	AD_P_TI_3	UINT	0..65535		r/w	800
81	Limit PID-regulator, P-part	AD_P_KP_3	UINT	1..65535		r/w	160
82	Limit PID-regulator, counter P-part	AD_P_KR_3	UINT	0..65535		r/w	1
83	Limit PID-regulator, D-part	AD_P_TD_3	UINT	0..65535		r/w	0
84	Limit PID-regulator, I-part, default value	AD_P_TI_3_STD	UINT	0..65535		r/w	800
85	Limit PID-regulator, P-part, default value	AD_P_KP_3_STD	UINT	0..65535		r/w	160
86	Limit PID-regulator, counter P-part, default value	AD_P_KR_3_STD	UINT	0..65535		r/w	1
87	Limit PID-regulator, D-part, default value	AD_P_TD_3_STD	UINT	0..65535		r/w	0
88	Rate of angular displacement 1	AD_P_MOSI_PHASE_1 _DELTA_ALPHA	UINT	0..65535		r/w	1100
89	Rate of angular displacement 2	AD_P_MOSI_PHASE_2 _DELTA_ALPHA	UINT	0..65535		r/w	50

TAB. 11: OBJECT DEVICE PARAMETERS (0X64): REGULATION

11.6 LIMITATION

ATTR ID	NAME	SYMBOL	DATA TYPE	VALUE RANGE	UNIT/Me ANING	RW	DEFAULT
90	Minimum r.m.s. voltage set point	AD_P_UEMI	UINT	0..65535	V	r/w	0
91	Maximum r.m.s. voltage set point	AD_P_UEMA	UINT	0..65535	V	r/w	440
92	Minimum r.m.s. current set point	AD_P_IEMI	UINT	0..65535	A		0
93	Maximum r.m.s. current set point	AD_P_IEMA	UINT	0..65535	A		110
94	Minimum power set point	AD_P_PMI_H	UDINT	0..	W		0
95	Maximum power set point	AD_P_P_MA_H	UDINT	0..	W		48400
96	Front pulse limit position	AD_P_VIE	UINT	0..180°el	0.01°el		180
97	Back pulse limit position	AD_P_HIE	UINT	0..180°el	0.01°el		0

TAB. 12: OBJECT DEVICE PARAMETERS (0X64): LIMITATION

11.7 CONTROL CHARACTERISTIC

ATTR ID	NAME	SYMBOL	DATA TYPE	VALUE RANGE	UNIT/MeANING	RW	DEFAULT
98*	Set point activation	AD_P_SW_ENABLE	UINT	0..15		r/w	15
99	Set point linking	AD_P_SW	UINT	0..3	_ADD, IADD, _PRO, IPRO	r/w	0
100	Factor peak current limitation	AD_P_MOSI_FA	UINT	0..50		r/w	25
101	Set point jump correction	AD_P_SW_SPRUNG	UINT	0..1	Off, On	r/w	1 (On)
102	Input voltage/current terminal 10	AD_P_SW_10	UINT	0..2	5V, 10V, 20mA	r/w	2 (20mA)
103	Control start regulator input terminal 10	AD_P_STA_RE	UINT	0..20480		r/w	240
104	Control end regulator input terminal 10	AD_P_STE_RE	UINT	0..20480		r/w	16383
105	Input voltage/current terminal 11	AD_P_SW_11	UINT	0..2	5V, 10V, 20mA	r/w	0 (5V)
106	Control start regulator input terminal 11	AD_P_STA_PO	UINT	0..20480		r/w	240
107	Control end regulator input terminal 11	AD_P_STE_PO	UINT	0..20480		r/w	16383
108	Control start master	AD_P_STA_MASTER	UINT	0..16383		r/w	0
109	Control end master	AD_P_STE_MASTER	UINT	0..16383		r/w	16383
110	Control start motor potentiometer	AD_P_STA_MOPO	UINT	0..16383		r/w	0
111	Control end motor potentiometer	AD_P_STE_MOPO	UINT	0..16383		r/w	16383

TAB. 13: OBJECT DEVICE PARAMETERS (0X64): CONTROL CHARACTERISTIC

* Additional information of Attr. ID 98: Set point activation

BIT	ACTIVE SET POINT
0	Set point terminal 10
1	Set point terminal 11
2	Set point master
3	Set point motor potentiometer

11.8 TEMPERATURE

ATTR ID	NAME	SYMBOL	DATA TYPE	VALUE RANGE	UNIT/Me ANING	RW	DEFAULT
112	Temperature sensor	AD_P_TEMP	UINT	0..3	NONE PT100 PT1000 NTC		0 (None)
113	Characteristic number	AD_P_TEMP_KVE	UINT	0..7		r/w	1
114	Level wire breakage	AD_P_FU_DR_BR	UINT	0..4000		r/w	2000
115	Level short circuit	AD_P_FU_KURZ	UINT	0..4000		r/w	800
116	Temperature error duration	AD_P_TEMP_FEHLER DAUER	UINT	1..1000		r/w	10
117	Coefficient 5	AD_P_A5_H	REAL	0..65535		r/w	1
118	Coefficient 4	AD_P_A4_H	REAL	0..65535		r/w	1
119	Coefficient 3	AD_P_A3_H	REAL	0..65535		r/w	1
120	Coefficient 2	AD_P_A2_H	REAL	0..65535		r/w	1
121	Coefficient 1	AD_P_A1_H	REAL	0..65535		r/w	1
122	Coefficient 0	AD_P_A0_H	REAL	0..65535		r/w	1
123	Load transformer ratio	AD_P_R_KORR_H	REAL	0..65535		r/w	

TAB. 14: OBJECT DEVICE PARAMETERS (0X64): TEMPERATURE

11.9 ANALOG OUTPUTS

ATTR ID	NAME	SYMBOL	DATA TYPE	VALUE RANGE	UNIT/Me ANING	RW	DEFAULT
124	Actual value output 1	AD_P_IST_1	UINT	0,1	20mA, 10V	r/w	20mA
125	Offset 1	AD_P_OF_1	UINT	0.. 20000 uA	uA	r/w	4000 uA
126	Measuring instrument fullscale deflection DAC1, voltage	AD_P_DAC1_VA_U	UINT	0..10000 mV	mV	r/w	10000 mV
127	Measuring instrument fullscale deflection DAC1, current	AD_P_DAC1_VA_I	UINT	0..20000 mA	mA	r/w	20000 mA
128	Configuration register analog output 1	AD_P_DAC_1_CTRL	WORD	bitwise		r/w	26
129	Scale end value voltage actual value output 1	AD_P_U_FA_1	UINT	0..65535 V	V	r/w	500 V
130	Scale end value current actual value output 1	AD_P_I_FA_1	UINT	0..65535 A	A	r/w	150 A
131	Scale end value power actual value output 1	AD_P_P_FA_1_H	UDINT	0.. W	W	r/w	50000 W
132	Scale end value alpha actual value output 1	AD_P_A_FA_1	UINT	0..180°el	0.01°el	r/w	180°el

133	Scale start value temperature actual value output 1	AD_P_T_OF_1	UINT	0..65535 °C	°C	r/w	0 °C
134	Scale end value temperature actual value output 1	AD_P_T_FA_1	UINT	0..65535 °C	°C	r/w	1000 °C
135	Actual value output 2	AD_P_IST_2	UINT	0..1	20mA, 10V	r/w	20mA
136	Offset 2	AD_P_OF_2	UINT	0..20000 uA	uA	r/w	4000 uA
137	Measuring instrument fullscale deflection DAC2, voltage	AD_P_DAC2_VA_U	UINT	0..10000 mV	mV	r/w	10000 mV
138	Measuring instrument fullscale deflection DAC2, current	AD_P_DAC2_VA_I	UINT	0..20000 mA	mA	r/w	20000 mA
139	Configuration register analog output 2	AD_P_DAC_2_CTRL	WORD	bitwise		r/w	26
140	Scale end value voltage actual value output 2	AD_P_U_FA_2	UINT	0..65535 V	V	r/w	500 V
141	Scale end value current actual value output 2	AD_P_I_FA_2	UINT	0..65535 A	A	r/w	150 A
142	Scale end value power actual value output 2	AD_P_P_FA_2_H	UDINT	0.. W	W	r/w	50000 W
143	Scale end value alpha actual value output 2	AD_P_A_FA_2	UINT	0..180°el	0.01°el	r/w	180°el
144	Scale start value temperature actual value output 2	AD_P_T_OF_2	UINT	0..65535 °C	°C	r/w	0 °C
145	Scale end value temperature actual value output 2	AD_P_T_FA_2	UINT	0..65535 °C	°C	r/w	1000 °C
146	Actual value output 3	AD_P_IST_3	UINT	0..1	20mA, 10V	r/w	20mA
147	Offset 3	AD_P_OF_3	UINT	0..20000 uA	uA	r/w	4000 uA
148	Measuring instrument fullscale deflection DAC3, voltage	AD_P_DAC3_VA_U	UINT	0..10000 mV	mV	r/w	10000 mV
149	Measuring instrument fullscale deflection DAC3, current	AD_P_DAC3_VA_I	UINT	0..20000 mA	mA	r/w	20000 mA
150	Configuration register analog output 3	AD_P_DAC_3_CTRL	WORD	bitwise		r/w	26
151	Scale end value voltage actual value output 3	AD_P_U_FA_3	UINT	0..65535 V	V	r/w	500 V
152	Scale end value current actual value output 3	AD_P_I_FA_3	UINT	0..65535 A	A	r/w	150 A
153	Scale end value power actual value output 3	AD_P_P_FA_3_H	UDINT	0.. W	W	r/w	50000 W

154	Scale end value alpha actual value output 3	AD_P_A_FA_3	UINT	0..180°el	0.01°el	r/w	180°el
155	Scale start value temperature actual value output 3	AD_P_T_OF_3	UINT	0..65535 °C	°C	r/w	0 °C
156	Scale end value temperature actual value output 3	AD_P_T_FA_3	UINT	0..65535 °C	°C	r/w	1000 °C
157	Averaging	AD_P_DAC_MITTELWERT	UINT	0..1000		r/w	25

TAB. 15: OBJECT DEVICE PARAMETERS (0X64): ANALOG OUTPUTS

11.10 HARDWARE PARAMETERS

ATTR ID	NAME	SYMBOL	DATA TYPE	VALUE RANGE	UNIT/Meaning	RW	DEFAULT
158	Power controller rated current	AD_P_I_TYP	UINT	0...65535 A	A	r	110 A
159	Rated current in LSB	AD_P_I_TYP_LSB	UINT	0...65535		r	3500
160	Current converter ratio	AD_P_UE_I	UINT	0...65535		r	100
161	Load resistor current	AD_P_RB_I	UINT	0...653 Ohm	0.01 Ohm	r	0,91 Ohm
162	Scaling factor current	AD_P_NORM_I	UINT	0...65535		r	845
163	Current value threshold	AD_P_I_SCHW	UINT	0...65535		r/w	65535
164	Power controller connection voltage	AD_P_U_TYP	UINT	0..1000 V	V	r	400 V
165	Rated voltage in LSB	AD_P_U_TYP_LSB	UINT	0...65535		r	3800
166	Mains voltage user	AD_P_U_NETZ	UINT	0..1000 V	V	r	400 V
167	Voltage converter ratio	AD_P_UE_U	UINT	0..1000		r	16
168	Voltage range changeover	AD_P_U_TYP_BEREICH	UINT	0..2	230V, 400V, 500V, 690V	r	1 (400V)
169	Load resistor voltage	AD_P_RB_U	UINT	0...65535 Ohm	Ohm	r	2000 Ohm
170	Load resistor voltage range 1	AD_P_RB_U_BER_1	UINT	0...65535 Ohm	Ohm	r	1111 Ohm
171	Load resistor voltage range 2	AD_P_RB_U_BER_2	UINT	0...65535 Ohm	Ohm	r	667 Ohm
172	Scaling factor 230V	AD_P_FNORM_U_230	UINT	0...65535		r	1279
173	Scaling factor 400V	AD_P_FNORM_U_400	UINT	0...65535		r	1324
174	Scaling factor 500V-690V	AD_P_FNORM_U_690	UINT	0...65535		r	1344
175	Min. frequency	AD_P_FREQUENZ_MIN	UINT	14286..25000 1/X * 10^6	Hz	r/w	22222
176	Max. frequency	AD_P_FREQUENZ_MAX	UINT	14286..25000 1/X * 10^6	Hz	r/w	15151

177	Frequency tolerance	AD_P_FREQUENZ_TOL	UINT	0..100	%	r/w	10 %
178	Power controller rated power	AD_P_P_TYP_H	UDINT	0…	W	r	44000
179	Rated power in LSB	AD_P_P_TYP_LSB_H	UDINT	0..		r	15360544
180	Potentiometer regulator parameter Ti	AD_P_TI_FA	UINT	0...65535		r/w	0
181	Potentiometer regulator parameter Kp	AD_P_KP_FA	UINT	0...65535		r/w	0
182	Voltage divider resistor	AD_P_R_TEIL	UINT	0...65535	Ohm	r	32400 Ohm
183	Meter circuit	AD_P_MESSUNG	UINT	0..5	Aron, 1/2 Aron 1, 1/2 Aron 2, 1/2 Aron 3, Asymm etrical load, Symmet rical load;	r	0 (Aron)
184	DAC Multilexer	AD_P_DAC_MUX	UINT	0...65535		r/w	0
185	DAC Measuring MUX 1	AD_P_MESSDATEN_M UX_1	UINT	0...65535		r/w	291
186	DAC Measuring MUX 2	AD_P_MESSDATEN_M UX_2	UINT	0...65535		r/w	1383
187	DAC Measuring MUX 3	AD_P_MESSDATEN_M UX_3	UINT	0...65535		r/w	2475

TAB. 16: OBJECT DEVICE PARAMETERS (0X64): HARDWARE PARAMETERS

11.11 MONITORING

ATTR ID	NAME	SYMBOL	DATA TYPE	VALUE RANGE	UNIT/MeANING	RW	DEFAULT
188	Mains voltage monitoring minimum	AD_P_SPG_MIN	UINT	0..1000 V	V	r/w	180
189	Mains voltage monitoring maximum	AD_P_SPG_MAX	UINT	0..1000 V	V	r/w	480
190	Undercurrent monitoring	AD_P_UN_S	UINT	0..1	Off,On	r/w	0 (Off)
191	Overcurrent monitoring	AD_P_UE_S	UINT	0..1	Off,On	r/w	0 (Off)
192	Load break	AD_P_REL_ABS	UINT	0..1	REL ABS	r/w	0 (REL)
193	Undercurrent monitoring value	AD_P_LASTBRUCH_MIN	UINT	0..99 %	%	r/w	0
194	Overcurrent monitoring value	AD_P_LASTBRUCH_MAX	UINT	0..255 %	%	r/w	0
195	Undercurrent monitoring value	AD_P_LASTBRUCH_MIN_ABS	UINT	0..65535		r/w	0
196	Overcurrent monitoring value	AD_P_LASTBRUCH_MAX_ABS	UINT	0..65535		r/w	0
197	Monitoring L2 enable	AD_P_UEBERWACHUNG_L2_ENA	UINT	0..1	Off,On	r/w	0 (Off)
198	Monitoring L3 enable	AD_P_UEBERWACHUNG_L3_ENA	UINT	0..1	Off,On	r/w	0 (Off)

TAB. 17: OBJECT DEVICE PARAMETERS (0X64): MONITORING

11.12 LED AND RELAYS

ATTR ID	NAME	SYMBOL	DATA TYPE	VALUE RANGE	UNIT/Me ANING	RW	DEFAULT
199	LED & Relays work principle	AD_P_K1RU	UINT	0..255		r/w	224
200	LED CONTROL mode	AD_P_OUT0_CFG_UIO	UINT	0..65535		r/w	4096
201	LED LIMIT mode	AD_P_OUT1_CFG_UIO	UINT	0..65535		r/w	0
202	LED PULSE LOCK mode	AD_P_OUT2_CFG_UIO	UINT	0..65535		r/w	0
203	LED FAULT mode	AD_P_OUT3_CFG_UIO	UINT	0..65535		r/w	1792
204	LED OVERHEAT mode	AD_P_OUT4_CFG_UIO	UINT	0..65535		r/w	0
205	Relay K1 mode	AD_P_OUT5_CFG_UIO	UINT	0..65535		r/w	1792
206	Relay K2 mode	AD_P_OUT6_CFG_UIO	UINT	0..65535		r/w	768
207	Relay K3 mode	AD_P_OUT7_CFG_UIO	UINT	0..65535		r/w	59392
208	LED CONTROL config 0	AD_P_OUT0_STOERMASK_LOW_UIO	UINT	0..65535		r/w	0
209	LED LIMIT config 0	AD_P_OUT1_STOERMASK_LOW_UIO	UINT	0..65535		r/w	2048
210	LED PULSE LOCK config 0	AD_P_OUT2_STOERMASK_LOW_UIO	UINT	0..65535		r/w	256
211	LED FAULT config 0	AD_P_OUT3_STOERMASK_LOW_UIO	UINT	0..65535		r/w	0
212	LED OVERHEAT config 0	AD_P_OUT4_STOERMASK_LOW_UIO	UINT	0..65535		r/w	0
213	Relay K1 config 0	AD_P_OUT5_STOERMASK_LOW_UIO	UINT	0..65535		r/w	0
214	Relay K2 config 0	AD_P_OUT6_STOERMASK_LOW_UIO	UINT	0..65535		r/w	2048
215	Relay K3 config 0	AD_P_OUT7_STOERMASK_LOW_UIO	UINT	0..65535		r/w	1
216	LED CONTROL config 1	AD_P_OUT0_STOERMASK_HIGH_UIO	UINT	0..65535		r/w	0
217	LED LIMIT config 1	AD_P_OUT1_STOERMASK_HIGH_UIO	UINT	0..65535		r/w	0
218	LED PULSE LOCK config 1	AD_P_OUT2_STOERMASK_HIGH_UIO	UINT	0..65535		r/w	0
219	LED FAULT config 1	AD_P_OUT3_STOERMASK_HIGH_UIO	UINT	0..65535		r/w	256
220	LED OVERHEAT config 1	AD_P_OUT4_STOERMASK_HIGH_UIO	UINT	0..65535		r/w	0
221	Relay K1 config 1	AD_P_OUT5_STOERMASK_HIGH_UIO	UINT	0..65535		r/w	256
222	Relay K2 config 1	AD_P_OUT6_STOERMASK_HIGH_UIO	UINT	0..65535		r/w	0
223	Relay K3 config 1	AD_P_OUT7_STOERMASK_HIGH_UIO	UINT	0..65535		r/w	0

TAB. 18: OBJECT DEVICE PARAMETERS (0X64): LED AND RELAYS

11.13 OTHER

ATTR ID	NAME	SYMBOL	DATA TYPE	VALUE RANGE	UNIT/Meaning	RW	DEFAULT
224	Data logger register	AD_P_DAT_LOG_ENABLE_H1	UDINT	0..65535		r/w	0
225	Reset trigger on error register	AD_P_RESET_H1	UDINT	0..65535		r/w	31
226	Pulse switch-off on error register	AD_P_IMAB_H1	UDINT	0..65535		r/w	0
227	Version year	AD_VERS_JJJJ	UINT	0..65535		r	2004
228	Version month	AD_VERS_MM	UINT	1..12		r	9
229	Version day	AD_VERS_TT	UINT	1..31		r	3
230	Userparameter 0	AD_P_TEMP_0_0	UINT	0..65535		r/w	0
231	Userparameter 1	AD_P_TEMP_0_1	UINT	0..65535		r/w	0
232	Userparameter 2	AD_P_TEMP_0_2	UINT	0..65535		r/w	0
233	Userparameter 3	AD_P_TEMP_0_3	UINT	0..65535		r/w	0
234	Userparameter 4	AD_P_TEMP_0_4	UINT	0..65535		r/w	0
235	Userparameter 5	AD_P_TEMP_0_5	UINT	0..65535		r/w	0
236	Userparameter 6	AD_P_TEMP_0_6	UINT	0..65535		r/w	0
237	Userparameter 7	AD_P_TEMP_0_7	UINT	0..65535		r/w	0
238	Userparameter 8	AD_P_TEMP_0_8	UINT	0..65535		r/w	0
239	Userparameter 9	AD_P_TEMP_0_9	UINT	0..65535		r/w	0
240	Userparameter 10	AD_P_TEMP_0_10	UINT	0..65535		r/w	0
241	Userparameter 11	AD_P_TEMP_0_11	UINT	0..65535		r/w	0
242	Userparameter 12	AD_P_TEMP_0_12	UINT	0..65535		r/w	0
243	Userparameter 13	AD_P_TEMP_0_13	UINT	0..65535		r/w	0
244	Userparameter 14	AD_P_TEMP_0_14	UINT	0..65535		r/w	0

TAB. 19: OBJECT DEVICE PARAMETERS (0X64): OTHER

12. USER-DEFINED OBJECT CONFIGURATION PARAMETERS (CLASS CODE 0X65)

All configuration parameters (start parameters) of the Thyro-P/Thyro-P MC device are specified as attributes in the user-defined object 0x65 and are in the range from 1 to 6. They are always downloaded when the connection is set up as a configuration assembly with the ID 109 (see Tab. 21).

ATTR ID	NAME	SYMBOL	DATA TYPE	VALUE RANGE	UNIT/MeANING	RW	DEFAULT
1	Configuration byte	MODULE_POS_CONFIG	UINT	0..7		r/w	0
2	Average (No. of values)	MODULE_POS_AVERAGE	UINT	0..20		r/w	0
3	Selection for fast values	MODULE_POS_FAST_VALUES	UINT	0..63		r/w	0
4	Set point active Channel 1	MODULE_POS_SETPOINT_ACTIV_MC1	UINT	0..255		r/w	72
5	Set point active Channel 2	MODULE_POS_SETPOINT_ACTIV_MC2	UINT	0..255		r/w	65
6	Set point active Channel 1	MODULE_POS_SETPOINT_ACTIV_MC3	UINT	0..255		r/w	66

TAB. 20: OBJECT CONFIGURATION PARAMETERS (0X65)

13. ASSEMBLY OBJECT (CLASS CODE 0X04)

With the aid of the assembly class several even quite different objects can be combined.
Assemblies enable the sending or receiving of data via a single connection. This can be input and output data, status and control information or diagnosis information. The terms input and output assemblies are defined from the perspective of the network. The input assemblies
produce (send) data on the bus; the output assemblies consume (receive) data from the bus. With the aid of input and output assemblies' cyclical IO data are transmitted.
The assemblies are addressed with the aid of Instance IDs. The user-defined address range is from 100 (0x64) to 199 (0xC7) and from 768 (0x300) to 2047 (0x4FF).
Thyro-P/Thyro-P MC contains several sets of assemblies. The user can select the corresponding assemblies depending on whether they want to use integer or float data types for the set point and actual value variables.
Configuration data are also combined in an assembly (configuration assembly with instance ID 109) and downloaded onto the device when the connection is set up (see Fig. 3).

13.1 CONFIGURATION ASSEMBLY

Assembly 109 is the configuration assembly for Thyro-P/Thyro-P MC and contains all attributes of the configuration object with Class ID 0x65. The assembly is downloaded onto the device when the connection is set up.

BYTE OFFSET	ATTR ID	DATA TYPE	NAME	SYMBOL
0-1	1*	UINT	Configuration byte	MODULE_POS_CONFIG
2-3	2*	UINT	Average (No. of values)	MODULE_POS_AVERAGE
4-5	3*	UINT	Selection for fast values	MODULE_POS_FAST_VALUES
6-7	4*	UINT	Set point active Channel 1	MODULE_POS_SETPOINT_ACTIV_MC1
8-9	5*	UINT	Set point active Channel 2	MODULE_POS_SETPOINT_ACTIV_MC2
10-11	6*	UINT	Set point active Channel 1	MODULE_POS_SETPOINT_ACTIV_MC3

TAB. 21: CONFIGURATION ASSEMBLY

* Additional information of:

Attr. ID 1: Configuration byte

BIT	MEANING
0	No connection to Master setpoint =: Here you can set which setpoint should be used if the connection to the master is interrupted. 0 In the case of an error the setpoint master error is used. Its default value is 0. 1 In the case of an error the setpoint master will continue to be used.
1	Motor potentiometer = master: This setting activates the writing of the „master setpoint“ to the „motor potentiometer setpoint“ in remote operation if the „local operation of a setpoint“ is used. This prevents a volatile alteration of the setpoint occurring when switching over from remote to local.
2	Discount all output data in local: This setting actviates the discounting of all output data in local operation. This can, for example, be useful if the control has set the controller inhibit and, in spite of this, the controller needs to be switched locally. If the controller inhibit needs to be set at the time of switching over from remote to local then the motor potentiometer setpoint is set to 0 and the controller inhibit is deactivated.

Attr. ID 2: Average (No. of values)

Here the number of actual values can be entered which flow into the averaging. A new value is calculated once a second. Values from 0-20 can be entered, whereby 0 or 1 deactivates this function.

Attr. ID 3: Selection for fast values

BIT	FAST VALUES
0	Power
1	Load voltage
2	Current
3	Conductance
4	Load temperature
5	Supply voltage

Activation of quick read-out of these actual values: These values will be read out every time the set point is transferred.

Attr. ID 4-6: Set point active Channel 1,2,3

BIT	MEANING
0	Local set point terminal 10 active
1	Local set point terminal 11 active
2	Local set point master active
3	Local set point motor potentiometer active
4	Remote set point terminal 10 active
5	Remote set point terminal 11 active
6	Remote set point master active
7	Remote set point motor potentiometer active

13.2 ASSEMBLY OBJECTS IN THYRO-P

The following assemblies contain attributes which are localized in object with Class ID 0x64, instance 1 of Thyro-P.

13.2.1 ASSEMBLIES FOR CYCLIC DATA

13.2.1.1 OUTPUT ASSEMBLY 101

In Output Assembly with Instance ID 101 the integer set points are combined:

BYTE	ATTR ID	DATA TYPE	NAME	SYMBOL
0-1	1	UINT	Set point Master	AD_SW_MASTER
2-3	2	UINT	Set point Master Error	AD_SW_MASTER_ERROR
4-5	5	UINT	Function	AD_FUNCTION

TAB. 22: THYRO-P ASSEMBLIES FOR CYCLIC DATA:
OUTPUT ASSEMBLY 101

13.2.1.2 OUTPUT ASSEMBLY 104

In Output Assembly with Instance ID 104 the float set points are combined:

BYTE	ATTR ID	DATA TYPE	NAME	SYMBOL
0-3	3	REAL	Set point Master Float	AD_SW_MASTER
4-7	4	REAL	Set point Master Error Float	AD_SW_MASTER_ERROR
8-9	5	UINT	Function	AD_FUNCTION

TAB. 23: THYRO-P ASSEMBLIES FOR CYCLIC DATA:
OUTPUT ASSEMBLY 104

13.2.1.3 INPUT ASSEMBLY 102

In Input Assembly with Instance ID 102 the following integer actual values are combined:

BYTE	ATTR ID	DATA TYPE	NAME	SYMBOL
0-1	28	UINT	Total Set point	AD_SW_SUMME
2-3	36	UINT	Digital input	AD_DIGITAL_IN
4-5	37	UINT	Status	AD_IW_STOER
6-7	98	UINT	Set point activation	AD_P_SW_ENABLE

TAB. 24: THYRO-P ASSEMBLIES FOR CYCLIC DATA: INPUT ASSEMBLY 102

13.2.1.4 INPUT ASSEMBLY 103

In Input Assembly with Instance ID 103 the following float actual values are combined:

BYTE	ATTR ID	DATA TYPE	NAME	SYMBOL
0-3	26	REAL	Total set point float	AD_SW_SUMME_FLOAT
4-5	36	UINT	Digital input	AD_DIGITAL_IN
6-7	37	UINT	Status	AD_IW_STOER
8-9	98	UINT	Set point activation	AD_P_SW_ENABLE

TAB. 25: THYRO-P ASSEMBLIES FOR CYCLIC DATA: INPUT ASSEMBLY 103

13.2.2 INPUT ASSEMBLIES FOR ACYCLIC ACCESS

The following parameters are combined in assemblies so that they can be read as a group with one acyclic read access. The EPATH for addressing the assembly data has the following format: "20 04 24 XX 30 03". XX is the assembly number in hexadecimal format. With attribute 4
("20 04 24 XX 30 04") the size of the data in assembly XX can be read.

13.2.2.1 INPUT ASSEMBLY 105

In Assembly with Instance ID 105 the following parameters for the Thyro-P (current value 1P) are contained:

BYTE	ATTR ID	DATA TYPE	NAME	SYMBOL
0-3	6	REAL	Power L1	AD_IW_P_EFF_LSB_H_1
4-7	7	REAL	Load voltage L1	AD_IW_U_EFF_LSB_1
8-11	8	REAL	Current L1	AD_IW_I_EFF_LSB_1
12-15	9	REAL	Conductance L1	AD_IW_G_IST_L1
16-17	10	UINT	Supply voltage L1	AD_SW_PUE_L1
18-19	11	UINT	Load temperature L1	AD_IW_TEMP_LAST_1

TAB. 26: THYRO-P ASSEMBLIES FOR ACYCLIC ACCESS:
INPUT ASSEMBLY 105

13.2.2.2 INPUT ASSEMBLY 106

In Assembly with Instance ID 106 the following parameters for Thyro-P (current value 2P) are combined:

BYTE	ATTR ID	DATA TYPE	NAME	SYMBOL
0-3	6	REAL	Power L1	AD_IW_P_EFF_LSB_H_1
4-7	7	REAL	Load voltage L1	AD_IW_U_EFF_LSB_1
8-11	8	REAL	Current L1	AD_IW_I_EFF_LSB_1
12-15	9	REAL	Conductance L1	AD_IW_G_IST_L1
16-17	10	UINT	Supply voltage L1	AD_SW_PUE_L1
18-19	11	UINT	Load temperature L1	AD_IW_TEMP_LAST_1
20-23	12	REAL	Power L3	AD_IW_P_EFF_LSB_H_3
24-27	13	REAL	Load voltage L3	AD_IW_U_EFF_LSB_3
28-31	14	REAL	Current L3	AD_IW_I_EFF_LSB_3
32-35	15	REAL	Conductance L3	AD_IW_G_IST_L3
36-37	16	UINT	Supply voltage L3	AD_SW_PUE_L3
38-39	17	UINT	Load temperature L3	AD_IW_TEMP_LAST_31

TAB. 27: THYRO-P ASSEMBLIES FOR ACYCLIC ACCESS: INPUT ASSEMBLY 106

13.2.2.3 INPUT ASSEMBLY 107

In Assembly with Instance ID 107 the following parameters for Thyro-P (current value 3P) are contained:

BYTE	ATTR ID	DATA TYPE	NAME	SYMBOL
0-3	6	REAL	Power L1	AD_IW_P_EFF_LSB_H_1
4-7	7	REAL	Load voltage L1	AD_IW_U_EFF_LSB_1
8-11	8	REAL	Current L1	AD_IW_I_EFF_LSB_1
12-15	9	REAL	Conductance L1	AD_IW_G_IST_L1
16-17	10	UINT	Supply voltage L1	AD_SW_PUE_L1
18-19	11	UINT	Load temperature L1	AD_IW_TEMP_LAST_1
20-23	12	REAL	Power L2	AD_IW_P_EFF_LSB_H_2
24-27	13	REAL	Load voltage L2	AD_IW_U_EFF_LSB_2
28-31	14	REAL	Current L2	AD_IW_I_EFF_LSB_2
32-35	15	REAL	Conductance L2	AD_IW_G_IST_L2
36-37	16	UINT	Supply voltage L2	AD_SW_PUE_L2
38-39	17	UINT	Load temperature L2	AD_IW_TEMP_LAST_1
40-43	18	REAL	Power L3	AD_IW_P_EFF_LSB_H_3
44-47	19	REAL	Load voltage L3	AD_IW_U_EFF_LSB_3
48-51	20	REAL	Current L3	AD_IW_I_EFF_LSB_3
52-55	21	REAL	Conductance L3	AD_IW_G_IST_L3
56-57	22	UINT	Supply voltage L3	AD_SW_PUE_L3
58-59	23	UINT	Load temperature L3	AD_IW_TEMP_LAST_3

TAB. 28: THYRO-P ASSEMBLIES FOR ACYCLIC ACCESS:
INPUT ASSEMBLY 107

13.2.2.4 INPUT ASSEMBLY 108 - SEVERAL PARAMETERS

In Assembly with Instance ID 108 the following several parameters are combined:

BYTE	ATTR ID	DATA TYPE	NAME	SYMBOL
0-3	24	REAL	Total Power	AD_IW_P_EFF_LSB_H_GES
4-7	25	REAL	Temperature	AD_IW_TEMP
8-9	30	UINT	Set point terminal 10	AD_SW_REGLER
10-11	31	UINT	Set point terminal 11	AD_SW_POTI
12-13	32	UINT	On-angle alpha	AD_IW_ALPHA
14-15	33	UINT	On-time value	AD_IW_TS
16-17	34	UINT	Periodic time	AD_IW_FREQUENZ
18-19	35	UINT	LED & relays state	AD_P_LED_REL_CURRENT
20-23	38	REAL	Operating hour	AD_IW_BETRIEBSSTD_H
24-27	39	REAL	Energy	AD_IW_ARBEIT_WORT_3

TAB. 29: THYRO-P ASSEMBLIES FOR ACYCLIC ACCESS:
INPUT ASSEMBLY 108

13.3 ASSEMBLY OBJECTS IN THYRO-P MC

The following assemblies contain attributes which are localized in the object with Class ID 0x64, instances 2, 3 and 4 correspondingly for channel 1, 2 and 3 of Thyro-P MC.

13.3.1 ASSEMBLIES FOR CYCLIC DATA

13.3.1.1 OUTPUT ASSEMBLY 111

In Output Assembly with Instance ID 111 the integer set points for the 3 channels are combined:

BYTE	ATTR ID	INST-ANCE	CHANNEL	DATA TYPE	NAME	SYMBOL
0-1	1	2	1	UINT	Set point Master	AD_SW_MASTER
2-3	2	2	1	UINT	Set point Master Error	AD_SW_MASTER_ERROR
4-5	5	2	1	UINT	Function	AD_FUNCTION
6-7	1	3	2	UINT	Set point Master	AD_SW_MASTER
8-9	2	3	2	UINT	Set point Master Error	AD_SW_MASTER_ERROR
10-11	5	3	2	UINT	Function	AD_FUNCTION
12-13	1	4	3	UINT	Set point Master	AD_SW_MASTER
14-15	2	4	3	UINT	Set point Master Error	AD_SW_MASTER_ERROR
16-17	5	4	3	UINT	Function	AD_FUNCTION

TAB. 30: THYRO-P MC ASSEMBLIES FOR CYCLIC DATA:
OUTPUT ASSEMBLY 111

13.3.1.2 OUTPUT ASSEMBLY 114

In Output Assembly with Instance ID 114 the float set points for the 3 channels are combined:

BYTE	ATTR ID	INST-ANCE	CHANNEL	DATA TYPE	NAME	SYMBOL
0-3	3	2	1	REAL	Set point Master float	AD_SW_MASTER_FLOAT
4-7	4	2	1	REAL	Set point Master Error float	AD_SW_MASTER_ERROR_FLOAT
8-9	5	2	1	UINT	Function	AD_FUNCTION
10-13	3	3	2	REAL	Set point Master float	AD_SW_MASTER_FLOAT
14-17	4	3	2	REAL	Set point Master Error float	AD_SW_MASTER_ERROR_FLOAT
18-19	5	3	2	UINT	Function	AD_FUNCTION
20-23	3	4	3	REAL	Set point Master float	AD_SW_MASTER_FLOAT
24-27	4	4	3	REAL	Set point Master Error float	AD_SW_MASTER_ERROR_FLOAT
28-29	5	4	3	UINT	Function	AD_FUNCTION

TAB. 31: THYRO-P MC ASSEMBLIES FOR CYCLIC DATA: OUTPUT ASSEMBLY 114

13.3.1.3 INPUT ASSEMBLY 112

In Input Assembly with Instance ID 112 the integer actual values for the 3 channels are combined:

BYTE	ATTR ID	INST-ANCE	CHANNEL	DATA TYPE	NAME	SYMBOL
0-1	28	2	1	UINT	Total Set point	AD_SW_SUMME
2-3	36	2	1	UINT	Digital input	AD_DIGITAL_IN
4-5	37	2	1	UINT	Status	AD_IW_STOER
6-7	98	2	1	UINT	Set point activation	AD_P_SW_ENABLE
8-9	28	3	2	UINT	Total Set point	AD_SW_SUMME
10-11	36	3	2	UINT	Digital input	AD_DIGITAL_IN
12-13	37	3	2	UINT	Status	AD_IW_STOER
14-15	98	3	2	UINT	Set point activation	AD_P_SW_ENABLE
16-17	28	4	3	UINT	Total Set point	AD_SW_SUMME
18-19	36	4	3	UINT	Digital input	AD_DIGITAL_IN
20-21	37	4	3	UINT	Status	AD_IW_STOER
22-23	98	4	3	UINT	Set point activation	AD_P_SW_ENABLE

TAB. 32: THYRO-P MC ASSEMBLIES FOR CYCLIC DATA: INPUT ASSEMBLY 112

13.3.1.4 INPUT ASSEMBLY 113

In Input Assembly with Instance ID 113 the float actual values for the 3 channels are combined:

BYTE	ATTR ID	INST-ANCE	CHANNEL	DATA TYPE	NAME	SYMBOL
0-3	26	2	1	REAL	Total Set point float	AD_SW_SUMME_FLOAT
4-5	36	2	1	UINT	Digital input	AD_DIGITAL_IN
6-7	37	2	1	UINT	Status	AD_IW_STOER
8-9	98	2	1	UINT	Set point activation	AD_P_SW_ENABLE
10-13	26	3	2	REAL	Total Set point float	AD_SW_SUMME_FLOAT
14-15	36	3	2	UINT	Digital input	AD_DIGITAL_IN
16-17	37	3	2	UINT	Status	AD_IW_STOER
18-19	98	3	2	UINT	Set point activation	AD_P_SW_ENABLE
20-23	26	4	3	REAL	Total Set point float	AD_SW_SUMME_FLOAT
24-25	36	4	3	UINT	Digital input	AD_DIGITAL_IN
26-27	37	4	3	UINT	Status	AD_IW_STOER
28-29	98	4	3	UINT	Set point activation	AD_P_SW_ENABLE

TAB. 33: THYRO-P MC ASSEMBLIES FOR CYCLIC DATA: INPUT ASSEMBLY 113

13.3.2 INPUT ASSEMBLIES FOR ACYCLIC ACCESS

The following parameters are combined in assemblies so that they can be read with an acyclial read access. The EPATH for addressing the assembly data has the format: “20 04 24 XX 30 03“. XX is the hexadecimal assembly instance ID number. With attribute 4 (“20 04 24 XX 30 03“) the size of the data in assembly XX can be read.

13.3.2.1 INPUT ASSEMBLY 115

In Assembly with Instance ID 115 the following parameters for the 3 channels are contained:

BYTE	ATTR ID	CHANNEL TYPE	DATA	NAME	SYMBOL
0-3	1006	1	REAL	Power L1	AD_IW_P_EFF_LSB_H_1
4-7	1007	1	REAL	Load voltage L1	AD_IW_U_EFF_LSB_1
8-11	1008	1	REAL	Current L1	AD_IW_I_EFF_LSB_1
12-15	1009	1	REAL	Conductance L1	AD_IW_G_IST_L1
16-17	1010	1	UINT	Supply voltage L1	AD_SW_PUE_L1
18-19	1011	1	UINT	Load temperature L1	AD_IW_TEMP_LAST_1
20-23	2006	2	REAL	Power L1	AD_IW_P_EFF_LSB_H_1
24-27	2007	2	REAL	Load voltage L1	AD_IW_U_EFF_LSB_1
28-31	2008	2	REAL	Current L1	AD_IW_I_EFF_LSB_1
32-35	2009	2	REAL	Conductance L1	AD_IW_G_IST_L1
36-37	2010	2	UINT	Supply voltage L1	AD_SW_PUE_L1
38-39	2011	2	UINT	Load temperature L1	AD_IW_TEMP_LAST_1
40-43	3006	3	REAL	Power L1	AD_IW_P_EFF_LSB_H_1
44-47	3007	3	REAL	Load voltage L1	AD_IW_U_EFF_LSB_1
48-51	3008	3	REAL	Current L1	AD_IW_I_EFF_LSB_1
52-55	3009	3	REAL	Conductance L1	AD_IW_G_IST_L1
56-57	3010	3	UINT	Supply voltage L1	AD_SW_PUE_L1
58-59	3011	3	UINT	Load temperature L1	AD_IW_TEMP_LAST_1

TAB. 34: THYRO-P MC ASSEMBLIES FOR ACYCLIC ACCESS: INPUT ASSEMBLY 115

13.3.2.2 INPUT ASSEMBLY 116

In Assembly with Instance ID 116 the following several parameters for the 3 channels are combined:

BYTE	ATTR ID	CHANNEL TYPE	DATA	NAME	SYMBOL
0-3	1024	1	REAL	Total Power	AD_IW_P_EFF_LSB_H_GES
4-7	1025	1	REAL	Temperature	AD_IW_TEMP
8-9	1030	1	UINT	Set point terminal 10	AD_SW_REGLER
10-11	1031	1	UINT	Set point terminal 11	AD_SW_POTI
12-13	1032	1	UINT	On-angle alpha	AD_IW_ALPHA
14-15	1033	1	UINT	On-time value	AD_IW_TS
16-17	1034	1	UINT	Periodic time	AD_IW_FREQUENZ
18-19	1035	1	UINT	LED & relays state	AD_P_LED_REL_CURRENT
20-23	1038	1	REAL	Operating hour	AD_IW_BETRIEBSSTD_H
24-27	1039	1	REAL	Energy	AD_IW_ARBEIT_WORT_3
28-31	2024	2	REAL	Total Power	AD_IW_P_EFF_LSB_H_GES
32-35	2025	2	REAL	Temperature	AD_IW_TEMP
36-37	2030	2	UINT	Set point terminal 10	AD_SW_REGLER
38-39	2031	2	UINT	Set point terminal 11	AD_SW_POTI
40-41	2032	2	UINT	On-angle alpha	AD_IW_ALPHA
42-43	2033	2	UINT	On-time value	AD_IW_TS
44.45	2034	2	UINT	Periodic time	AD_IW_FREQUENZ
46-47	2035	2	UINT	LED & relays state	AD_P_LED_REL_CURRENT
48-51	2038	2	REAL	Operating hour	AD_IW_BETRIEBSSTD_H
52-55	2039	2	REAL	Energy	AD_IW_ARBEIT_WORT_3
56-59	3024	3	REAL	Total Power	AD_IW_P_EFF_LSB_H_GES
60-63	3025	3	REAL	Temperature	AD_IW_TEMP
64-65	3030	3	UINT	Set point terminal 10	AD_SW_REGLER
66-67	3031	3	UINT	Set point terminal 11	AD_SW_POTI
68-69	3032	3	UINT	On-angle alpha	AD_IW_ALPHA
70-71	3033	3	UINT	On-time value	AD_IW_TS
72-73	3034	3	UINT	Periodic time	AD_IW_FREQUENZ
74-75	3035	3	UINT	LED & relays state	AD_P_LED_REL_CURRENT
76-79	3038	3	REAL	Operating hour	AD_IW_BETRIEBSSTD_H
80-83	3039	3	REAL	Energy	AD_IW_ARBEIT_WORT_3

TAB. 35: THYRO-P MC ASSEMBLIES FOR ACYCLIC ACCESS: INPUT ASSEMBLY 116

14. PROJECT SET UP OF THYRO-P/THYRO-P MC

14.1 EDS (ELECTRONIC DATA SHEETS)

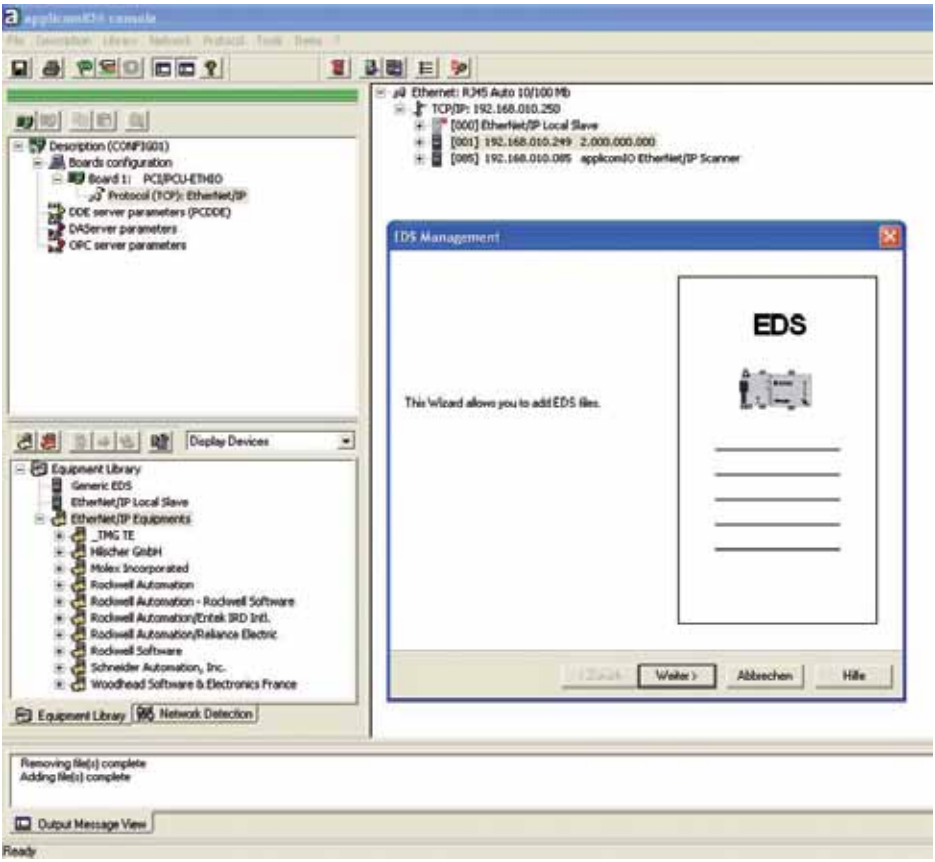
The device description file (EDS) is a text file which contains the necessary information for accessing configurable device parameters, I/O data and connections. The EDS file is made available by the device manufacturer and is adapted to individual product functions. The EDS can be used by configuration tools (e.g. RSNetWorks from Rockwell Automation) to configure the device and as such it makes the set up and integration process of the device easier.
To make it easier to operate a specific EDS file is used for each device type (Thyro-P/Thyro-P MC): ThyroP_Eip.eds and ThyroP_Eip_MC.eds.
The connection manager section of the EDS file defines a set of supported IO connections according to the desired IO assembly type (integer or float).

14.2 SETTING THE IP ADDRESS

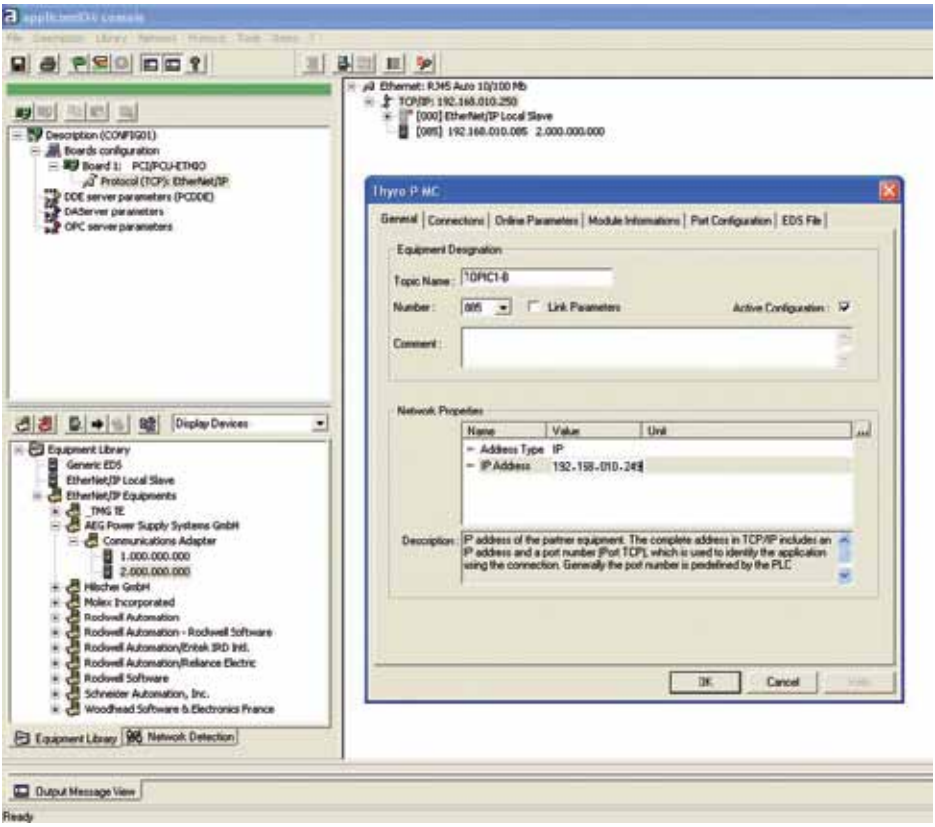
The IP address of the Thyro-P/Thyro-P MC can be set via a DHCP server. The IP address is stored remanently (not fluctuating) in the device. When initiating "Power On" the device waits for the IP address to be assigned from a DHCP server. If no DHCP server is found within 136
seconds the device starts with the saved address. If the saved IP address is 0.0.0.0 (initial start up) then the green network status LED remains off (see chapter 15).

14.3 PROJECT SET UP WITH APPLICOM FROM MOLEX

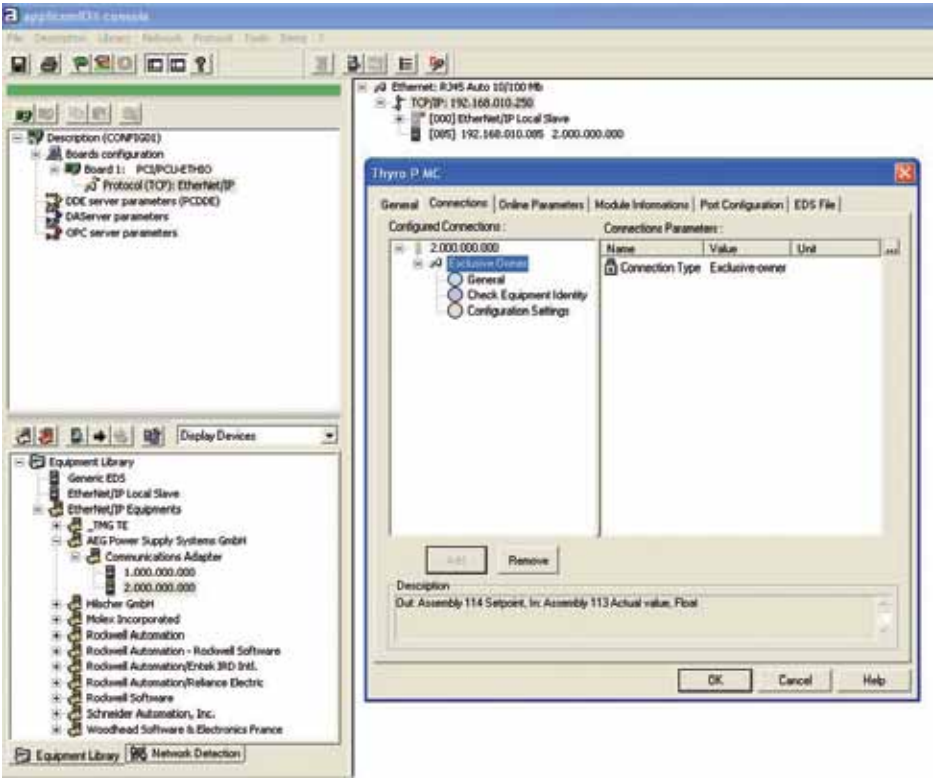
applicomIO from the company BradCommunications is a PC communication application for automating and visualizing industrial processes. The EtherNet/IP protocol is available via the applicomIO PCI-ETHIO cards. The applicomIO application consists of a configuration console,
test and diagnosis tools and interfaces for data access on the field device. The configuration of the device takes place via its EDS file.
The administration of the EDS files is carried out in the Equipment Library Area of applicomIO via the "Add" menu:


Ethernet: RJ45 Auto 10/100 Mb
TCP/IP: 192.168.010.250
[000] EtherNet/IP Local Slave
[001] 192.168.010.249 2.000.000.000
[005] 192.168.010.085 applcom/O EtherNet/IP Scanner
Description (CONFIG01)
Boards configuration
Board 1: PCI/PCU-ETH10
Protocol (TCP): EtherNet/IP
DDE server parameters (PCDDE)
DAServer parameters
OPC server parameters
EDS Management
EDS
This Wizard allows you to add EDS files.
Weiter >
Abbrechen
Hilfe
Display Devices
Equipment Library
Generic EDS
EtherNet/IP Local Slave
EtherNet/IP Equipments
_TMG TE
Hilscher GmbH
Molex Incorporated
Rockwell Automation
Rockwell Automation - Rockwell Software
Rockwell Automation/Entek IRD Intl.
Rockwell Automation/Reliance Electric
Rockwell Software
Schneider Automation, Inc.
Woodhead Software & Electronics France
Equipment Library
Network Detection
Removing file(s) complete
Adding file(s) complete
Output Message View
Ready

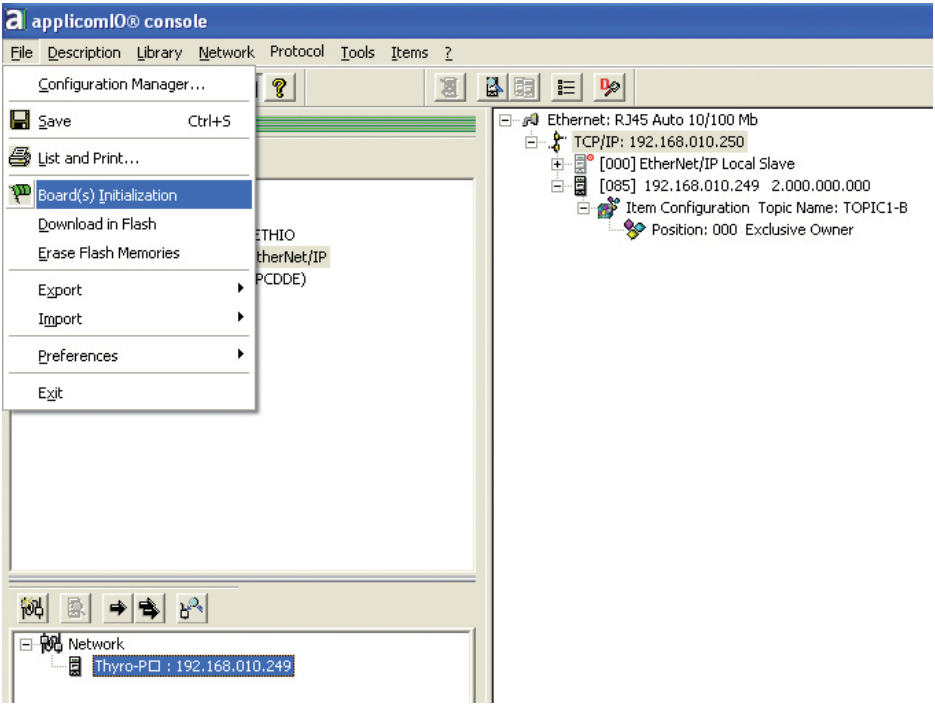
After the EDS file has been successfully scanned in the Advanced Energy Thyro-P and Thyro-P MC devices appear with corresponding catalogue numbers in the Equipment Library. Using drag and drop the device is then configured in the scanner and the IP address of the Thyro-P is set:



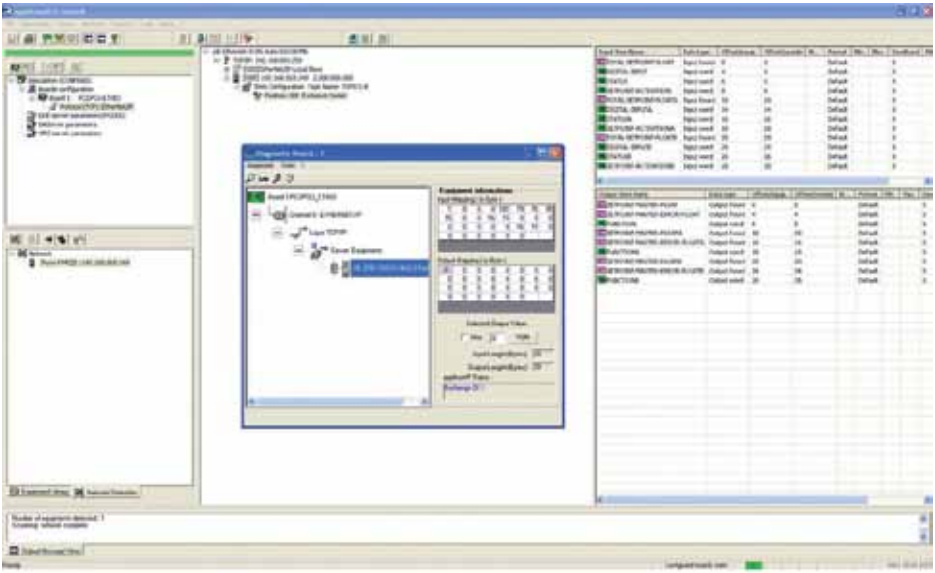
Under Connections the characteristics of the selected connection can be displayed.
The configured assemblies are displayed in the bottom line:



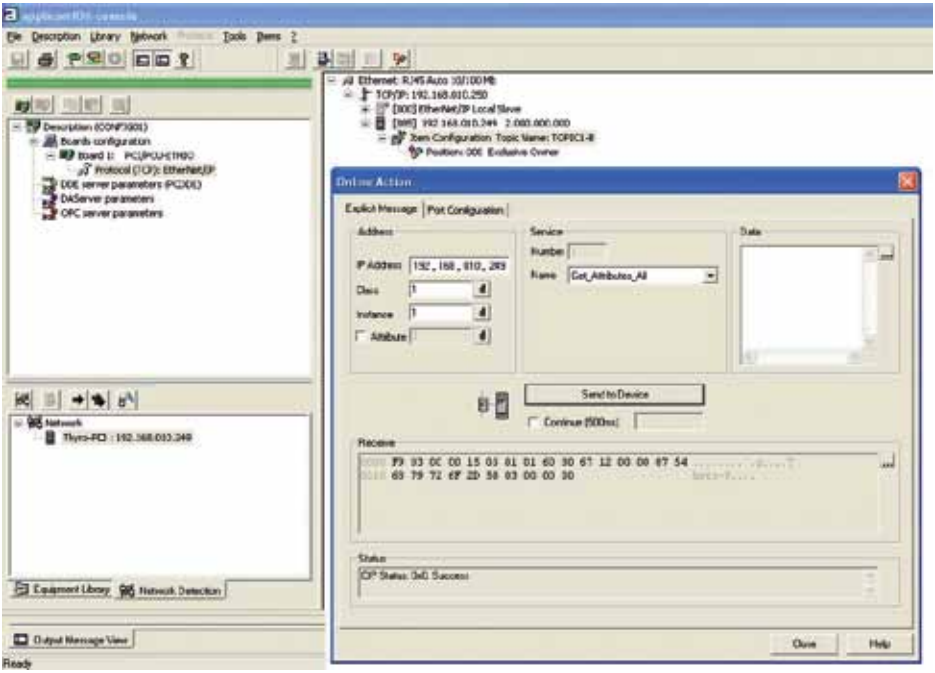
In the menu "File/Board Initialization" the configuration of Thyro-P is loaded into applicomIO.
Following successful configuration the cyclical communication is automatically set up and the NS-LED on the card lights up solid green.



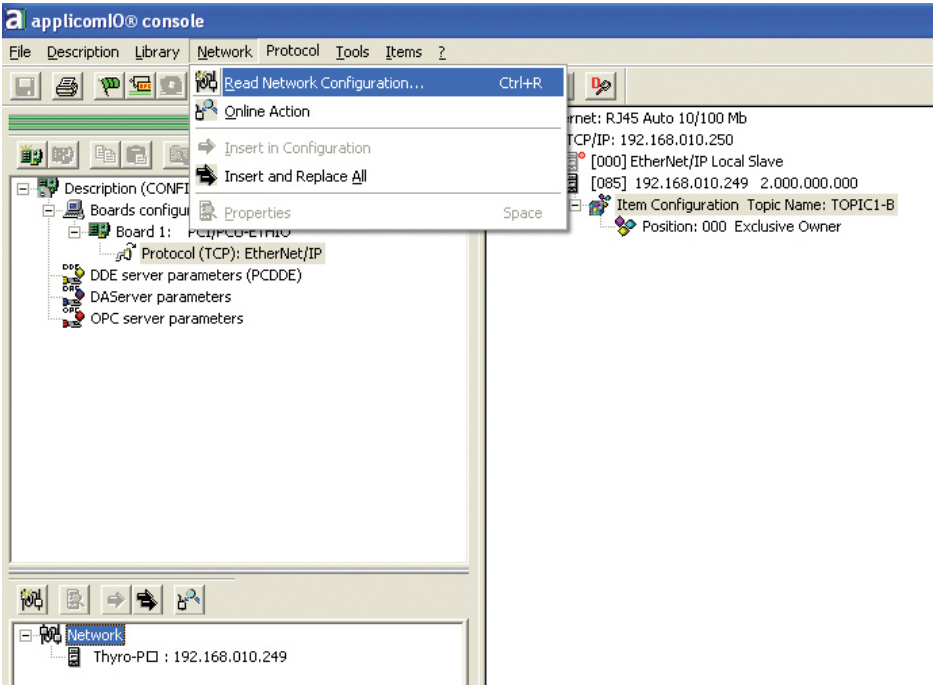
In the menu "Protocol/Diagnostic…" or with the "Diagnostic" button the input and output data of the assemblies can be displayed:



Via the menu “Online Action” in the “Network Detection” field data can be read or written acyclically from the device, even if the device is not entered into the configuration. The illustration shows the reading of all attributes of the identity object:



If the IP address of Thyro-P is not known, the "Automatic Detection" function can be activated and located devices appear left below "Network":



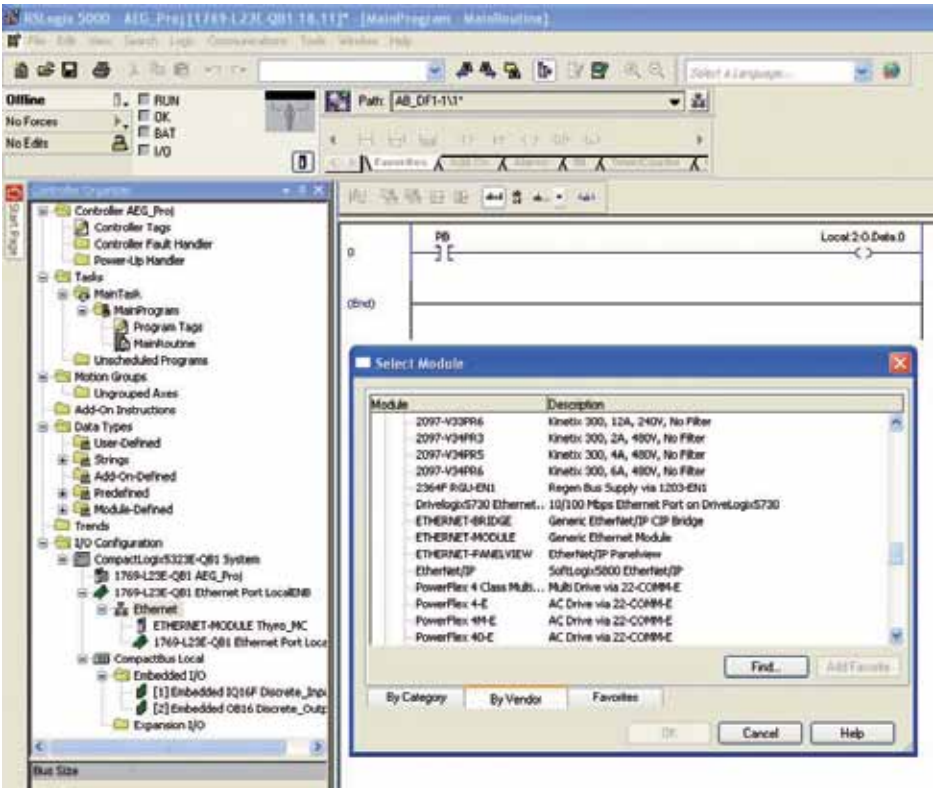
14.4 PROJECT SET UP WITH ROCKWELL AUTOMATION

Rockwell Automation provides the Logix platform for EtherNet/IP. Different levels of the Logix family can be used depending on the capacity of the system. For smaller applications the following components can be used:

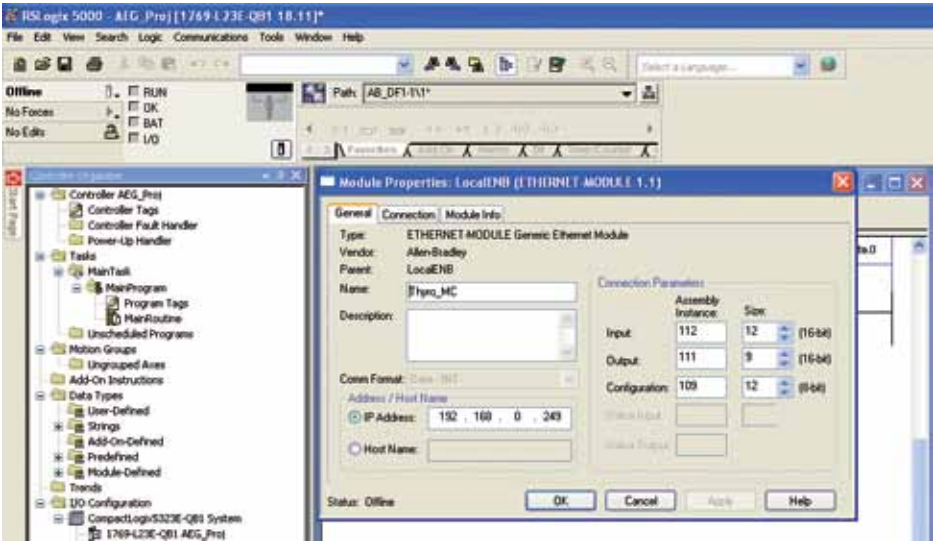
- CompactLogix™ L23E Processor with integrated EtherNet/IP port
- RSLogix™ 5000 program software for Logix controllers.
- RSLinx is a communication server and supports the programming software and component software products (OPC) from Rockwell.

As an option, the RSNetWorks tool can be used. RSNetworks is the con-figuration tool for EtherNet/IP and enables the graphical display of the system, the integration of EDS files from Ethernet devices, the display of I/O and configuration data, connection information, etc. The EDS file of Thyro-P/Thyro-P

MC can be read in via RSNetWorks and the device conveniently configured. Without RSNetWorks, Thyro-P/Thyro-P MC can be configured in RSLogix™ 5000 as a generic EtherNet/IP module:

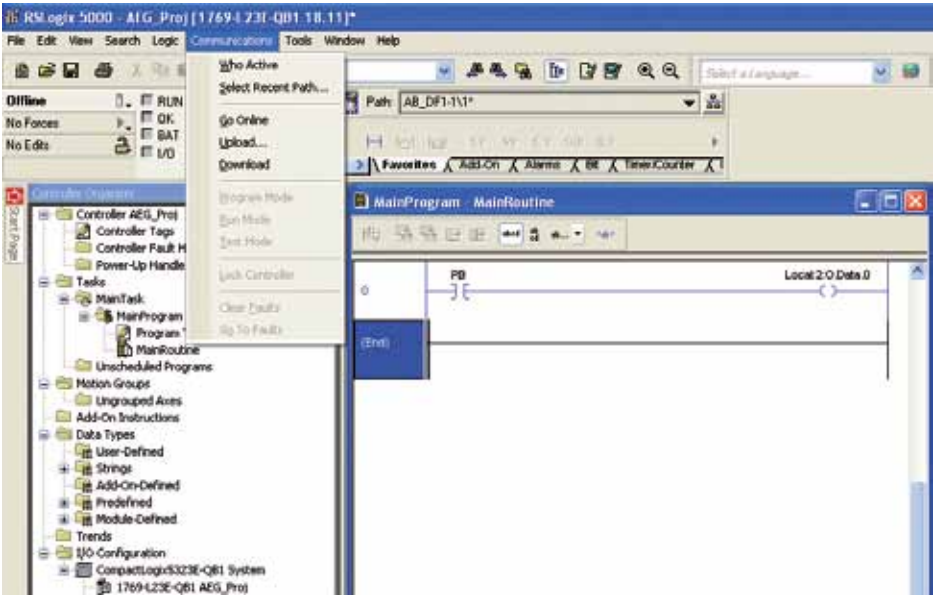


The user enters the current IP address of the device and the I/O size, I/O and configuration assembly IDs into the following dialogue box:



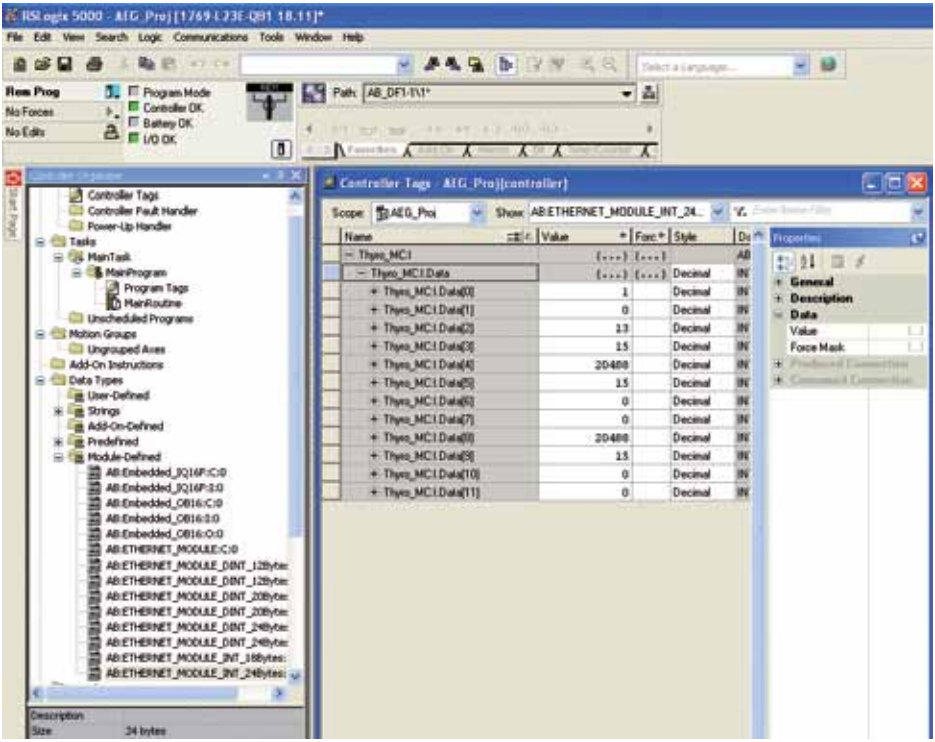
The RPI (Requested Packet Interval) can be changed in the Connection dialogue box. The default setting is 10 ms.

The Online operating mode (Go Online) is activated below the "Communications" menu:



Then the configuration is downloaded, and when the download is completed without errors the cyclical connection to Thyro-P is taken up.

The input data can be viewed in Module-View:



15. STATUS LED DISPLAYS

For the purpose of error analysis there are several LEDs on the plug-in card. They give information on the status of the application and the bus system. The two module status LEDs show if the device is supplied with power or not and whether it is functioning properly.
The two colored (green/red) network status LED shows the status of the communication connection.

LED		COLOR	STATUS	MEANING
MS (Module Status)	Run	Green	On	Operating system running
			Off	Power Off, error (see MS Error Red)
	Error	Red	Flashing with 5 Hz	Hardware error
			Flashing with 1 Hz	Error in boot process
			On	Waiting for boot process (check switch position „Protocol“)
			Off	No error
NS (Network Status)		Green	Off	Power Off, No IP-adress (0.0.0.0)
			Flashing with 2 Hz	No data exchange
			On	The device is exchanging data with the controller
		Red	Flashing	Timeout of the connection
			Off	No error

TAB. 36: OPERATING STATUS

In the start up phase the red MS LED flickers briefly (about 1 sec).
The Ethernet link status LEDs show the status of the Ethernet communication:

LED	COLOR	STATUS	MEANING
Link	Green	On	There is an Ethernet connection
Activity	Yellow	On	Data are being exchanged via Ethernet

TAB. 37: STATUS LED OF ETHERNET PORTS 1&2

16. EXTERNAL CONNECTIONS

16.1 ETHERNET INTERFACE

Communication medium	CAT 5e
Network topology	tree, star and line
Maximum cable length	100m
EtherNet/IP -participants	restricted to the maximum supported number of devices by the controller used
PNO identification number	0x0188
Device ID	0x0002
Transmission rate	100 Mbit/s

17. APPROVALS AND CONFORMITIES

Due to European harmonization and international reconciliation, the standards will be subject to years of adjustment and renumbering. The detailed schedule therefore contains the current standards as well, even if the date for their expiry has already been set.
Approvals and conformities are available for Thyro-P EtherNet/IP Card:
- Quality standard in acc. with DIN EN ISO 9001
- CE conformity
- EtherNet/IP conformity
- RoHS compliant 5/6
- Directives

The CE mark on the device confirms compliance with the EC directives 2006 / 95 / EEC for low voltage and 2004 / 108 / EEC for electromagnetic compatibility if the instructions on installation and commissioning described in the operating instructions are followed.

In detail:

DEVICE APPLICATION

EtherNet/IP		IEC 61158, IEC 61784,
Built-in device (VDE0160)		DIN EN 50 178
Storage temperature (D)		-25°C – +55°C
Transport temperature (E)		-25°C – +70°C
Operating temperature		-10°C – +55°C
Humidity class	B	DIN EN 50 178 tab. 7 (EN 60 721)
Degree of contamination	2	DIN EN 50 178 tab. 2
(Air pressure		900 mbar * 1000 m above sea level)
Degree of protection	IP00	DIN EN 69 529
EMC-testing		EN 61000-6-2 (-4)
Emitted interference		CISPR 16
Radiated immunity		EN/IEC 61000-4-3
Conducted immunity		EN/IEC 61000-4-6
ESD	8 kV(A)	EN/IEC 61000-4-2
Burst control lines	1 kV (A)	EN 61000-4-4

World Headquarters
1625 Sharp Point Drive
Fort Collins, CO 80525 USA

970.221.4670 Main
970.221.5583 Fax

www.advanced-energy.com

Specifications are subject to change without notice.