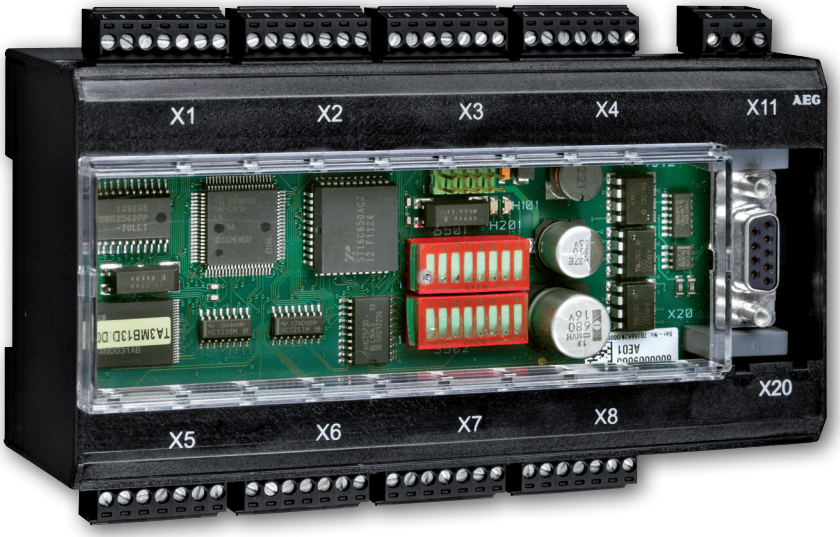
BUS MODULE MODBUS RTU

FOR THYRO-S, THYRO-A AND THYRO-AX

July 2014 DE/EN - V3



CONTACT INFORMATION

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1. INTRODUCTION

The following operating instructions merely serve as a supplement and apply only in connection with the operating instructions of the Advanced Energy power controllers Thyro-S and Thyro-A of types H1 and H RL1, as well as Thyro-A H RLP1 as well as Thyro-AX of types H RL2 and H RLP2. Particular attention must be paid to the safety instructions included in them.

1.1 GENERAL

The bus module Modbus RTU can connect up to 8 power controllers of type Thyro-A...1, Thyro-AX...2 or power switches of type Thyro-S…1 to a Modbus master in any random order.
Several bus modules can be employed at one device. Each bus module occupies one address on the Modbus.
The power supply of the bus module is provided by an external 24 V d.c. power source (150 mA), which is fed into X11.1 (+) and X11.2 (ground) (reverse battery protected). The 24 V d.c. supply must be ungrounded when operating under SELV. Several modules can be operated at one power supply.
For EMC reasons, the earth connection to X11.3 must be as short as possible.
The Modbus connector with a 9-terminal standard allocation must be connected to the socket X20.

1.2 SPECIFIC CHARACTERISTICS

- The bus module is a slave component
- Function control via LED
- 8 free digital outputs X1.5 to X8.5
- processing of actual values as float number in physical units
- C-rail assembly
- When the bus module is linked to Thyro-AX, please be aware that data transfer is the same as for Thyro-A whereas special features or other additional parameters are excluded from this.

1.3 TYPE DESIGNATION

Bus module Modbus RTU Order No. 2000 000 842

1.4 WARRANTY

In the event of any claims in connection with the Modbus RTU, please contact us immediately quoting:

- Type designation
- Works number/Serial number
- Reason for the complaint
- Environmental conditions of the device
- Operating mode
- Period of use

Goods and services are subject to the general conditions of supply for products of the electrical industry, and our general sales conditions.
Claims in connection with supplied goods must be submitted within one week of receipt, along with the delivery note. Advanced Energy will rescind all obligations such as warranty agreements, service contracts, etc. entered into by Advanced Energy or its representatives without prior notice if maintenance and repair work is carried out using anything other than original Advanced Energy spare parts or spare parts purchased fromAdvanced Energy.

2. SAFETY

2.1 IDENTIFICATION IN THE OPERATING INSTRUCTIONS

In these operating instructions, there are warnings before 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 damage to property.

CAUTION
Dangers that can lead to injuries and damage 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 GENERAL DANGER INFORMATION

DANGER
Failure to observe the safety regulations in the operating instructions for the power controllers used risk of injury or damage to the device or plant.
> Observe all safety regulations in the safety chapter of the operating instructions for the power controllers used.

DANGER
Electric current
Risk of injury from live parts/risk of damage to the bus module.
> Never operate the device without the cover.
> Only carry out adjustments or wiring when the device is deenergised.

CAUTION
Risk of damage to the bus module
The current at terminals X1.5 to X8.5 may not exceed 120 mA.
> Check the connection data of the upstream relay.

NOTE
Communication faults
To avoid communication faults, observe the following points:
> Use shielded cables.
> Ensure grounding on the bus module (X1.7 to X8.7). Do not also ground on the power controller.

2.3 OPERATOR REQUIREMENTS

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

2.4 PERSONNEL REQUIREMENTS

Only qualified electro-technical personnel who are familiar with the pertinent safety and installation regulations may perform the following:
- Transport
- Installation
- Connection
- Start-up
- 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.

2.5 INTENDED PURPOSE

The device may only be used for the pupose for which it was intended, as persons may otherwise be exposed to dangers (e.g. electric shock, burns) and plants also (e.g. overload). The user must therefore observe the following points:
- It is not permitted to make any unauthorised modifications to the unit or to use any spare parts or replacement parts not approved by Advanced Energy, or to use the unit for any other purpose.

- The warranty obligations of the manufacturer are only applicable if these operating instructions are observed and complied with.
- The device is a component that cannot function alone.
- Project planning must account for the proper use of the device.

2.6 USE OF THE DEVICE

2.6.1 OPERATION

- Only switch on the mains voltage at the machine when there is no danger to persons, system or load.
- Protect the device against dust and damp.
- Ensure that the ventilation openings are not blocked.

2.6.2 PRIOR TO INSTALLATION/START-UP

- If stored in a cold environment: ensure that the device is absolutely dry. (Allow the device a period of at least two hours to acclimatise before start-up.)
- Ensure sufficient ventilation of the cubicle if mounted in a cubicle.
- Observe minimum spacing.
- Ensure that the device cannot be heated up by heat sources below it (see chapter 10, Technical data).
- Ground the device in accordance with local regulations.
- Connect the device in accordance with the connection diagram.

2.6.3 MAINTENANCE, SERVICE, FAULTS

In order to avoid injuries and damage, the user must observe the following:

- Before all work:
  > Disconnect the device from all external voltage sources.
  > 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 neighbouring live parts.
- The device may only be serviced and repaired by trained electrotechnical personnel.

2.6.4 TRANSPORT

- Only transport the device in the original packaging.
- Protect the device against damage, caused by jolts, knocks and contamination, for instance.

3. FUNCTIONS

3.1 SETPOINT PROCESSING Thyro-S

The setpoints via the bus (setpoints master) are interpreted as an operating mode with Thyro-S as shown in table 1.

SETPOINT (setpoint master)				RETURN VALUE (total setpoint)
to	409	=	OFF	0
to	1091	=	1/5	819
to	1706	=	1/3	1365
to	3071	=	1/2	2047
to	4096	=	ON	4096

TAB. 1 INTERPRETATION OF THE MASTER SETPOINTS WITH Thyro-S

The setpoint processing continues to depend on how the bus module is connected to the power controller. For Thyro-S different variations can be realised as required. The connection of terminal X22.4 of Thyro-S controls the procedures (Chapt. 8, Fig. 4).

- No connection to X22.4
  The bus module is fully functional, only the analog signal of control terminal X22.1, however, is used as a setpoint (ON / OFF).
- X22.4 has ground potential
  Only the master setpoints are used by the bus module (graded as in table 1). The controller's terminal X22.4 can be directly connected to earth if an alternative operation is excluded.
- X22.4 is switched
  - Thyro-S's terminal X22.4 is connected to one of the terminals X1.1 to X8.1 of the bus module (Fig. 4).
    With malfunctions on the bus line an automatic switchover takes place to the corresponding signal of the setpoint input of Thyro-S.
  - Thyro-S's connection X22.4 is connected to one of the terminals X1.5 to X8.5 of the bus module (Fig. 4). The controllers can then individually be switched (selectively) via bus to „Hand".
    With malfunctions on the bus line the last setpoint is automatically retained.

• Digital outputs with free drives
If a terminal X1.5 to X8.5 of the bus module is not allocated, a relay with 24 V d.c. coil can be connected for free use (Fig. 1). The free circuit is integrated.
The driver current is maximum 120mA per output.
Ventilation cabinets, auxiliary heating, circuit breakers or control lamps for example, can be activated with this via the Modbus.

3.2 SETPOINT PROCESSING Thyro-A/Thyro-AX

The setpoint processing depends on how the bus module is connected to the power controller. For Thyro-A/Thyro-AX different variations can be realised depending on the requirements. The connection of terminal X22.1 of Thyro-A/Thyro-AX controls the procedures (Chapt. 7, Fig. 3).

• No connection to X22.1
The bus module is fully functional, however, only the analog signal of control terminal X2.4 is used as the setpoint.

• X22.1 has ground potential
Only the master setpoint is accepted by the bus module as a setpoint. The controller's terminal X22.1 can be directly connected to earth if an alternative operation is excluded.

• X22.1 is switched
  • The terminal X22.1 of Thyro-A/Thyro-AX is connected to one of the terminals X1.1 to X8.1 of the bus module (Fig. 3).
  With malfunctions on the bus line all controllers are automatically switched over to the respective analog signal of the setpoint input of Thyro-A/Thyro-AX.
  • The circuit X22.1 of Thyro-A/Thyro-AX is connected to one of the terminals X1.5 to X8.5 of the bus module (Fig.3). Then each controller can be switched individually (selectively) via bus to „Hand".
  With malfunctions on the bus line the last setpoint is automatically retained.

• Digital outputs with free drives
If a terminal X1.5 to X8.5 of the bus module is not allocated, a relay with 24 V d.c. coil can be connected for free use (Fig. 1). The free circuit is integrated.
The driver current is maximum 120 mA per output.
Ventilation cabinets, auxiliary heating, circuit breakers or control lamps, for example, can be switched via the Modbus.

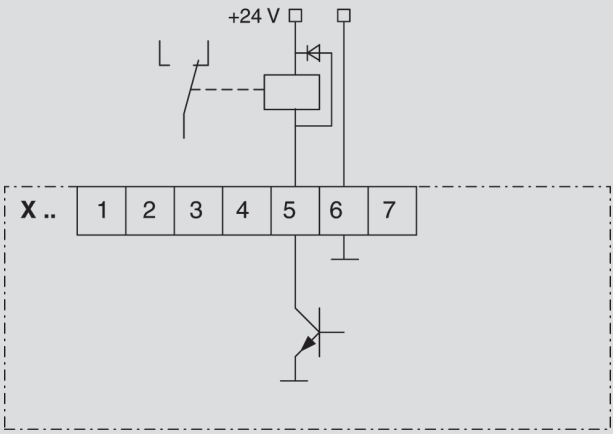


FIG. 1 RELAY DRIVE

3.3 OPERATION DISPLAY

STATUS LED	MODBUS	INDICATION
ON	–	Card error
BLINKS with 1 Hz	OFF	No bus signal present
BLINKS with 1 Hz	ACTIVE	Card error
OFF	OFF	Power supply absent (also green LED off)
OFF	ACTIVE	Everything OK

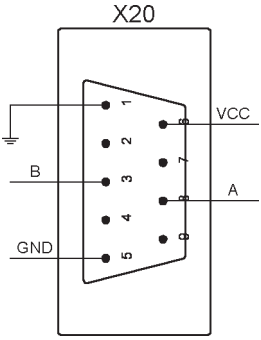
TAB. 2 STATUS DIAGNOSIS LED

3.4 ADDITIONAL FUNCTIONS FOR Thyro-S, Thyro-A AND Thyro-AX

By using a bus module, additional functions for the power controllers Thyro-S, Thyro-A and Thyro-AX can be employed.
All the accessible parameters of both type ranges can be found in columns S/A (abbreviation for Thyro-S and Thyro-A; these modifications also apply for Thyro-AX) under R/W in table 8.
The most important parameters are described in more detail in the according power controller operating instructions. Here r = read, i.e. can only be read, r/w = read and write possible.

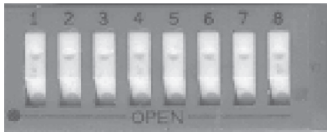
4. OPERATION

The Modbus connection is lead through a 9-pole sub-D bushing (X20). It provides the data lines A and B as well as an electrically isolated supply voltage (5 V, 80 mA).



PIN ALLOCATION OF THE MODBUS SOCKET

4.1 SELECTING THE BUS ADDRESS



1 = CLOSED

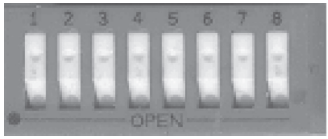
0 = OPEN

1, 2, 4, 8, 16, 32, 64, 128 S 501

A device address, which only exists once in the system, must be set in a switched-off state between 1 to 247 at the bus module via the switch S501.1 to S501.7.

4.2 SETTING THE TRANSMISSION PARAMETERS

The settings which are required for communication assimilation can be made via the DIP switch S502 (configuration switch). At the standard setting all switches are open. The following table illustrates the function of the switches. 0 represents an open switch and 1 a closed switch.



1 = CLOSED

0 = OPEN

S 502

SWITCH								FUNCTION
1	2	3	4	5	6	7	8	
0	0	0						4800 Baud
1	0	0						9600 Baud
0	1	0						19200 Baud
1	1	0						38400 Baud
0	0	1						57600 Baud
1	0	1						115200 Baud
0	1	1						230400 Baud
			1					Parity
				1				Even nOdd
					1			2 Stopp-Bit
						1		Long Break
							x	free

Baud rate: Works setting = 4800 Baud.
The baud rate can be set with the first three switches. The transmission rates of 4800 to 230 400 baud are sustained.

Parity: Works setting = no parity
This switch activates transmission with parity bit.

Even nOdd: Works setting = Odd
With activated parity bit it is possible to switch between Even and Odd parity.

2 Stopp-Bit: Works setting = 1 Stopp Bit
This switch allows an additional Stopp Bit to be sent.

Long Break: Works setting = no extension
This switch allows the delay time between master inquiry and slave reply to be increased by 3.5 bytes.

4.3 MODBUS-/J BUS LOG

The transmission mode RTU (Remote Terminal Unit) is used for communication.

General telegram set up:

START	ADDRESS	FUNCTION	DATA BYTES	CRC	END
Pause >3,5 bytes	1 byte	1 byte	x bytes	2 bytes	Pause >3,5 bytes

The following functions are sustained:

1. Read Holding Register
   Reads one or more registers from the slave.
2. Preset Single Register
   Changes a register in the slave.
3. Preset Multiple Regs
   Changes several registers in the slave.
4. Report Slave ID
   Reads the slave ID of the slave.

The individual registers as well as the calculations of the corresponding register addresses are described in chapter 4.4. The J-bus register address is always used (i.e. also with Modbus) within the telegrams.

4.3.1 READ HOLDING REGISTERS (0X03)

With this telegram the master can read out one or more registers (function code 0x03). The registers must lie in series.
Example:
Registers 72 + 128 (load voltage chapter 4.4, Controller 1) are to be read out from the bus module with the address 100. (72 + 128 = 200, no overflow into high byte).

Inquiry:

ADDRESS	FUNCTION	REGISTER	NUMBER	CRC
100	3	0, 200	0, 2	76, 00

Response:

ADDRESS	FUNCTION	NO. BYTES	DATA	CRC
100	3	4	250, 184, 70, 23	13, 166

Error:
Should the address of the register to be read out lie outside the address location, the reply Exception Response „ILLEGAL DATA ADDRESS" is transmitted (see chapter 4.3.5).

Response:

ADDRESS	FUNCTION	ERROR CODE	CRC
100	131	2	208, 238

If more than 120 registers are requested simultaneously the Exception Response „ILLEGAL DATA VALUE" is transmitted (see Chapt. 4.3.5).

Response:

ADDRESS	FUNCTION	ERROR CODE	CRC
100	131	3	17, 46

4.3.2 PRESET SINGLE REGISTER (0X06)

With this telegram the master can change a register (function code 0x06).

Example:
Registers 6 + 256 (operating mode Thyro-A/Thyro-AX, Controller 2) are to be changed to 2 (VAR) in the bus module with the address 100 (1 overflow into high byte).

Inquiry:

ADDRESS	FUNCTION	REGISTER	DATA	CRC
100	6	1, 6	0, 2	224, 3

Response:

ADDRESS	FUNCTION	REGISTER	DATA	CRC
100	6	1, 6	0, 2	224, 3

Error:
Should the register's address lie outside the address location or is an attempt made to write on an address that cannot be changed, the Exception Response responds by transmitting „ILLEGAL DATA ADDRESS" (see Chapt. 4.3.5). This is also the case if the controller in question is not connected!

Response:

ADDRESS	FUNCTION	ERROR CODE	CRC
100	134	2	211, 190

4.3.3 PRESET MULTIPLE REGS (0X10)

With this telegram the master can change one or more registers, whereby the registers must lie in series.

Example:
The registers 24 (+25) + 384 (Pmax Thyro-A H RLP1/Thyro-AX H RLP2, Controller 3) are to be changed to 10kW in the bus module with the address 100.
(24+3*128=408, 408-(1 x 256) = 152; 10000 = 39,16 (256 * 39 + 16 = 10000)

Inquiry:

ADDRESS	FUNCTION	REGISTER	NUMBER	NO. BYTES	DATA	CRC
100	16	1, 152	0, 2	4	0, 0, 39, 16	3, 4

Response:

ADDRESS	FUNCTION	REGISTER	NUMBER	CRC
100	16	1, 152	0, 2	200, 46

Error:
Should the register's address lie outside the address location, the Exception Response „ILLEGAL DATA ADDRESS" is transmitted (see-Chapt. 4.3.5).

Response:

ADDRESS	FUNCTION	ERROR CODE	CRC
100	144	2	221, 222

Should there be registers which can only be read out, the change requested is ignored.

4.3.4 REPORT SLAVE ID (0X11)

With this telegram the master can read out the slave ID.

Example:
The ID is to be read out from the bus module with the address 100.

Inquiry:

ADDRESS	FUNCTION	CRC
100	17	235, 124

Response:

ADDRESS	FUNC-TION	NO. BYTES	SLAVE ID	RUN STA-TUS	CRC
100	17	2	4	255	18, 116

4.3.5 EXCEPTION RESPONSE

With an incorrect inquiry an Exception Response is transmitted and the inquiry is rejected.

ILLEGAL FUNCTION:
The function code received in the inquiry is not sustained by the slave.

ILLEGAL DATA ADDRESS:
The register address does not exist. It must be smaller than 1152. With the inquiries „Read Holding Registers" and „Preset Multiple Regs" the address comprises the register's start address and the number of registers. So that the following applies
Register + number <1152; 128+8x128.

ILLEGAL DATA VALUE:
The data in the inquiry are not permitted. For example the number of registers to be read is too high (max. 120).

4.4 REGISTER ALLOCATION

The registers are split up into the following areas:

PARAMETERS	REGISTER ADDRESSES	
	J-BUS	MODBUS
Bus module	0 - 127	40001 - 40128
Controller X1	128 - 255	40129 - 40256
Controller X2	256 - 383	40257 - 40384
Controller X3	384 - 511	40385 - 40512
Controller X4	512 - 639	40513 - 40640
Controller X5	640 - 767	40641 - 40768
Controller X6	768 - 895	40769 - 40896
Controller X7	896 - 1023	40897 - 41024
Controller X8	1024 - 1151	41025 - 41152

TAB. 3 REGISTER ALLOCATION OF THE BUS MODULE FOR J-BUS AND MOD-BUS RTU

The index of the individual registers below corresponds to the offset at the beginning of the area concerned. The corresponding register is calculated as followed (for bus module parameters the Controller No. equals 0):

J-bus: Register address = index + (128 * Controller No.)

Modbus: Register address = Index + (128 * Controller No.) + 40001

4.4.1 BUSMODULE PARAMETERS

General information can be read out via the bus module (participant recognition). The parameters are thereby only addressed via the index number. Parameters for Thyro-A apply also to Thyro-AX.

MODUL-PARAMETER							R/W		
INDEX	ADR.	SYMBOL	NAME	VALUE RANGE	COMBO-OPT	UNIT	S	A	DEFAULT
0		GER_1	Device type at port 1	5, 9, 10, ..	S, 1A, 2A,..		r	r	
1		GER_2	Device type at port 2	5, 9, 10, ..	S, 1A, 2A,..		r	r	
2		GER_3	Device type at port 3	5, 9, 10, ..	S, 1A, 2A,..		r	r	
3		GER_4	Device type at port 4	5, 9, 10, ..	S, 1A, 2A,..		r	r	
4		GER_5	Device type at port 5	5, 9, 10, ..	S, 1A, 2A,..		r	r	
5		GER_6	Device type at port 6	5, 9, 10, ..	S, 1A, 2A,..		r	r	
6		GER_7	Device type at port 7	5, 9, 10, ..	S, 1A, 2A,..		r	r	
7		GER_8	Device type at port 8	5, 9, 10, ..	S, 1A, 2A,..		r	r	
8		res.							
9		VERS_J	Version year (Bus module)	0...9999			r	r	
10		VERS_M	Version month (Bus module)	1...12			r	r	
11		VERS_T	Version day (Bus module)	1...31			r	r	
12		res.							
13			Number of act. val. from which mean is taken	1...20			r/w	r/w	1
14			Digital outputs	Bit 0-7			r/w	r/w	0

TAB. 4 BUS MODULE PARAMETERS

DEVICE TYPE	H1	H RL1/H RL2	H RLP1/H RLP2
Thyro-S 1S	5	37	–
Thyro-A 1A/Thyro-AX 1A	9	41	297
Thyro-A 2A/Thyro-AX 2A	10	42	298
Thyro-A 3A/Thyro-AX 3A	11	43	299

TAB. 5 DEVICE TYPES

4.4.2 CONTROLLER PARAMETERS

					R/W		
INDEX	SETPOINT	TYPE	NO. REG.	UNIT	S	A	RESTRICT.
64	Setpoint Master	integer	1	4096=100%	r/w	r/w	

TAB. 6 SETPOINT MASTER

NOTE

For Thyro-S a setpoint conversion is made (see chapter 3.1)

The following tables show the maximum available actual values of a controller. If parameters are not used, they are 0.

					R/W		
INDEX	ACTUAL VALUES	TYPE	NO. REG.	UNIT	S	A	RESTRICT.
70	Power L1	float	2	W		r	only H RLP1/H RLP2
72	Load voltage L1	float	2	V	r	r	
74	Current L1	float	2	A	r	r	only Thyro-A H RL../Thyro-AX H RL..
76	Supply voltage L1	integer	1	V	r	r	
80	Power L2	float	2	W		r	only Thyro-A 3A H RLP1/Thyro-AX 3A H RLP2
82	Load voltage L2	float	2	V	r	r	only Thyro-A 3A/Thyro-AX 3A
84	Current L2	float	2	A	r	r	only Thyro-A 3A H RL../Thyro-AX 3A H RL..
86	Supply voltage L2	integer	1	V	r	r	only Thyro-A 3A/Thyro-AX 3A
90	Power L3	float	2	W		r	only Thyro-A 2A H RLP1/Thyro-AX 2A H RLP2
92	Load voltage L3	float	2	V		r	only Thyro-A 2A/Thyro-AX 2A
94	Current L3	float	2	A		r	only Thyro-A H RL../Thyro-AX H RL..
96	Mains voltage L3	integer	1	V		r	only Thyro-A 2A/Thyro-AX 2A
100	Total power	float	2	W		r	only H RLP1/H RLP2
102	Total setpoint	integer	1	4096 = 100%	r	r	
103	Setpoint input terminal	integer	1	4096 = 100%	r	r	
104	Connection angle alpha	integer	1	°el.		r	
105	Act. value connection time	integer	1	period	r	r	
106	Period duration	integer	1	µs	r	r	
107	Temperature	integer	1	°C	r	r	
115	Error	integer	1	s. Tab. 9a	r	r	
116	Status	integer	1	s. Tab. 9b	r	r	

TAB. 7 CONTROLLER ACTUAL VALUES

CONTROLLER PARAMETERS							R/W			
INDEX	SYMBOL	NAME	VALUE RANGE	COMBO-OPT.	UNIT	S	1A, 2A	3A	DEFAULT	REMARK
0	GER	Device type	0, 5, 9, 10, …	none, 1S, 1A, 2A, ...		r	r	r	Type	
1	I_TYP	Controller type current	0...1000		A	r	r	r	Type	
2	U_TYP	Controller connection voltage	0...1000		V	r	r	r	Type	
3	P_TYP_H	Controller type capacity high	0...65535		65535W		r	r	Type	H RLP1/H RLP2
4	P_TYP_L	Controller type capacity low	0...65535		W		r	r	Type	H RLP1/H RLP2
5	WANDLER	Transducer	0…	Bit coded		r	r	r	Type	
6	BETR	Operating mode Thyro-A/Thyro-AX	0...3	res., TAKT, VAR, QTM			r/w *	r/w *	TAKT	S1.1-2
7	BETR	Operating mode Thyro-S	0…3, 16	OFF, 1/2, 1/3, 1/5, 1		r			1	S1.1-2
8	AN1	Phase angle of 1st half wave	0...180		°el		r/w *	r/w *	60°el	R201
9	SST	Soft start time (standard)	0...100		period		r/w *	r/w *	6 period	R201
10	SDN	Soft stop time (standard)	0...100		period			r/w	6 period	
11	T0	Phase period duration	0...1000		period	r	r/w *	r/w *	50 period	R201
12	MP	Minimum interval	0...10		period		r/w *	r/w *	3 period	R201
13	TSMAX	Maximum phase switch-on time	0...T0		period		r/w	r/w	50 period	
14	TSMIN	Minimum phase switch-on time	0...T0		period		r/w	r/w	0 period	
15	V_IE	Front impulse stop position	0...180		°el		r/w	r/w	180°el	
16	H_IE	Back impulse stop position	0...180		°el		r/w	r/w	0°el	
17	RE	Control (control analog output)	0…8	U_{load^2}, $U_{load\,rms}$, I_{load^2}, $I_{load\,rms}$, res., Real power res. res. Without regulation			r/w *	r/w *	U_{load^2}	S1.3-5 Power only with H RLP1/H RLP2
18	TI_1	PID controller I part	0 = out 0...65535				r/w	r/w	20	
19	KP_1	PID controller P part	0 = out 0...65535				r/w	r/w	60	
20	KR_1	PID controller counter P part	0...65535				r/w	r/w	10	
21		res.						r/w		
22	UEMA	rms voltage setpoint max.	0…		V		r/w *	r/w *	440V	R202 **
23	IEMA	rms current setpoint max.	0…		0,1A		r/w *	r/w *	110A	R203
24	PMA_H	Power setpoint max. Hi	0...65535		65535W		r/w *	r/w *	0	R202 **
25	PMA_L	Power setpoint max. Lo	0...65535		W		r/w *	r/w *	44000W	R202 **

TAB. 8 A CONTROLLER PARAMETER FOR Thyro-S, Thyro-A AND Thyro-AX

CONTROLLER PARAMETERS							R/W			
INDEX	SYMBOL	NAME	VALUE RANGE	COMBO-OPT.	UNIT	S	1A, 2A	3A	DEFAULT	REMARK
26	SW_ACTIV	Setpoint activation	0…3	"Bit0=1 (Setpoint X2.4 active), Bit1=1 (Setpoint Master active)		r	r	r	0	
27		res.								
28		res.								
29		res.								
30	OF	Analog output offset	0...4095		20/4095 mA		r/w *	r/w *	0mA	S1.9
31	FA	Scale end value of analog output	0...4095		1 / 819		r/w *	r/w *	1	R204
32	SPG_MIN	Power monitor circuit min.	0...1000		V	r/w	r/w	r/w	Type	
33	SPG_MAX	Power monitor circuit max.	0...1000		V	r/w	r/w	r/w	Type	
34	UN_S	Undercurrent monitor	0...1	Off, On		r	r/w *	r/w *	Aus	R205
35		res.						r/w		
36	LASTBRUCH_MIN_ABS	Load fault min. value	0…4095		100/4095 %	r	r/w *	r/w *	0%	R205
37		res.						r/w		
38	SYNC_ADR	Synchronous phase address	0...65535		period / 2		r/w	r/w	100	
39	IMAB	Impulse cut-off with fault	0...65535	Bit coded		r/w	r/w	r/w	0	
40	STA_RE	Contr. start contr. analog setpoint value	0...4095		20/4095 mA		r/w *	r/w *	0mA	S1.6
41	STE_RE	Contr. end contr. analog setpoint value	0...4095		20/4095 mA		r/w	r/w	20mA	
42		res.						r/w		
43	MOSI_FA	Peak load value limit	0...4095				r/w	r/w	Type	
44	DAC1_CTRL	Analog output configuration	0…10			r/w	r/w	r/w	6	
45		res.				r/w	r/w	r/w		
46	VERS_T	Version day	1...31			r	r	r		
47	VERS_M	Version month	1...12			r	r	r		
48	VERS_J	Version year	0...9999			r	r	r		
49		res.								
50		Controller lock	0...1	Off, On			r/w	r/w	Off	
51	RELAIS_CTRL	Relay configuration 1	0...65535	Bit coded			r/w	r/w	447	
52		Store	0...1	Off, Save		r/w	r/w	r/w	Off	
53	MITTEL	Mean value analogue output	0...65535				r/w	r/w	100	

TAB. 8 B CONTROLLER PARAMETER FOR Thyro-S, Thyro-A AND Thyro-AX

REMARK

If a potentiometer or contact of DIP switch S1 is entered in the "Note" column of the table, this hardware setting is used when the mains returns (For exceptions, see * or **)

* In the "Thyro-Tool" mode (switch S1.3-5 on "On") the parameters marked with * are not given by the switches and Potis, instead, the stored values are used.

** The allocation of the parameters marked with ** to the Poti depends on the chosen controller mode.

4.5 STATUS AND ERROR COMMUNICATION

DESCRIPTION: Thyro-S, Thyro-A and Thyro-AX		Thyro-A/Thyro-AX LEDs	RELAY*	Thyro-S LEDs	RELAY*
Frequency measurement outside of 47 Hz to 63 Hz	Bit0	Pulse Inhibit LED flashes slowly	dropped out	Test LED flashes slowly	dropped out
SYNC error, no zero crossing within the gate	Bit1	Pulse Inhibit LED flashes slowly	dropped out	Test LED flashes slowly	dropped out
Temperature monitoring triggered	Bit2	Load Fault LED flashes slowly	dropped out	Load Fault flashes slowly	dropped out
Load error	Bit3	Load Fault LED on	dropped out	Load Fault on	dropped out
Flash values invalid	Bit4	Pulse Inhibit LED and Load Fault LED flash fast simultaneously	dropped out	Test LED a. Load Fault LED flash fast simultaneously	dropped out
Mains Undervoltage (< AD_P_SPG_MIN)	Bit5	Pulse Inhibit LED, Load Fault LED a. Test-LED on	dropped out	Load Fault LED and Test LED on	dropped out
Mains Overvoltage (> AD_P_SPG_MAX)	Bit6	none	energised	none	energised
Master/Slave error (only with 2A)	Bit8	none	energised	only with Thyro-A/Thyro-AX	---
Undervoltage Limit	Bit9	none	energised	only with Thyro-A/Thyro-AX	---
Overvoltage Limit	Bit10	none	energised	only with Thyro-A/Thyro-AX	---
Undercurrent Limit	Bit11	none	energised	only with Thyro-A/Thyro-AX	---
Overcurrent Limit	Bit12	none	energised	only with Thyro-A/Thyro-AX	---
Low Power Limit	Bit13	none	energised	only with Thyro-A/Thyro-AX	---
High Power Limit	Bit14	none	energised	only with Thyro-A/Thyro-AX	---

TAB. 9 A ERROR FLAGS (ERROR)

* The table only shows the default configuration of the relay function.
It can be configured by Thyro-Tool Family, which message shall be shown by the relay an which not.
The relay only exists in H RL1, H RLP1, H RL2 or H RLP2 device, not in the H1 types.

DESCRIPTION: Thyro-S, Thyro-A and Thyro-AX		Thyro-A/Thyro-AX LEDs	RELAY*	Thyro-S LEDs	RELAY*
Pulse blocking active (bridge X2.1-X2.2open)	Bit0	Pulse Inhibit LED on	energised	none	energised
Mains frequency is 60 Hz	Bit2	none	energised	none	energised
U limiting active	Bit4	Pulse Inhibit LED and Load Fault LED flash slowly alternately	energised	only with Thyro-A/Thyro-AX	---
I limiting active	Bit5	Pulse Inhibit LED and Load Fault LED flash slowly alternately	energised	only with Thyro-A/Thyro-AX	---
P limiting active	Bit6	Pulse Inhibit LED and Load Fault LED flash slowly alternately	energised	only with Thyro-A/Thyro-AX	---
Relay status (0=relay off/ 1=relay on)	Bit8	none	on/off	none	on/off
Busmodul aktiv (0=no bus module/1=bus modul active)	Bit11	none	energised	none	energised
Thyristor short-circuit (Thyro-S)	Bit14	only with Thyro-S	---	Test-LED a. Load Fault LED flash slowly alternately	dropped out
Failure in rotating field/ phase (only Thyro-A 2A or 3A/ Thyro-AX 2A or 3A)	Bit15	Pulse Inhibit LED and Test LED flash slowly simulta-neously	dropped out	only with Thyro-A/Thyro-AX	---

TAB. 9 B ERROR FLAGS (STATUS)

* The table only shows the default configuration of the relay function.
It can be configured by Thyro-Tool Family, which message shall be shown by the relay an which not.
The relay only exists in H RL1, H RLP1, H RL2 or H RLP2 device, not in the H1 types.

5. EXTERNAL CONNECTIONS

5.1 CURRENT SUPPLY

+24V to X11, current consumption ca. 150 mA

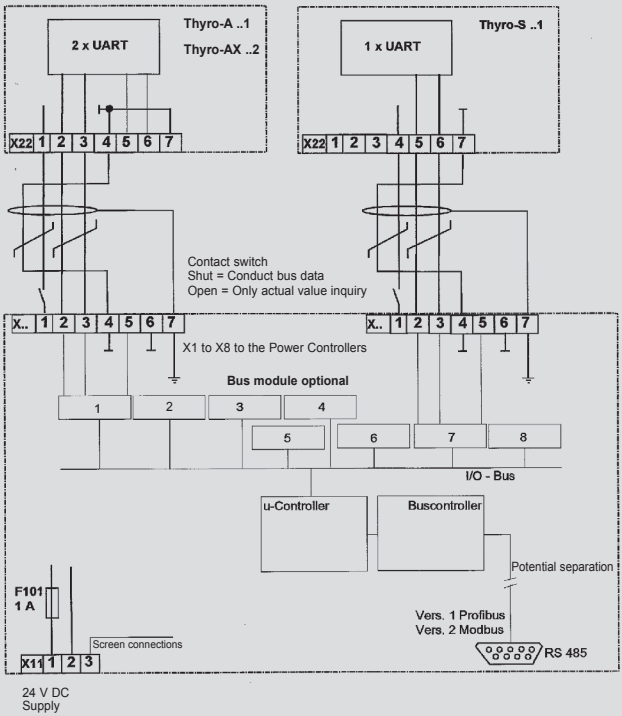


FIG. 2 BLOCK CONNECTING DIAGRAM

The above connecting diagram shows the essential functions of the bus module.

5.2 OPERATING ELEMENTS AND TERMINAL STRIPS

This chapter describes the terminal strips, connectors and operating elements.

Allocation of the 7 terminal connector X1 to X8:

1 Total ground connected
2 RxD
3 TxD
4 Ground
5 Individually connectable ground
6 Ground
7 Earth potential for screen connection

Allocation of the 3 terminal connector X11:
X11: 1 +24 V
X11: 2 24 V – ground
X11: 3 earthing, connected earthing cable should be as short as possible for EMC reasons

Allocation of the 9 terminal sub-D socket X20:
Standard allocation

S 501 device address S501. 1 2 3 4 5 6 7 8
1 2 4 8 16 32 64 128

Example: Switch 3 and 4 „on" = 4 + 8 = address 12

S502 see chapter 4.2

6. INTERFACES

6.1 SYSTEM INTERFACES

The bus module is connected to the respective system interfaces of the power controller via X1 to X8 (4-lead, 2x2 twisted, joint screen).
The transmission rate is 38,400 Bd.
The asynchronous signals are transmitted with 8bit, no parity, one stopbit.
The log begins with STX, followed by an identification key, the data and ends with a check sum. Faulty logs are ignored.

6.2 MODBUS INTERFACE

This interface, in accordance with RS485, is designed for a transmission rate up to 230.4 kbd. The allocation corresponds to the industrial standard.
The length of the data line and the transmission rate are in fixed relation.
The maximum lengths of the bus master given in the manufacturer's specifications may not be exceeded.

7. CONNECTING PLANS Thyro-A/Thyro-AX

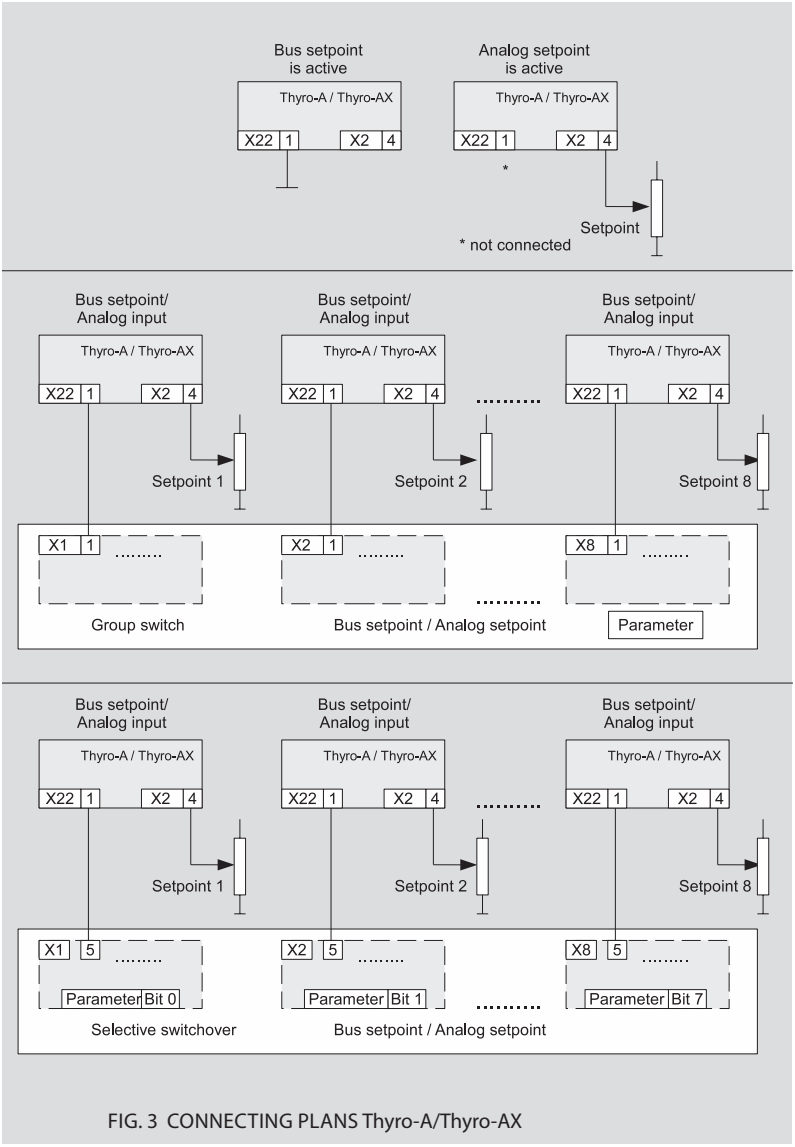


FIG. 3 CONNECTING PLANS Thyro-A/Thyro-AX

8. CONNECTING PLANS Thyro-S

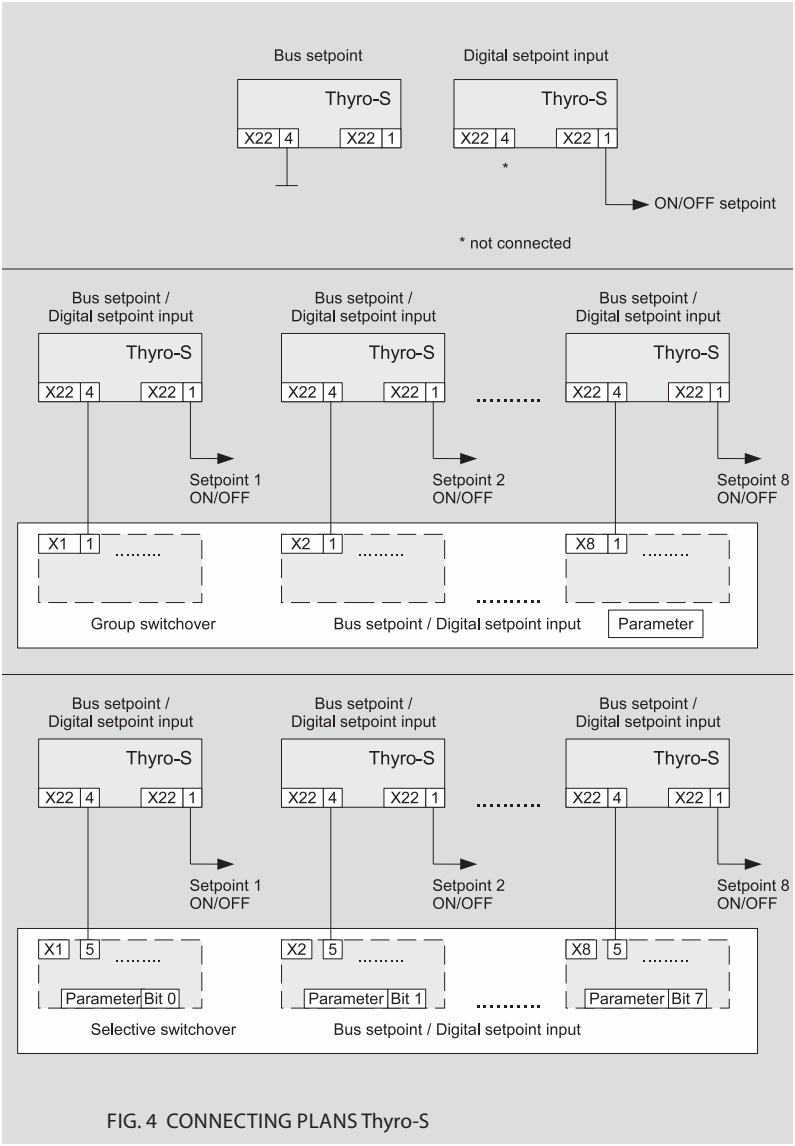


FIG. 4 CONNECTING PLANS Thyro-S

9. SPECIAL REMARKS

9.1 INSTALLATION

The bus module can be arranged as desired.
On delivery the device is set at:
bus address 000, baudrate 4 800 bd, no parity, Odd, 1 stopbit, no extension set.

9.2 COMMISSIONING

- Set address switch according to bus plan application
- Set configuration switch
- Carry out cabling
- Feed 24V d.c. - green LED must light up,
  - bus module is ready for operation,
  - red LED stops blinking as soon as the Modbus starts operating.
- Should errors occur, the bus master's log must be eval.

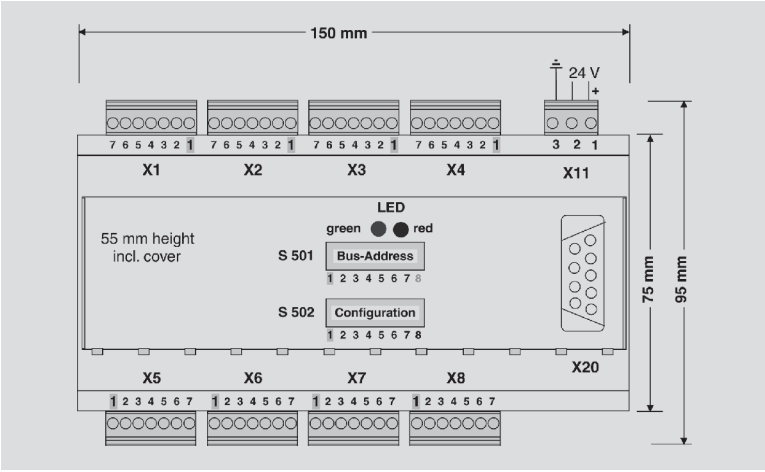
9.3 SERVICE

The delivered devices have been produced under quality standard ISO9001. Should nevertheless faults or problems arise, please contact our Advanced Energy team for assistance (see chapter CONTACT INFORMATION).

10. TECHNICAL DATA

Voltage supply	24 VDC (+/-20 %) 150 mA
Possible bus addresses	1 to 247, only one address necessary per bus module
Connection options	Up to 8 Advanced Energy power controllers of the Thyro-S, Thyro-A and Thyro-AX series of types ...H1, ...H RL1, ...H RLP1, ...H RL2 and ...H RLP2
Function check	Via LEDs
Mounting	On DIN rail
Ambient temperature	Max. 65 °C

11. DIMENSIONAL DRAWINGS



Phoenix EMG 150 casing
150x75x55 mm without upper part of plug,
recommended space required 150x150 mm

12. ACCESSORIES AND OPTIONS

Cord set, screened cables are available with the bus module.
One loom of cables consists of 4 equally long connecting cables for the connection of 4 power controllers.

Order No. 2000 000 848	Bus module connecting cable for 4 controllers, 2.5 m long
Order No. 2000 000 849	Bus module connecting cable for 4 controllers, 1.5 m long

13. APPROVALS AND CONFORMITY

- Data transmission in acc. with ISO 11898
- Quality standard in acc. with DIN EN ISO 9001
- CE conformity
- Low voltage directive 73/23 EEC
- EMC directive 89/336 EEC; 92/31 EEC
- Marking directive 93/68 EEC

DIRECTIVES

The CE mark on the device confirms compliance with the EC directives 72/23 EEC for low voltage and 89/339 EEC for electromagnetic compatibility if the instructions on installation and start-up described in the operating instructions are followed.

In Detail

DEVICE APPLICATION CONDITIONS

Integrated device (VDE0160)		DIN EN 50 178
General requirements		DIN EN 60146-1-1:12.97
Design, vertical installation		
Operating conditions		DIN EN 60 146-1-1; ch. 2.5
Area of application, industrial		CISPR 6
Temperature behaviour		DIN EN 60 146-1-1; ch. 2.2
Storage temperature (D)		-25 °C – +55 °C
Transport temperature (E)		-25 °C – +70 °C
Operating temperature (better B)	-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 m. sea level
Index of protection	IP00	DIN EN 69 529
Protection class	III	DIN EN 50178 chap. 3
Mechanical jolt		DIN EN 50 178 chap. 6.2.1
Tests in acc. with		DIN EN 60 146-1-1 4.
EMC emitted interference		EN 61000-6-4
Radio interference suppression control unit	Class A	DIN EN 55011:3.91 CISPR 11
EMC resistance		EN 61000-6-2
ESD	8 kV (A)	EN 61000-4-2:3.96
Burst control lines	1 kV (A)	EN 61000-4-4
Conductor-bound		EN 61000-4-6

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