INTERFACE CARD MODBUS TCP

FOR THYRO-P AND THYRO-P MC

July 2014   DE/EN - V2

CONTENTS

1. SAFETY NOTES

The safety notes and the operating instructions are to be read carefully before installing and commissioning.

1.1 OBLIGATORY INSTRUCTION

These safety notes and the operating instructions shall carefully be read by the persons deployed for work using and employing the Modbus TCP interface card prior to assembly, installation and the initial start-up of the Modbus TCP interface card. These operating instructions are part of the Modbus TCP interface card.

The operator of the device is committed to provide these operating instructions without limitation to all persons, who transport the device, start it up, maintain it, or perform other work tasks to it.
In accordance with the Product Liability Act the manufacturer of this product is obligated to inform about and warn against
• other than the intended use of a product
• the residual hazards of a product as well as
• incorrect usages and their consequences
The following information is intended for this purpose. This information should warn the product user and protect him and his appliances.

1.2 APPROPRIATE USAGE

• The Modbus TCP interface card is an interface component which may only be operated in connection with the Thyro-P.
• As a component the Modbus TCP interface card is not functional on its own and must be project planned for its appropriate usage in order to minimize the residual hazards of the product.
• The Modbus TCP interface 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 systems also (e. g. overload).
• It is not permitted to make any unauthorized modifications to the device or to use any spare parts or replacement parts not approved by Advanced Energy, or to use the device for any other purpose.
• The warranty obligations of the manufacturer are only applicable if these operating instructions are observed and complied with.
• The Modbus TCP interface card connects a Thyro-P with a master.
• The devices supplied have been produced in accordance with the ISO 9001 quality standard.

• Multiple plug-in cards can be used on one assembly.
• The power supply for the plug-in card comes through the Thyro-P.

1.3 RESIDUAL HAZARDS OF THE PRODUCT

Even with intended use it is possible, in the case of an error, that the currents, voltages or power in the load circuit are no longer affected by the Modbus TCP interface card.

If the power components are destroyed, for example, the following cases are possible: current interruption, continiual flow of energy. If such a case occurs, then the occuring load voltages and currents result from the physical sizes of the overall circuit. Throughout the project planning of the system it must be ensured, that no uncontrolled large currents, voltages or power can occur.

1.4 INCORRECT OPERATION AND THEIR CONSEQUENCES

In the case of incorrect operations, higher power, voltages or currents than intended can reach the Modbus TCP interface card, the thyristor power controller or the load. This can cause damage to the Modbus TCP interface card, the thyristor power controller or the load.

In particular, factory-set parameters may not be altered in such a way that the Thyro-P or the Modbus TCP interface card are overloaded.

1.5 SCOPE OF SUPPLY

The supply consists of the following parts:
• Ethernet interface card Modbus TCP
• Operating instructions

1.6 STORAGE

The devices may be stored originally OEM packaged in rooms, which are dry and ventilated.
• permissible ambient temperature: -25°C to +55°C
• permissible relative air humidity: max. 85%
For longer storage durations, the devices should be contained in airtight plastic skins with the addition of commercially available drying agents.

1.7 ASSEMBLY

• If stored in cold environments it must be ensured that the device is absolu-
  tely dry before commissioning. Therefore allow at least 2 hours acclimatizati-
  on time before commissioning.
• Ensure sufficient ventilation and deaeration of the cabinet if mounted in a
  cabinet.
• Observe minimum spacing.
• Ensure that the device cannot be heated up by heat sources below it. (see
  Technical data).
• Ground the device in accordance with the local regulations.
• Connect the device in accordance with the connection diagrams.

1.8 CONNECTION

Before connection, the indicated voltage on the type plate is to be compared
with the mains voltage to make sure they match.
The electrical connection is made at the points labelled on the Thyro-P.

1.9 OPERATION

The Modbus TCP interface card may only be started when there is absolutely
no danger to persons or system.
• Protect the device against dust and damp.
• Ensure that the ventilation opening is not blocked.

1.10 MAINTENANCE, SERVICE, FAULTS

The symbols used in the following are explained in the chapter on safety
requirements.
In order to avoid damage to personnel or property the user must note the
following points before all work:

CAUTION

In the case of smoke or smell development, as well as in the case of fire, the device must be disconnected from all external voltage sources.

CAUTION

For maintenance and repair works the device must be disconnected from all external voltage sources and safeguarded against it being switched on again. After switching off wait at least two minutes for the snubber capacitors to discharge. The absence of voltage is to be ascertained using appropriate measurement instruments. The device is to be grounded and short-circuited. Adjacent components under voltage are to be covered or separated off. These activities may only be carried out by an electrically qualified person. The local electrotechnical regulations are to be adhered to.

CAUTION

The thyristor power controller contains voltages which are hazardous. Repairs are strictly only to be carried out by qualified and trained maintenance personnel.

CAUTION

Hazard of electric shocks. Even after the separation from the mains, capacitors can still contain dangerously high levels of energy.

CAUTION

Hazard of electric shocks. Even with a non-activated thyristor controller the load circuit is not separated from the mains by the thyristor controller.

ATTENTION

Different power components are screwed in place with exact torques according to their function. For safety reasons repairs to power components are to be carried out by Advanced Energy.

1.11 DECOMMISSIONING AND REMOVAL

If shutting down and dis-assembling the device for the reason of venue change or for disposal purposes the following safety rules must be complied with prior to the beginning of all work performed:

ATTENTION MAINS VOLTAGE!

Safety rules for work performed to electrical facilities:

1. Disconnect the device from the power supply (establish a voltage free status)
2. Secure against re-activation
3. Verify by measurement that there is no voltage present
4. Ground and short-circuit equipment
5. Cover or separate adjacent parts which are under voltage

For dis-assembly, perform the following steps:

1. Separate the device from the 230VAC, respectively 110VAC, power supply.
2. Separate all other connections.

Electrical connections are thus dis-assembled and now, the device can be removed by dis-assembly from the overhead rail.

2. SAFETY REQUIREMENTS

2.1 IMPORTANT INSTRUCTIONS AND EXPLANATIONS

For the protection of personnel and the maintenance of good working order, usage and repairs must be in line with the guidelines, and the safety requirements listed must be adhered to. The personnel who set up / disassemble the devices, start them up, operate them, maintain them, must know and adhere to these safety requirements. All works may only be carried out by specialist personnel trained for the purpose and equipped with faultless tools, appliances, means of testing and materials required and intended for that purpose. In these operating instructions, there are important warnings before dangerous actions. These warnings are divided into the following classes of hazards:

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

WARNING
Hazards that can lead to serious injuries or considerable damage to property.

CAUTION
Hazards that can lead to injuries and damage to property.

CAUTION
Hazards 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 device") , e.g.

 in case of risk of electric current or

 in case of risk of burns

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

NOTE
Content of note

2.2 GENERAL DANGER INFORMATION

DANGER
Not adhering to the safety requirements in the operating instructions of the power controllers being used can lead to danger of injury / danger of dama-ging the device or system.
> Adhere to all safety requirements in the chapter "Safety" of the
   operating instructions of the power controllers being used.

DANGER
ELECTRIC CURRENT
Risk of injury from current carrying parts/danger of damaging the
plug-in card. Never operate the device without covering.
Make adjustments and connections disconnected from the power supply.

NOTE
Communication error
In order to avoid communication errors the following point has to be
taken into account:
Use shielded cables.

2.3 QUALIFIED PERSONNEL

Only qualified personnel who are familiar with the pertinent safety and installation regulations may perform the following with the the Modbus TCP interface card:

• transport
• installation
• connection
• commissioning
• maintenance
• testing
• operation

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

2.4 REQUIREMENTS TO THE OPERATOR

The person responsible for the system must ensure that

• Safety notes and operating instructions are available and adhered to.
• Operating conditions and technical data are heeded.
• Protective devices are used.
• Maintenance personnel are informed immediately or the Modbus TCP interface card or the Thyro-P, respectively, is taken out of action immediately if abnormal voltages or noises, higher temperatures, vibrations or similar occur, in order to identify the cause.
• 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 Modbus TCP interface card in connection with the Thyro-P 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 systems also (e. g. overload).

It is not permitted to make any unauthorised modifications to the Modbus TCP interface card or to use any spare parts or replacement parts not approved by Advanced Energy, or to use the device for any other purpose.

These operating instructions contain all the information required by skilled personnel using the device. Additional information and notes for non-qualified persons and for the use of the device outside of industrial assemblies are not contained in these operating instructions.

The warranty obligations of the manufacturer are only applicable if these operating instructions are observed and complied with.

2.6 LIABILITY

No liability is burdened for non-intended by the manufacturer use of the Modbus TCP interface card. The operator or user, respectively, shall burden the responsibility for possibly necessary measures for the prevention of people and asset damage. In case of complaints, please contact us immediately and include the following information:
• type designation
• fabrication number /serial number
• complaint description
• duration in operations
• ambient conditions of the device
• mode of operation

3. NOTES ON THESE OPERATING INSTRUCTIONS

3.1 VALIDITY

These operating instructions correspond with the technical status of the Modbus TCP interface card at the time of issue. The content is not the subject of the contract, but rather serves to provide information. We reserve the right to make amendments to the details in these operating instructions, in particular to technical data, operation, measurements and weights. Advanced Energy-reserves the right to make content amendments and technical alterations to the details in these operating instructions unannounced. Advanced Energy cannot be held responsible for any inaccuracies or incorrect details in these operating instructions as there is no obligation to make ongoing updates to these operating instructions.

These operating instructions serve only as an addition to be used in conjunction with 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.

3.2 HANDLING

These operating instructions for the Modbus TCP interface card are structured in a manner so that according expert personnel may perform all work necessary for commissioning, maintenance, and repair.
If threats to personnel and material cannot be ruled out for certain work, such tasks are marked with a pictogram, from which the according content may be extracted from the before mentioned chapter „Safety requirements".

3.3 TYPE DESIGNATION

Ethernet interface card Modbus TCP order no. 2000 000 396

3.4 LOSS OF WARRANTY

Our supplies and services are subject to the general conditions of supply for products of the electrical industry, as well as our general sales conditions. Claims in connection with supplied goods must be submitted within eight days upon receipt, along with the packing slip. Claims made later cannot receive consideration.

Advanced Energy will rescind all possible obligations such as warranty agreements, service contracts, etc. entered into by Advanced Energy or its distributors without prior notice if maintenance and repair work is carried out using anything other than original Advanced Energy spare parts or spare parts purchased from Advanced Energy.

3.5 COPYRIGHT

No part of these operating instructions may be transmitted, reproduced and/or copied by any electronic or mechanical means without the express prior written permission of Advanced Energy.

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3.6 FURTHER INFORMATION ON COPYRIGHT

Thyro-™, Thyro-P™ are registered trademark of Advanced Energy Industries GmbH.

All other company and product names are (registered) trademarks of the respective owners.

4. CONTACT

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.
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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

5.1 GENERAL INFORMATION

The Ethernet interface card connects Thyro-P or Thyro-P MC with a master.
In one installation, various interface cards can be used. The electrical power
supply is done by Thyro-P for the interface card.

5.2 KEY FEATURES

• The Ethernet interface card connetcs the devices with different Ethernet bus
systems. By setting the switch „Protocol" to 1, the Ethernet interface card will
be a Modbus TCP IO-Device

• Function control via LED

• 3 free digital outputs or local operation of a set point

• Modbus communication requires a TC P connection to be set up between
a client and the server. At the server end the port number 502 is fixed for the
Modbus TC P. The connection is set up automatically through the protocol
software and as such is completely transparent for the application process.
As soon as the connection has been made, client and server can exchange
as much data as they want as often as they want via this connection. The
connection between client and server can either remain permanent or can be
ended following completion of communication and set up again.

5.3 GENERAL TELEGRAM SET UP WITH THE
    MODBUS TCP

By sending out the request telegram the client initiates a service call
up which is answered by the server with a response telegram. Request and
response telegrams contain parameters and/or data. In the case of Modbus
TCP communication the tasks relating to addressing and checksum are taken
on by the TCP protocol.

The ADU (application data unit) of the Modbus TCP protocol is made up of
the MBAP Header, function code and data. The MBAP Header is independent
of function and is no longer documented in the Modbus functions described
below.

GENERAL MODBUS TCP TELEGRAM SET UP (ADU)

MBAP HEADER	FUNCTION CODE	DATA
7 bytes	1 byte	x-bytes
		(value range 1.. 252 byte)

MBAP HEADER (MODBUS APPLICATION PROTOCOL HEADER)
Byte 0,1:   Transaction Identifier
Byte 2,3:   Protocol identifier 0 for Modbus TCP protocol
Byte 4,5:   Number of consecutive bytes (High-Byte, Low-Byte)
Byte 6:   Unit identifier (Unit Identifier Remote)

FUNCTION CODE
Byte 7:   Modbus function code see chapter 5.5

DATA
Byte 8..n: The data range corresponds with that of the standard Modbus
protocol.
The CRC checksum, however, is no longer required as it is implemented at
the TCP/IP protocol level.
Both the request and the response telegrams always contain a function
code (length: 1 byte) on which the further set up of the subsequent data
depends.

5.4 HANDLING EXCEPTIONS

In the case of an exception the device (server) sends an exception re-
sponse and the request telegram (the request in question) is discarded.
The response telegram in the case of an exception contains the function
code received, however, here the highest value bit (MSB) is set to display
an exception.

EXCEPTION FUNCTION CODE	EXCEPTION CODE
1 BYTE	1 BYTE
Function code + 0x80	01 or 02 or 03 or 04

In the Exception code one of the following exception types is entered:

1. ILLEGAL FUNCTION (0X01)
The function code received in the request is not supported by the device.

2. ILLEGAL DATA ADDRESS (0X02)
The register address does not exist. It must be smaller than 624. In the
case of „Read Holding Registers" and „Preset Multiple Regs" requests the

address is made up of the start address of the register and the number of registers. So that means: register + number < 624.

3. ILLEGAL REGISTER QUANTITY (0X03)
The number of registers is invalid, which means that it is outside the range of 1 to 125.

4. REQUEST PROCESSING (0X04)
A device exception occurred whilst accessing the parameter in the application (e.g. parameter is write-protected, invalid value, incorrect index/incorrect slot in the application).

5.5 MODBUS DATA TYPES

Modbus distinguishes between the following data types: byte (8 bit) and register (16 bit). A register corresponds to two bytes, whereby the byte with the higher value is transferred as the first data unit each time. As such Modbus uses the so-called bigendian format for the display of addresses and data.
Extended data types such as 32 bit integer and 32 bit float are transmitted as 2 consecutive 16 bit registers.
In the Thyro-P/Thyro-P MC the information from the device is dis-played in the following register types (16 bit).

DATA TYPE	LENGTH	VALUE RANGE	ACCESS	DESCRIPTION
Input Register	16 Bit	0.. 65536	r	Data made available by the device as Read Only
Holding Register	16 Bit	0.. 65536	r/w	Data can be altered from the application

The data is addressed using addresses in the range from 0x0000 to 0xFFFF. The smallest data unit which can be read is a register
(16 bits). The number of registers which can be read can vary from 1 to maximum 125 (0x7D).

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

DATA TYPE NAME	DESCRIPTON	RANGE
UINT	Unsigned integer	0 to 65535
UDINT	Unsigned double integer	0 to 2^{31}-1
REAL	Float	
WORD	Bit-string 16 bits	
DWORD	Bit-string 32 bits	

5.6 FUNCTIONS

The following functions from the range of „Public Function Codes" are supported:

FUNCTION	FUNCTION CODE	DATA TYPE	ACCESS	DESCRIPTION
Read Holding Register	0x03	Holding Register	Read	Reads one or more Holding Registers from the device
Read Input Register	0x04	Input Register	Read	Reads one or more Input Registers form the device
Preset Single Register	0x06	Holding Register	Write	Alters a register in the device
Preset Multiple Register	0x10	Holding Register	Write	Alters multiple registers in the device

5.6.1 READ HOLDING REGISTERS (0X03)

With this telegram the client can read out one or multiple registers from the Thyro-P/Thyro-P MC device (function code 0x03), whereby the registers must be consecutive.

REQUEST:

FUNCTION CODE	START ADDRESS OF THE REGISTERS	NUMBER OF REGISTERS
1 byte	2 byte	2 bytes
0x03	0x0000 to 0xFFFF	1..125

RESPONSE:

FUNCTION CODE	NUMBER OF BYTES	DATA (CONTENT OF REGISTERS)
1 byte	1 byte	2 * number of registers byte
0x03	2 * number of registers	0x0000 to 0xFFFF

EXCEPTION RESPONSE:

EXECPTION FUNCTION CODE	EXCEPTION CODE
1 byte	1 byte
0x83	01 or 02 or 03 or 04

5.6.2 READ INPUT REGISTERS (0X04)

With this telegram the client can read out one or multiple registers from the Thyro-P/Thyro-P MC device (function code 0x04), whereby the registers must be consecutive.

REQUEST:

FUNCTION CODE	START ADDRESS OF THE REGISTERS	NUMBER OF INPUT REGISTERS
1 byte	2 bytes	2 bytes
0x04	0x0000 to 0xFFFF	1..125

RESPONSE:

FUNCTION CODE	NUMBER OF BYTES	DATA (CONTENT OF REGISTERS)
1 byte	1 byte	2 * numer of regis-ters byte
0x04	2 * number of registers	0x0000 to 0xFFFF

EXCEPTION RESPONSE:

EXCEPTION RESPONSE CODE	EXCEPTION CODE
1 byte	1 byte
0x84	01 or 02 or 03 or 04

5.6.3 PRESET SINGLE REGISTER (0X06)

With this telegram the client can alter a register in the Thyro-P/ Thyro-P MC device (function code 0x06). The response in an excep-tion free case is identical to the request.

REQUEST:

FUNCTION CODE	ADDRESS OF THE REGISTER	DATA
1 byte	2 bytes	2 bytes
0x06	0x0000 to 0xFFFF	0x0000 to 0xFFFF

RESPONSE

FUNCTION CODE	ADDRESS OF THE REGISTER	DATA
1 byte	2 bytes	2 bytes
0x06	0x0000 to 0xFFFF	0x0000 to 0xFFFF

EXCEPTION RESPONSE:

EXCEPTION FUNCTION CODE	EXCEPTION CODE
1 byte	1 byte
0x86	01 or 02 or 03 or 04

5.6.4 PRESET MULTIPLE REGS (0X10)

With this telegram the client can alter one or multiple registers in the Thyro-P/Thyro-P MC device (function code 0x10), whereby the registers must be consecutive.

REQUEST:

FUNCTION CODE	START ADDRESS OF THE REGISTERS	NUMBER OF REGISTERS	NUMBER OF BYTES	DATA
1 byte	2 bytes	2 bytes	1 byte	2 * number of regis-ters byte
0x10	0x0000 to 0xFFFF	1..123	2 * number of registers	0x0000 to 0xFFFF

RESPONSE:

FUNCTION CODE	START ADDRESS OF THE REGISTERS	NUMBER OF REGISTERS
1 byte	2 bytes	2 bytes
0x10	0x0000 to 0xFFFF	1..123

EXCEPTION RESPONSE:

EXCEPTION FUNCTION CODE	EXCEPTION CODE
1 byte	1 byte
0x90	01 or 02 oder 03 or 04

6. INSTALLATION

DANGER

DANGER DURING INSTALLATION

Danger of injury/danger of damaging the device or system. Adhere to all safety stipulations in the chapter "Safety".
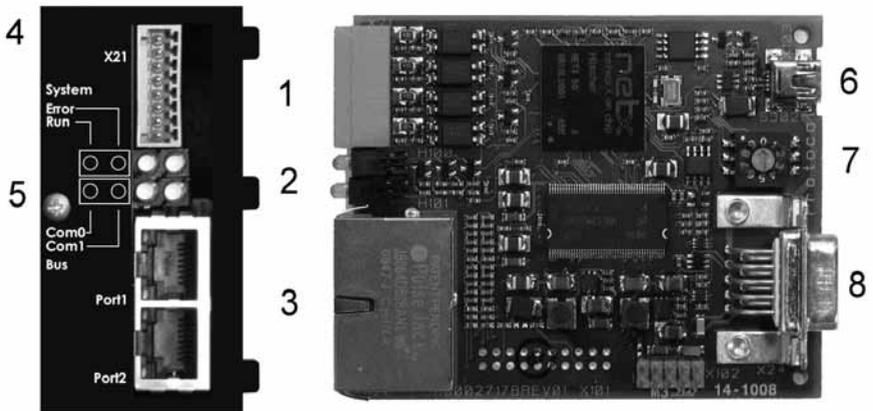
1 Terminal X21 digital inputs	5 Fastening screw
2 System and Bus LEDs	6 USB (Softwareupdate)
3 Ethernet Port 1 & 2	7 Switch "Protocol"
4 Front cover	8 Connection to Thyro-P (SSC, 5V)

FIG. 1 HARDWARE STRUCTURE

6.1 SETTING THE PROTOCOL

The Ethernet plug-in card supports various real time Ethernet bus systems. The desired system can be selected using the rotary switch "Protocol". For Modbus TCP this needs to be set to 1.

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 Thyro-P Ethernet plug-in card Modbus TCP is connected by a 9 pole SUB-D connector X24 to the Thyro-P. The plug-in card is inserted into the front side of the Thyro-P controlling device and is ready to operate immediately following parameterization of the bus system.

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

6.3 CONNECTING THE ETHERNET PLUG-IN 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 crossover cable is required.

7. CONFIGURATION

7.1 DIGITAL INPUTS

The Ethernet plug-in card makes available three digital inputs as well as an input for activating local operation (see chapter 7) via the 8 pole terminal (X21). The status of the inputs can be requested using the "digital inputs" parameter.

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	+24 V/internal 24 V supply
7	M24	ground/internal 24 V supply
8	earth	earth

TAB. 1 TERMINAL CONFIGURATION X21

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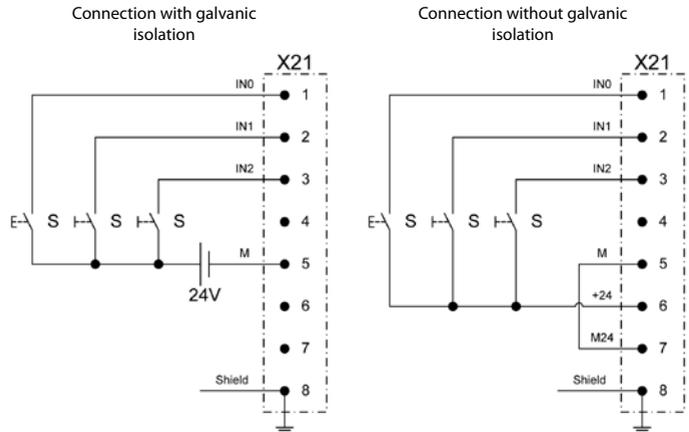

FIG. 2 EXAMPLE FOR INPUT CONNECTIONS

7.2 SETTING THE IP ADDRESS

The IP address of Thyro-P/Thyro-P MC can be set via a DHCP server. The IP address is stored in the device as nonvolatile. In Power-On mode the device waits for the IP address to be allocated from a DHCP server. If a DHCP server is not found within 136 seconds, the device starts up with the saved address (see status LED displays).

7.3 STATUS LED DISPLAYS

For the analysis of faults there are several LEDs on the plug-in card. They provide a picture of the status of the application and the bus system.
The two module status LEDs indicate if the device is supplied with current and if it is functioning properly.
The two-tone (green/red) network status LED displays the status of the communication connection.
In the start up phase the red module status (MS) LED flickers briefly – roughly for one second.

OPERATING STATUS

LED		COLOR	STATUS	MEANING
Module Status MS	Run	Green	On	Operating system is running
			Off	Power Off, exeption (see MS red)
	Error	Red	Flashing at 5 Hz	Hardware error
			Flashing at 1 Hz	Exception Boot up process
			On	Waiting for boot up process (check switch setting "protocol")
			Off	No exception
Network Status NS		Green	Off	Power Off
			Flashing at 1 Hz	IP address not configured
			Flashing at 5 Hz	IP address configured, no data exchange
			On	The device is exchanging data with the controller
		Red	Flashing	Timeout of the connection
			Off	No exception

The status of the Ethernet communication is displayed by the LEDs integrated into the RJ 45:

STATUS LED OF ETHERNET PORTS 1 AND 2

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

8. REGISTER

Each controller has its own address range:
• Thyro-P has the address range 0x0000 to 0x0999
• Thyro-P MC Channel 1 has the address range 0x1000 to 0x1999
• Thyro-P MC Channel 2 has the address range 0x2000 to 0x2999
• Thyro-P MC Channel 3 has the address range 0x3000 to 0x3999
The start up parameters are only present once and have a separate
address range:
0x4000 to 0x4005.
The parameters are collated in the following groups and as such can be
read or written individually or together. Accessing address ranges outside
of the groups invokes the exception „Illegal Data Address".

GROUPS:

NAME	OFFSET ADRESSBEREICH
Setpoint values	0x000 to 0x01F
Actual values	0x020 to 0x0FF
Operating parameters	0x100 to 0x13F
Times	0x140 to 0x17F
Control	0x180 to 0x1BF
Limitation	0x1C0 to 0x1FF
Control characteristics	0x200 to 0x23F
Temperature	0x240 to 0x27F
Analog outputs	0x280 to 0x2BF
Hardware parameters	0x2C0 to 0x2FF
Monitoring	0x300 to 0x33F
LED and Relays	0x340 to 0x37F
Other	0x380 to 0x3BF

NAME	ADDRESS RANGE
Startup parameters	0x4000 to 0x4005

8.1 SET POINTS

TAB. 8.1-1 REGISTER: SET POINTS

ATTR ID	PARAMETER NAME	NAME	DATA TYPE	SIZE (BYTE)	VALUE RANGE	UNIT/ MEANING	R/W	DEF- AULT
0	Setpoint master	AD_SW_MASTER	UINT	2		16363 == 100[%]	r/w	0
1	Setpoint master error	AD_SW_MASTER_ERROR	UINT	2		16363 == 100[%]	r/w	0
2	Setpoint master float	AD_SW_MASTER_FLOAT	REAL	4		[A,V,W,%]	r/w	0
4	Setpoint master error float	AD_SW_MASTER_ ERROR_FLOAT	REAL	4		[A,V,W,%]	r/w	0
6	Function	AD_FUNCTION	WORD 16	2	0..65535	bitstring	r/w	0

TAB. 8.1-2 FUNCTION

BIT	STATIC FUNCTIONS
0	Control lock
1	Ext. fault indication
...	

BIT	RISING EDGE CONTROLLED
8	Acknowledge error
9	Reset
10	Save
11	Reset Energie Indication
...	

8.2 ACTUAL VALUES

TAB. 8.2-1 REGISTER: ACTUAL VALUES

ATTR ID	NAME	SYMBOL	DATA TYPE	SIZE (BYTE)	VALUE RANGE	UNIT/ MEANING	R/W
20	Power L1	AD_IW_P_EFF_LSB_H_1	REAL	4	Power L1	W	r
22	Load voltage L1	AD_IW_U_EFF_LSB_1	REAL	4	Load voltage L1	V	r
24	Current L1	AD_IW_I_EFF_LSB_1	REAL	4	Current L1	A	r
26	Conductance L1	AD_IW_G_IST_L1	REAL	4	Conductance L1	S	r
28	Supply voltage L1	AD_SW_PUE_L1	UINT	2	Supply voltage L1	V	r
29	Load temperature L1	AD_IW_TEMP_LAST_1	UINT	2	Load temperature L1	°C	r
2A	Power L2	AD_IW_P_EFF_LSB_H_2	REAL	4	Power L2	W	r
2C	Load voltage L2	AD_IW_U_EFF_LSB_2	REAL	4	Load voltage L2	V	r
2E	Current L2	AD_IW_I_EFF_LSB_2	REAL	4	Current L2	A	r
30	Conductance L2	AD_IW_G_IST_L2	REAL	4	Conductance L2	S	r
32	Supply voltage L2	AD_SW_PUE_L2	UINT	2	Supply voltage L2	V	r
33	Load temperature L2	AD_IW_TEMP_LAST_2	UINT	2	Load temperature L2	°C	r
34	Power L3	AD_IW_P_EFF_LSB_H_3	REAL	4	Power L3	W	r
36	Load voltage L3	AD_IW_U_EFF_LSB_3	REAL	4	Load voltage L3	V	r
38	Current L3	AD_IW_I_EFF_LSB_3	REAL	4	Current L3	A	r
3A	Conductance L3	AD_IW_G_IST_L3	REAL	4	Conductance L3	S	r
3C	Supply voltage L3	AD_SW_PUE_L3	UINT	2	Supply voltage L3	V	r
3D	Load temperature L3	AD_IW_TEMP_LAST_3	UINT	2	Load temperature L3	°C	r
3E	Total power	AD_IW_P_EFF_LSB_H_GES	REAL	4	Total power	W	r
40	Temperature	AD_IW_TEMP	REAL	4	Temperature	°C	r
42	Total setpoint float	AD_SW_SUMME_FLOAT	REAL	4	Total setpoint float	[A,V, W,%]	r
44	Setpoint motorpoti float	AD_SW_MOPO_FLOAT	REAL	4	Setpoint motorpoti float	[A,V, W,%]	r
46	Total setpoint	AD_SW_SUMME	UINT	2	Total setpoint	%	r
47	Setpoint motorpoti	AD_SW_MOPO	UINT	2	Setpoint motorpoti	%	r
48	Setpoint terminal 10	AD_SW_REGLER	UINT	2	Setpoint terminal 10	%	r
49	Setpoint terminal 11	AD_SW_POTI	UINT	2	Setpoint terminal 11	%	r
4A	On-angle alpha	AD_IW_ALPHA	UINT	2	On-angle alpha	°el	r
4B	On-time value	AD_IW_TS	UINT	2	On-time value	period	r
4C	Periodic time	AD_IW_FREQUENZ	UINT	2	Periodic time	µs	r
4D	LED & relays state	AD_P_LED_REL_CURRENT	WORD	2	LED & relays state	bitstring	r
4E	Digital input	AD_DIGITAL_IN	WORD	2	Digital input	bitstring	r
4F	Status	AD_IW_STOER	WORD	2	Status	see Tab. 7.2-2	r
50	Operating hour	AD_IW_BETRIEBSSTD_H	REAL	4	Operating hour	h	r
52	Energy	AD_IW_ARBEIT_WORT_3	REAL	4	Energy	Ws	r

TAB. 8.2-2 LED & RELAYS STATE

BIT	STATUS
0	LED Control
1	LED Limit
2	LED Pulse lock
3	LED Fault
4	LED Overheat
5	Relais K1
6	Relais K2
7	Relais K3

TAB. 8.2-3 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)

TAB. 8.2-2 STATUS

BIT	STATUS MESSAGES
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

8.3 OPERATING PARAMETERS

TAB. 8.3-1 REGISTER: OPERATING PARAMETERS

ATTR ID	NAME	SYMBOL	DATA TYPE	SIZE (BYTE)	VALUE RANGE	UNIT/ MEANING	R/W	DEFAULT
100	Operating mode	AD_P_BETR	UINT	2	0..2	TAKT VAR SSSD	r/w	0 (TAKT)
101	Op. of molybdenum silicide rods	AD_P_MOSI	UINT	2	0..2	Off Ramp Stell	r/w	0 (Off)
102	Service mode	AD_P_SEB	UINT	2	0..1	Off, On	r/w	0 (Off)
103	ASM	AD_P_ASM	UINT	2	0..1	Off, On	r	0 (Off)
104	ASM total current	AD_P_ASM_I_SUMME	UINT	2	1...65535	A	r/w	65000A
105	ASM threshold	AD_P_ASM_SCHWELLE	UINT	2	1..65535		r/w	200
106	ASM tolerance	AD_P_ASM_TOLERANZ	UINT	2	1..65535		r/w	100
107	ASM time constant	AD_P_ASM_SCHNEL-LER_MITTELWERT	UINT	2	1..65535		r/w	100
108	ASM delay	AD_P_ASM_WARTEZEIT	UINT	2	1..65535		r/w	1
109	Number of controlled phases	AD_P_TYP	UINT	2	1..3		r/w	1 Phase
10A	Directly earthed conductor	AD_P_NULLLEITER	UINT	2	0..1	Off,On	r/w	0 (Off)
10B	Re-ignitions	AD_P_NACHIMPULS	UINT	2	0..1	Off,On	r/w	0 (Off)
10C	Phase shift	PHASENSCHWENK_syn-chron	UINT	2	0..1	Off,On	r/w	0 (Off)
10D	Phase shift polarity	AD_P_POL_PHASEN-SCHW	UINT	2	0..1	Plus Minus		0 (Plus)
10E	Phase shift L1	AD_P_SCHW_L1	UINT	2	0...360°el	0.01 °el	r/w	0°el
10F	Phase shift L2	AD_P_SCHW_L2	UINT	2	0...360°el	0.01 °el	r/w	0°el
110	Phase shift L3	AD_P_SCHW_L3	UINT	2	0...360°el	0.01 °el	r/w	0°el
111	Number of sync voltages	AD_P_TYP_SYNC	UINT	2	1..3		r/w	1
112	Rotating field	AD_P_SYNC_RICHTUNG	UINT	2	0..1	Right Left	r/w	0 (Right)
113	Canal-separation	AD_P_KANALTRENNUNG	UINT	2	0..1	Off,On	r/w	1 (On)

8.4 TIMES

TAB. 8.4-1 REGISTER: TIMES

ATTR ID	NAME	SYMBOL	DATA TYPE	SIZE (BYTE)	VALUE RANGE	UNIT	R/W	DEF-AULT
140	Phase angle of the 1st half-wave	AD_P_AN1	UINT	2	0..180 °el	0.01 °el	r/w	60°el
141	Soft-start time (setting)	AD_P_SST	UINT	2	0..9980ms	20 ms	r/w	300ms
142	Soft-down time (setting)	AD_P_SDN	UINT	2	0..9980ms	20 ms	r/w	300ms
143	Cycle period	AD_P_T0TI	UINT	2	1..1310s	20 ms	r/w	1s
144	Max. cycle period	AD_P_T0MA	UINT	2	1..1310s	20 ms	r/w	5s
145	Limits the max. operating duration	AD_P_TSMA	UINT	2	0..1310s	20 ms	r/w	1s
146	Minimum cycle on-time	AD_P_TSMI	UINT	2	0..1310s	20 ms	r/w	0 ms
147	Minimum pause	AD_P_MP	UINT	2	0..200ms	20 ms	r/w	60ms
148	Synchronous cycle	AD_P_SYNC_EXT	UINT	2	0..1	Internal External	r/w	0 (Internal)
149	Synchronous cycle address	AD_P_SYNC_ADR	UINT	2	0..655350ms	10 ms	r/w	0

8.5 REGULATION

TAB. 8.5-1 REGISTER: REGULATION

ATTR ID	NAME	SYMBOL	DATA TYPE	SIZE (BYTE)	VALUE RANGE	UNIT	R/W	DEF-AULT
180	Regulation	AD_P_REGELUNG	UINT	2	0..8		r/w	0
181	Standard regulator	AD_P_STD_RE	UINT	2	0..1	Off,On	r/w	1(On)
182	PID-regulator, I-part	AD_P_TI_1	UINT	2	0..65535		r/w	800
183	PID-regulator, P-part, denominator	AD_P_KP_1	UINT	2	1..65535		r/w	160
184	PID-regulator, P-part, numerator	AD_P_KR_1	UINT	2	0..65535		r/w	1
185	PID-regulator, D-part	AD_P_TD_1	UINT	2	0..65535		r/w	0
186	PID-regulator, I-part, default value	AD_P_TI_1_STD	UINT	2	0..65535		r	800

ATTR ID	NAME	SYMBOL	DATA TYPE	SIZE (BYTE)	VALUE RANGE	UNIT	R/W	DEF- AULT
187	PID-regulator, P-part, default value	AD_P_KP_1_STD	UINT	2	0..65535		r	160
188	PID-regulator, counter P-part, default value	AD_P_KR_1_STD	UINT	2	0..65535		r	1
189	PID-regulator, D-part, default value	AD_P_TD_1_STD	UINT	2	0..65535		r	0
18A	Limit PID-regulator, I-part	AD_P_TI_3	UINT	2	0..65535		r/w	800
18B	Limit PID-regulator, P-part	AD_P_KP_3	UINT	2	1..65535		r/w	160
18C	Limit PID-regulator, counter P-part	AD_P_KR_3	UINT	2	0..65535		r/w	1
18D	Limit PID-regulator, D-part	AD_P_TD_3	UINT	2	0..65535		r/w	0
18E	Limit PID-regulator, I-part, default value	AD_P_TI_3_STD	UINT	2	0..65535		r/w	800
18F	Limit PID-regulator, P-part, default value	AD_P_KP_3_STD	UINT	2	0..65535		r/w	160
190	Limit PID-regulator, counter P-part, default value	AD_P_KR_3_STD	UINT	2	0..65535		r/w	1
191	Limit PID-regulator, D-part, default value	AD_P_TD_3_STD	UINT	2	0..65535		r/w	0
192	Rate of angular displacement 1	AD_P_MOSI_PHASE_1_DELTA_ALPHA	UINT	2	0..65535		r/w	1100
193	Rate of angular displacement 2	AD_P_MOSI_PHASE_2_DELTA_ALPHA	UINT	2	0..65535		r/w	50

8.6 LIMITATION

TAB. 8.6-1 REGISTER: LIMITATION

ATTR ID	NAME	SYMBOL	DATA TYPE	SIZE (BYTE)	VALUE RANGE	UNIT	R/W	DEFAULT
1C0	Minimum r.m.s. voltage setpoint	AD_P_UEMI	UINT	2	0..65535	V	r/w	0V
1C1	Maximum r.m.s. voltage setpoint	AD_P_UEMA	UINT	2	0..65535	V	r/w	440V
1C2	Minimum r.m.s. current setpoint	AD_P_IEMI	UINT	2	0..65535	A	r/w	0A
1C3	Maximum r.m.s. current setpoint	AD_P_IEMA	UINT	2	0..65535	A	r/w	110A
1C4	Minimum power setpoint	AD_P_PMI_H	UDINT	4	0..	W	r/w	0W
1C6	Maximum power setpoint	AD_P_P_MA_H	UDINT	4	0..	W	r/w	48400W
1C8	Front pulse limit position	AD_P_VIE	UINT	2	0..180°el	0.01°el	r/w	180°el
1C9	Back pulse limit position	AD_P_HIE	UINT	2	0..180°el	0.01°el	r/w	0°el

8.7 CONTROL CHARACTERISTICS

TAB. 8.7-1 REGISTER: CONTROL CHARACTERISTICS

ATTR ID	NAME	SYMBOL	DATA TYPE	SIZE (BYTE)	VALUE RANGE	UNIT	R/W	DEFAULT
200	Setpoint activation	AD_P_SW_ENABLE	UINT	2	0..15		r/w	15
201	Setpoint linking	AD_P_SW	UINT	2	0..3	_ADD, IADD, _PRO, IPRO	r/w	0
202	Factor peak current limitation	AD_P_MOSI_FA	UINT	2	0..50		r/w	25
203	Setpoint jump correction	AD_P_SW_SPRUNG	UINT	2	0..1	Off, On	r/w	1 (On)
204	Input voltage/current terminal 10	AD_P_SW_10	UINT	2	0..2	5V, 10V, 20mA	r/w	2 (20mA)
205	Control start regulator input terminal 10	AD_P_STA_RE	UINT	2	0..20480		r/w	240
206	Control end regulator input terminal 10	AD_P_STE_RE	UINT	2	0..20480		r/w	16383
207	Input voltage/current terminal 11	AD_P_SW_11	UINT	2	0..2	5V, 10V, 20mA	r/w	0 (5V)
208	Control start regulator input terminal 11	AD_P_STA_PO	UINT	2	0..20480		r/w	240
209	Control end regulator input terminal 11	AD_P_STE_PO	UINT	2	0..20480		r/w	16383
20A	Control start master	AD_P_STA_MASTER	UINT	2	0..16383		r/w	0
20B	Control end master	AD_P_STE_MASTER	UINT	2	0..16383		r/w	16383
20C	Control start motor potentiometer	AD_P_STA_MOPO	UINT	2	0..16383		r/w	0
20D	Control end motor potentiometer	AD_P_STE_MOPO	UINT	2	0..16383		r/w	16383

TAB. 8.7-2 SETPOINT ACTIVATION

BIT	ACTIV SETPOINT
0	Setpoint terminal 10
1	Setpoint terminal 11
2	Setpoint master
3	Setpoint motor potentiometer

8.8 TEMPERATURE

TAB. 8.8-1 REGISTER: TEMPERATURE

ATTR ID	NAME	SYMBOL	DATA TYPE	SIZE (BYTE)	VALUE RANGE	UNIT	R/W	DEFAULT
240	Temperature sensor	AD_P_TEMP	UINT	2	0..3	None PT100 PT1000 NTC	r/w	0 (None)
241	Characteristic number	AD_P_TEMP_KVE	UINT	2	0..7		r/w	1
242	Level wire breakage	AD_P_FU_DR_BR	UINT	2	0..4000		r/w	2000
243	Level short circuit	AD_P_FU_KURZ	UINT	2	0..4000		r/w	800
244	Temperature error duration	AD_P_TEMP_ FEHLERDAUER	UINT	2	1..1000	20 ms	r/w	200ms
245	Coefficient 5	AD_P_A5_H	REAL	4	0..65535		r/w	1
247	Coefficient 4	AD_P_A4_H	REAL	4	0..65535		r/w	1
249	Coefficient 3	AD_P_A3_H	REAL	4	0..65535		r/w	1
24B	Coefficient 2	AD_P_A2_H	REAL	4	0..65535		r/w	1
24D	Coefficient 1	AD_P_A1_H	REAL	4	0..65535		r/w	1
24F	Coefficient 0	AD_P_A0_H	REAL	4	0..65535		r/w	1
251	Load transformer ratio	AD_P_R_KORR_H	REAL	4	0..65535		r/w	

8.9 ANALOG OUTPUTS

TAB. 8.8-1 REGISTER: ANALOG OUTPUTS

ATTR ID	NAME	SYMBOL	DATA TYPE	SIZE (BYTE)	VALUE RANGE	UNIT	R/W	DEFAULT
280	Actual value output 1	AD_P_IST_1	UINT	2	0,1	20mA, 10 V	r/w	20 mA
281	Offset 1	AD_P_OF_1	UINT	2	0..20000 uA	uA	r/w	4000uA
282	Measuring instrument full-scale deflection DAC1, voltage	AD_P_DAC1_VA_U	UINT	2	0..10000 mV	mV	r/w	10000mV
283	Measuring instrument full-scale deflection DAC1, current	AD_P_DAC1_VA_I	UINT	2	0..20000 mA	mA	r/w	20000mA

ATTR ID	NAME	SYMBOL	DATA TYPE	SIZE (BYTE)	VALUE RANGE	UNIT	R/W	DEFAULT
284	Configuration register analog output 1	AD_P_DAC_1_CTRL	WORD	2	bitweise		r/w	26
285	Scale end value voltage actual value output 1	AD_P_U_FA_1	UINT	2	0..65535 V	V	r/w	500V
286	Scale end value current actual value output 1	AD_P_I_FA_1	UINT	2	0..65535 A	A	r/w	150A
287	Scale end value power actual value output 1	AD_P_P_FA_1_H	UDINT	4	0.. W	W	r/w	50000W
289	Scale end value alpha actual value output 1	AD_P_A_FA_1	UINT	2	0..180°el	0.01°el	r/w	180°el
28A	Scale start value temperature actual value output 1	AD_P_T_OF_1	UINT	2	0..65535 °C	°C	r/w	0°C
28B	Scale end value temperature actual value output 1	AD_P_T_FA_1	UINT	2	0..65535 °C	°C	r/w	1000°C
28C	Actual value output 2	AD_P_IST_2	UINT	2	0,1	20mA, 10 V	r/w	20mA
28D	Offset 2	AD_P_OF_2	UINT	2	0..20000 uA	uA	r/w	4000uA
28E	Measuring instrument full-scale deflection DAC2, voltage	AD_P_DAC2_VA_U	UINT	2	0..10000 mV	mV	r/w	10000mV
28F	Measuring instrument full-scale deflection DAC2, current	AD_P_DAC2_VA_I	UINT	2	0..20000 mA	mA	r/w	20000mA
290	Configuration register analog output 2	AD_P_DAC_2_CTRL	WORD	2	bitweise		r/w	26
291	Scale end value voltage actual value output 2	AD_P_U_FA_2	UINT	2	0..65535 V	V	r/w	500V
292	Scale end value current actual value output 2	AD_P_I_FA_2	UINT	2	0..65535 A	A	r/w	150A
293	Scale end value power actual value output 2	AD_P_P_FA_2_H	UDINT	UDIN4T	0.. W	W	r/w	50000W
295	Scale end value alpha actual value output 2	AD_P_A_FA_2	UINT	2	0..180°el	0.01°el	r/w	180°el
296	Scale start value temperature actual value output 2	AD_P_T_OF_2	UINT	2	0..65535 °C	°C	r/w	0°C
297	Scale end value temperature actual value output 2	AD_P_T_FA_2	UINT	2	0..65535 °C	°C	r/w	1000°C
298	Actual value output 3	AD_P_IST_3	UINT	2	0..1	20mA, 10V	r/w	20mA
299	Offset 3	AD_P_OF_3	UINT	2	0..20000 uA	uA	r/w	4000uA
29A	Measuring instrument full-scale deflection DAC3, voltage	AD_P_DAC3_VA_U	UINT	2	0..10000 mV	mV	r/w	10000mV
29B	Measuring instrument full-scale deflection DAC3, current	AD_P_DAC3_VA_I	UINT	UINT	0..20000 mA	mA	r/w	20000mA

ATTR ID	NAME	SYMBOL	DATA TYPE	SIZE (BYTE)	VALUE RANGE	UNIT	R/W	DEFAULT
29C	Configuration register analog output 3	AD_P_DAC_3_CTRL	WORD	2	bitweise		r/w	26
29D	Scale end value voltage actual value output 3	AD_P_U_FA_3	UINT	2	0..65535 V	V	r/w	500V
29E	Scale end value current actual value output 3	AD_P_I_FA_3	UINT	2	0..65535 A	A	r/w	150A
29F	Scale end value power actual value output 3	AD_P_P_FA_3_H	UDINT	4	0.. W	W	r/w	50000W
2A1	Scale end value alpha actual value output 3	AD_P_A_FA_3	UINT	2	0..180°el	0.01°el	r/w	180°el
2A2	Scale start value temperature actual value output 3	AD_P_T_OF_3	UINT	2	0..65535 ℃	℃	r/w	0℃
2A3	Scale end value temperature actual value output 3	AD_P_T_FA_3	UINT	2	0..65535 ℃	℃	r/w	1000℃
2A4	Averaging	AD_P_DAC_ MITTELWERT	UINT	2	0..1000		r/w	25

8.10 HARDWARE PARAMETERS

TAB. 8.10-1 REGISTER: HARDWARE PARAMETERS

ATTR ID	NAME	SYMBOL	DATA TYPE	SIZE (BYTE)	VALUE RANGE	UNIT	R/W	DEFAULT
2C0	Power controller rated current	AD_P_I_TYP	UINT	2	0...65535 A	A	r	110A
2C1	Rated current in LSB	AD_P_I_TYP_LSB	UINT	2	0...65535		r	3500
2C2	Current converter ratio	AD_P_UE_I	UINT	2	0...65535		r	100
2C3	Load resistor current	AD_P_RB_I	UINT	2	0...653 Ohm	0.01 Ohm	r	0,91 Ohm
2C4	Scaling factor current	AD_P_NORM_I	UINT	2	0...65535		r	845
2C5	Current value threshold	AD_P_I_SCHW	UINT	2	0...65535		r/w	65535
2C6	Power controller connection voltage	AD_P_U_TYP	UINT	2	0..1000 V	V	r	400V
2C9	Rated voltage in LSB	AD_P_U_TYP_LSB	UINT	2	0...65535		r	3800
2C7	Mains voltage user	AD_P_U_NETZ	UINT	2	0..1000 V	V	r	400V
2C8	Voltage converter ratio	AD_P_UE_U	UINT	2	0..1000		r	16
2CA	Voltage range changeover	AD_P_U_TYP_BE-REICH	UINT	2	0..2	230V, 400V, 500V-690V	r	1 (400V)
2CB	Load resistor voltage	AD_P_RB_U	UINT	2	0...65535 Ohm	Ohm	r	2000 Ohm
2CC	Load resistor voltage range 1	AD_P_RB_U_BER_1	UINT	2	0...65535 Ohm	Ohm	r	1111 Ohm
2CD	Load resistor voltage range 2	AD_P_RB_U_BER_2	UINT	2	0...65535 Ohm	Ohm	r	667 Ohm
2CE	Scaling factor 230V	AD_P_FNORM_U_230	UINT	2	0...65535		r	1279
2CF	Scaling factor 400V	AD_P_FNORM_U_400	UINT	2	0...65535		r	1324
2D0	Scaling factor 500V-690V	AD_P_FNORM_U_690	UINT	2	0...65535		r	1344
2D1	Min. frequency	AD_P_FREQUENZ_MIN	UINT	2	14286..25000 1/X * 10^6	Hz	r/w	22222
2D2	Max. frequency	AD_P_FREQUENZ_MAX	UINT	2	14286..25000 1/X * 10^6	Hz	r/w	15151

ATTR ID	NAME	SYMBOL	DATA TYPE	SIZE (BYTE)	VALUE RANGE	UNIT	R/W	DEFAULT
2D3	Frequency tolerance	AD_P_FREQUENZ_TOL	UINT	2	0..100	%	r/w	10%
2D4	Power controller rated power	AD_P_P_TYP_H	UDINT	4	0…	W	r	44000
2D6	Rated power in LSB	AD_P_P_TYP_LSB_H	UDINT	4	0..		r	15360544
2D8	Potentiometer regulator parameter Ti	AD_P_TI_FA	UINT	2	0...65535		r/w	0
2D9	Potentiometer regulator parameter Kp	AD_P_KP_FA	UINT	2	0...65535		r/w	0
2DA	Voltage divider resistor	AD_P_R_TEIL	UINT	2	0...65535	Ohm	r	32400 Ohm
2DB	Meter circuit	AD_P_MESSUNG	UINT	2	0..5	Aron, 1/2 Aron 1, 1/2 Aron 2, 1/2 Aron 3, Asymmetrical load, Symmetrical load;	r	0 (Aron)
2DC	DAC Multilexer	AD_P_DAC_MUX	UINT	2	0...65535		r/w	0
2DD	DAC Measuring MUX 1	AD_P_MESSDATEN_MUX_1	UINT	2	0...65535		r/w	291
2DE	DAC Measuring MUX 2	AD_P_MESSDATEN_MUX_2	UINT	2	0...65535		r/w	1383
2DF	DAC Measuring MUX 3	AD_P_MESSDATEN_MUX_3	UINT	2	0...65535		r/w	2475

8.11 MONITORING

TAB. 8.11-1 REGISTER: MONITORING

ATTR ID	NAME	SYMBOL	DATA TYPE	SIZE (BYTE)	VALUE RANGE	UNIT	R/W	DEFAULT
300	Mains voltage monitoring minimum	AD_P_SPG_MIN	UINT	2	0..1000 V	V	r/w	180V
301	Mains voltage monitoring maximum	AD_P_SPG_MAX	UINT	2	0..1000 V	V	r/w	480V
302	Undercurrent monitoring	AD_P_UN_S	UINT	2	0..1	Off,On	r/w	0 (Off)
303	Overcurrent monitoring	AD_P_UE_S	UINT	2	0..1	Off,On	r/w	0 (Off)
304	Load break	AD_P_REL_ABS	UINT	2	0..1	REL ABS	r/w	0 (REL)
305	Undercurrent monitoring value	AD_P_LASTBRUCH_MIN	UINT	2	0..99 %	%	r/w	0
306	Overcurrent monitoring value	AD_P_LASTBRUCH_MAX	UINT	2	0..255 %	%	r/w	0
307	Undercurrent monitoring value	AD_P_LASTBRUCH_MIN_ABS	UINT	2	0..65535		r/w	0
308	Overcurrent monitoring value	AD_P_LASTBRUCH_MAX_ABS	UINT	2	0..65535		r/w	0
309	Monitoring L2 enable	AD_P_UEBERWA-CHUNG_L2_ENA	UINT	2	0..1	Off,On	r/w	0 (Off)
30A	Monitoring L3 enable	AD_P_UEBERWA-CHUNG_L3_ENA	UINT	2	0..1	Off,On	r/w	0 (Off)

8.12 LED AND RELAYS

TAB. 8.12-1 REGISTER: LED AND RELAYS

ATTR ID	NAME	SYMBOL	DATA TYPE	SIZE (BYTE)	VALUE RANGE	R/W	DEFAULT
340	LED & Relays work principle	AD_P_K1RU	UINT	2	0..255	r/w	224
341	LED CONTROL mode	AD_P_OUT0_CFG_UIO	UINT	2	0..65535	r/w	4096
342	LED LIMIT mode	AD_P_OUT1_CFG_UIO	UINT	2	0..65535	r/w	0
343	LED PULSE LOCK mode	AD_P_OUT2_CFG_UIO	UINT	2	0..65535	r/w	0
344	LED FAULT mode	AD_P_OUT3_CFG_UIO	UINT	2	0..65535	r/w	1792
345	LED OVERHEAT mode	AD_P_OUT4_CFG_UIO	UINT	2	0..65535	r/w	0
346	Relay K1 mode	AD_P_OUT5_CFG_UIO	UINT	2	0..65535	r/w	1792
347	Relay K2 mode	AD_P_OUT6_CFG_UIO	UINT	2	0..65535	r/w	768
348	Relay K3 mode	AD_P_OUT7_CFG_UIO	UINT	2	0..65535	r/w	59392
349	LED CONTROL config 0	AD_P_OUT0_STOER-MASK_LOW_UIO	UINT	2	0..65535	r/w	0
34A	LED LIMIT config 0	AD_P_OUT1_STOER-MASK_LOW_UIO	UINT	2	0..65535	r/w	2048
34B	LED PULSE LOCK config 0	AD_P_OUT2_STOER-MASK_LOW_UIO	UINT	2	0..65535	r/w	256
34C	LED FAULT config 0	AD_P_OUT3_STOER-MASK_LOW_UIO	UINT	2	0..65535	r/w	0
34D	LED OVERHEAT config 0	AD_P_OUT4_STOER-MASK_LOW_UIO	UINT	2	0..65535	r/w	0
34E	Relay K1 config 0	AD_P_OUT5_STOER-MASK_LOW_UIO	UINT	2	0..65535	r/w	0
34F	Relay K2 config 0	AD_P_OUT6_STOER-MASK_LOW_UIO	UINT	2	0..65535	r/w	2048
350	Relay K3 config 0	AD_P_OUT7_STOER-MASK_LOW_UIO	UINT	2	0..65535	r/w	1

ATTR ID	NAME	SYMBOL	DATA TYPE	SIZE (BYTE)	VALUE RANGE	R/W	DEFAULT
351	LED CONTROL config 1	AD_P_OUT0_STOER-MASK_HIGH_UIO	UINT	2	0..65535	r/w	0
352	LED LIMIT config 1	AD_P_OUT1_STOER-MASK_HIGH_UIO	UINT	2	0..65535	r/w	0
353	LED PULSE LOCK config 1	AD_P_OUT2_STOER-MASK_HIGH_UIO	UINT	2	0..65535	r/w	0
354	LED FAULT config 1	AD_P_OUT3_STOER-MASK_HIGH_UIO	UINT	2	0..65535	r/w	256
355	LED OVERHEAT config 1	AD_P_OUT4_STOER-MASK_HIGH_UIO	UINT	2	0..65535	r/w	0
356	Relay K1 config 1	AD_P_OUT5_STOER-MASK_HIGH_UIO	UINT	2	0..65535	r/w	256
367	Relay K2 config 1	AD_P_OUT6_STOER-MASK_HIGH_UIO	UINT	2	0..65535	r/w	0
358	Relay K3 config 1	AD_P_OUT7_STOER-MASK_HIGH_UIO	UINT	2	0..65535	r/w	0

8.13 OTHER

TAB. 8.13-1 REGISTER: OTHER

ATTR ID	NAME	SYMBOL	DATA TYPE	SIZE (BYTE)	VALUE RANGE	R/W	DEFAULT
380	Data logger register	AD_P_DAT_LOG_ENABLE_H1	UDINT	4	0..65535	r/w	0
382	Reset trigger on error register	AD_P_RESET_H1	UDINT	4	0..65535	r/w	31
384	Pulse switch-off on error register	AD_P_IMAB_H1	UDINT	4	0..65535	r/w	0
386	Version year	AD_VERS_JJJJ	UINT	2	0..65535	r	2004
387	Version month	AD_VERS_MM	UINT	2	1..12	r	9
388	Version day	AD_VERS_TT	UINT	2	1..31	r	3
389	Userparameter 0	AD_P_TEMP_0_0	UINT	2	0..65535	r/w	0
38A	Userparameter 1	AD_P_TEMP_0_1	UINT	2	0..65535	r/w	0
38B	Userparameter 2	AD_P_TEMP_0_2	UINT	2	0..65535	r/w	0
38C	Userparameter 3	AD_P_TEMP_0_3	UINT	2	0..65535	r/w	0
38D	Userparameter 4	AD_P_TEMP_0_4	UINT	2	0..65535	r/w	0
38E	Userparameter 5	AD_P_TEMP_0_5	UINT	2	0..65535	r/w	0
38F	Userparameter 6	AD_P_TEMP_0_6	UINT	2	0..65535	r/w	0
390	Userparameter 7	AD_P_TEMP_0_7	UINT	2	0..65535	r/w	0
391	Userparameter 8	AD_P_TEMP_0_8	UINT	2	0..65535	r/w	0
392	Userparameter 9	AD_P_TEMP_0_9	UINT	2	0..65535	r/w	0
393	Userparameter 10	AD_P_TEMP_0_10	UINT	2	0..65535	r/w	0
394	Userparameter 11	AD_P_TEMP_0_11	UINT	2	0..65535	r/w	0
395	Userparameter 12	AD_P_TEMP_0_12	UINT	2	0..65535	r/w	0
396	Userparameter 13	AD_P_TEMP_0_13	UINT	2	0..65535	r/w	0
397	Userparameter 14	AD_P_TEMP_0_14	UINT	2	0..65535	r/w	0

8.14 START PARAMETERS

TAB. 8.14-1 REGISTER: START PARAMETERS

ATTR ID	NAME	SYMBOL	DATA TYPE	SIZE (BYTE)	VALUE RANGE	R/W	DEFAULT
4000	Configuration byte	MODULE_POS_ CONFIG	UINT	2	0..7	r/w	0
4001	Average (No. of values)	MODULE_POS_ AVERAGE	UINT	2	0..20	r/w	0
4002	Selection for fast values	MODULE_POS_ FAST_VALUES	UINT	2	0..63	r/w	0
4003	Setpoint active Channel 1	MODULE_POS_ SETPOINT_AC- TIV_MC1	UINT	2	0..255	r/w	72
4004	Setpoint active Channel 2	MODULE_POS_ SETPOINT_AC- TIV_MC2	UINT	2	0..255	r/w	65
4005	Setpoint active Channel 3	MODULE_POS_ SETPOINT_AC- TIV_MC3	UINT	2	0..255	r/w	66

TAB. 8.14-2 CONFIGURATION BYTE

BIT	MEANING
0	No connection to Master setpoint =: Here the setpoint can be set which 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 activates the discounting of all output data in local opera- tion. This can be useful e.g. 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.

TAB. 8.14-3 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.

TAB. 8.14-4 SELECTION OF 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.

TAB. 8.14-5 SETPOINT ACTIVE CHANNEL 1-3

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 master potentiometer active

9. APPROVALS AND CONFORMITY

- Quality standard in accordance with EN ISO 9001
- CE conformity
- Modbus TCP conformity
- RoHS (RoHS compliant 5/6) [RoHS]

The devices of the type series Thyro-P, Modbus TCP interface card is a part hereof, comply with the currently applicable EN 50178 and EN 60146-1-1. By adhering to VDE 0106, section 100, BGV A2 (VBG4) is covered.

The CE sign attached to the device confirms compliance with the EC directives for 2066/95/EEC for low voltage and 2004/108/EEC for electro-magnetic compatibility, if the installation and commissioning instructions described within the operating instructions are followed.

Regulations and definitions for specialists are included in DIN 57105/VDE 0105 section 1.

Safe separation in accordance with VDE 0160 (EN 50178 chapter 3).

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