BUS MODULE CANopen

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

June 2014   DE/EN - V4

CONTACT

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

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

SERVICE-HOTLINE

Advanced Energy Industries GmbH
Branch Office Warstein-Belecke
Emil-Siepmann-Straße 32
D-59581 Warstein
Phone +49 (0) 2902 763-0
http://www.advanced-energy.com

COPYRIGHT

FURTHER INFORMATION ON COPYRIGHT

TABLE OF CONTENTS

1. GENERAL

CANopen is a bus module for controlling Advanced Energy thyristor power controllers.

Particularly where several power controllers are used at the same time, inexpensive solutions and improvements can be made in the following areas:
- Process flow
- Process documentation
- Start-up and costs
- System availability
- Wiring

These operating instructions are a supplement to the operating instructions for Advanced Energy Thyro-S thyristor power controllers of types ...H1 and ...H RL1 as well as Thyro-A ...H1, ...H RL1 and ...H RLP1 as well as Thyro-AX ...H RL2 and ...H RLP2.

The CANopen bus module can connect up to 8 Thyro-AX...2, Thyro-A...1 or Thyro-S...1 power controllers in any combination to a CANopen master. Several bus modules can be used in one system. Each bus module occupies one address on the bus.

These operating instructions describe the configuration and functions of the bus module CANopen and are designed to enable qualified personnel to perform the following work:
- Planning
- Start-up

Information and explanations for unqualified persons and for the use in nonindustrial applications are not included in these operating instructions.

1.1 TYPE DESIGNATIONS/VALIDITY

These operating instructions describe the bus module CANopen (Order No. 2000 000 843).

These operating instructions comply with the current technical specifications of the device at the time of publication. The contents do not constitute a subject matter of the contract, but serve for information purposes only. We reserve the right to alter any specifications given in these operating

instructions, especially with regard to technical data, operation, weights and dimensions.

Advanced Energy reserves the right to make modifications with regard to the content and technical data in these operating instructions.

1.2 ABBREVIATIONS

EDS	=	Electronic Data Sheet
EMCY	=	Emergency Object
NMT	=	Network management
SDO	=	Service Data Object
RPDO	=	Receive Process Data Object
TPDO	=	Transmit Process Data Object

1.3 SPECIAL FEATURES

· Slave module
· Function control via LEDs
· 8 free, digital outputs X1.5 to X8.5
· Transmission of actual values in physical units
· C rail mounting
· 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.

1.4 WARRANTY

In the event of any claims in connection with the CANopen, 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 from Advanced 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.
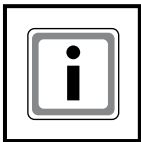
NOTE
Communication faults
To avoid communication faults, observe the following points:
· Use shielded cables.
· Ensure grounding on the bus module (X1.7 to X8.7). Do not also ground on the power controller.

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 country 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 regu-
  lations 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 mainte-
  nance 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 9: 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

The CANopen bus module has numerous functions. These functions are described in this chapter.

3.1 SETPOINT PROCESSING

3.1.1 SETPOINT PROCESSING Thyro-S

The CANopen bus module transmits setpoints to the power controller. These setpoints (setpoint master) are interpreted by the Thyro-S in acc. with the following table as an operating mode.

SETPOINT (MASTER)	STATUS (RETURN VALUE)	(SUM, SETPOINT)
up to 409	OFF	0
up to 1091	1/5	819
up to 1706	1/3	1365
up to 3071	1/2	2047
up to 4096	ON	4096

INTERPRETATION OF THE MASTER SETPOINTS FOR Thyro-S

Setpoint processing depends on how the bus module is connected to the power controller.
Different methods of setpoint processing are possible. This is controlled by the configuration of terminal X22.4 of the Thyro-S (see chapter 4.3: Setting setpoint processing Thyro-S).

3.1.2 SETPOINT PROCESSING Thyro-A/Thyro-AX

The CANopen bus module transmits setpoints to the power controller. Setpoint processing depends on how the bus module is connected to the power controller. Different methods of setpoint processing are possible. This is controlled by the configuration of terminal X22.1 of the Thyro-A/Thyro-AX (see chapter 4.3: Setting setpoint processing Thyro-A/Thyro-AX).

3.2 LED MESSAGES
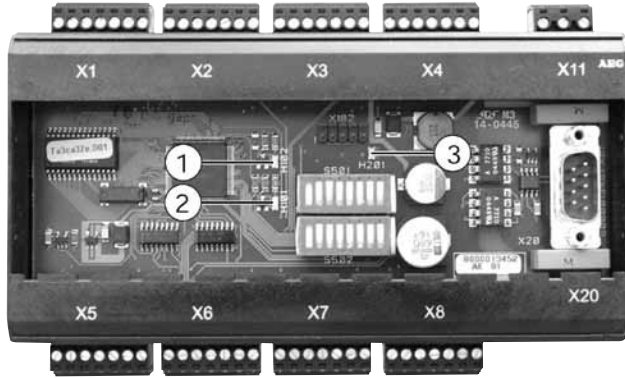
1 RUN-LED (H102)

2 Error-LED (H101)

3 Operating State LED (H201)

LED MESSAGES

LED/FUNCTION	MESSAGE	STATUS	DESCRIPTION
Error LED/ Fault at CANopen-Bus (H101)	OFF	No Error	Device operates without errors.
	Flashes once	Warning Limit Reached	At least one error counter of the CAN controller has reached the warning limit.
	Flashes twice	Error Control Event	A Node Guarding Telegram (NMT slave or NMT master) or a Heartbeat Telegram was not received.
	ON	Bus Off	CAN controller is in a bus off state.
RUN-LED/ Status of communication (H102)	Flashes once	STOPPED	The device is in a stopped state.
	Permanent flashing	PREOPERATIONAL	The device is in a preoperational state.
	ON	OPERATIONAL	The device is in an operational state.
Operating state LED/ Operating state of the bus module (H201)	OFF		No voltage supply
	ON		Voltage supply present

3.3 CANopen SERVICES

3.3.1 NETWORK MANAGEMENT (NMT)
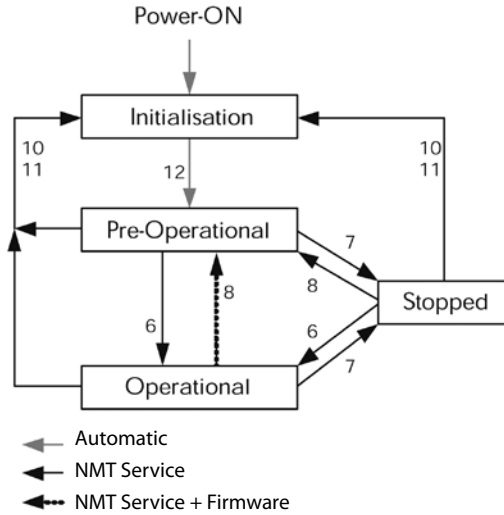
6	Start Remote Node
7	Stop Remote Node
8	Enter Pre-Operational State
10	Reset Node
11	Reset Communication
12	Initialisation finished

The NMT services control the operating state of the bus module.

STATE	DESCRIPTION
Initialisation	The device is in the initialisation phase. After completing initialisation, it automatically switches to „Pre Operational". Communication ist not possible at this time.
Pre-Operational	The device is ready for communication. The NMT, SDO and EMCY services are processed.
Operational	The master has set the device to „Operational" state. All available services are processed. If an error occures, it automatically switches to „Pre-Operational" state.
Stopped	The master has stopped the device. All „Setpoint masters" and the „Digital outputs X1.5 - X8.5"are automatically set to zero. Only NMT and EMCY services are supported.

OPERATING STATES

3.3.2 SDO

The bus module has an SDO service. With this service, a master can read out and modify the individual objects of the bus module (slave).

3.3.3 RECEIVE PDOs (RPDOs)

The bus module has eight RPDOs. Within this service, the „Setpoint Master" can be modified.

	RPDO1	RPDO2
Object 1	2104 „X1 Setpoint Master"	2504 „X5 Setpoint Master"
Object 2	2204 „X2 Setpoint Master"	2604 „X6 Setpoint Master"
Object 3	2304 „X3 Setpoint Master"	2704 „X7 Setpoint Master"
Object 4	2404 „X4 Setpoint Master"	2804 „X8 Setpoint Master"

INITIALISATION OF THE FIRST TWO RPDOs

The RPDOs support dynamic mapping. With dynamic mapping, the setpoints can be distributed over the eight RPDOs and sent directly from the temperature controller, for example, to the controller.

3.3.4 TRANSMIT PDOs (TPDOs)

The bus module has over 40 TPDOs. There are 5 TPDOs for each connected power controller.

	TPDO1	TPDO2
Object 1	2100:0 „X1 Setpoint Terminal"	2111:1 „X1 Load voltage L1"
Object 2	2107:0 „X1 Total Setpoint"	2112:1 „X1 Load current L1"
Object 3	2120:0 „X1 Error"	2113:1 „X1 Load power L1"
Object 4	2121:0 „X1 Status"	

	TPDO3	TPDO4
Object 1	2111:2 „X1 Load voltage L2"	2111:3 „X1 Load voltage L3"
Object 2	2112:2 „X1 Load current L2"	2112:3 „X1 Load current L3"
Object 3	2113:2 „X1 Load power L2"	2113:3 „X1 Load power L3"
Object 4		

	TPDO5
Object 1	2113:4 „X1 Total power"
Object 2	2118:0 „X1 Phase angle alpha"
Object 3	2119:0 „X1 Switch on time TS"
Object 4	

INITIALISATION OF THE TPDOs*

*All other TPDOs are initialised for the other controllers in the same manner.

The RPDOs support dynamic mapping. Transmitting the TPDOs can be controlled by a timer or a sync telegram. Ensure that the period chosen is not too small as the CANopen bus will otherwise be too heavily loaded or a buffer overflow will be generated in the bus module.
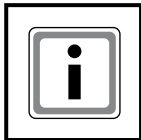
NOTE
Overload or buffer overflow of the bus module
The bus module can be overloaded or the buffer can overflow.
· Set a sufficiently long period for the transmit cycle of the telegrams.

EXAMPLE

At a transmission rate of 125 kbit/s, about 1000 telegrams can be transmitted per second. With 20 devices on one bus and a reserve of about 20%, 40 telegrams per device can be sent per second.

If 20 TPOs are used, the cycle time should therefore be at least 500ms.

3.4 MONITORING/PROTOCOLS

The state of the CAN controller and communication are monitored.

The „Node Guarding" and „„Heartbeat" services can be used to monitor communication.

If an error occurs, the following actions are triggered:

- Error LED indicates an error (see chapter 3.2: LED messages).
- Bus module switches to „Pre-Operational" state.
- Terminals X1.1 to X8.1 are set to 1 for all power controllers.
- Error telegram (EMCY) is generated (see chapter 3.4.4: Error telegram, emer-
  gency EMCY).

3.4.1 NODE-GUARDING

The Node Guarding protocol monitors communication.

3.4.2 HEARTBEAT PRODUCER

With the „Heartbeat Producer" service, it is possible for other devices to moni-tor the function of the bus module.

3.4.3 HEARTBEAT CONSUMER

With the „Heartbeat Consumer" service, it is possible to monitor the heartbeat of another device.

3.4.4 ERROR TELEGRAM (EMERGENCY EMCY)

When an error occurs, error telegrams are transmitted. The telegram is sent as a broadcast to all devices. When all errors have been remedied, a new error telegram is transmitted (Error code 0x0000).

ERROR CODE	ERROR REGISTER	DESCRIPTION
0x0000	0x00	No error
		Objekt 0x1003:0 is set to 0
0x8110	0x11	Some telegrams lost (overrun)
		No change in status to
		„Pre-Operational
0x8120	0x11	The CAN bus is passive (no answer)
		Change in status to
		„Pre-Operational"
0x8130	0x11	Node Guarding or Heartbeat error
		Change in status to
		„Pre-Operational"
0x8140	0x11	CAN Bus is off (short circuit)
		Change in status to
		„Pre-Operational"

ERROR CODES

3.5 ADDITIONAL FUNCTIONS

By using a bus module, additional device functions are possible with the Thyro-S, Thyro-A and Thyro-AX power controllers.

All the parameters of the two type series that are available are listed (see chapter 6: Object directory). The main one are described in more detail in the operating instructions of the power controller.

4. SETTING AND OPERATION

DANGER

Dangers involved in settings and operation

Risk of injury / Risk of damage to the device or plant

· Observe all safety regulations in the chapter on safety.

Setting and operating the CANopen bus module is described in this chapter.

4.1 DEVICE OVERVIEW
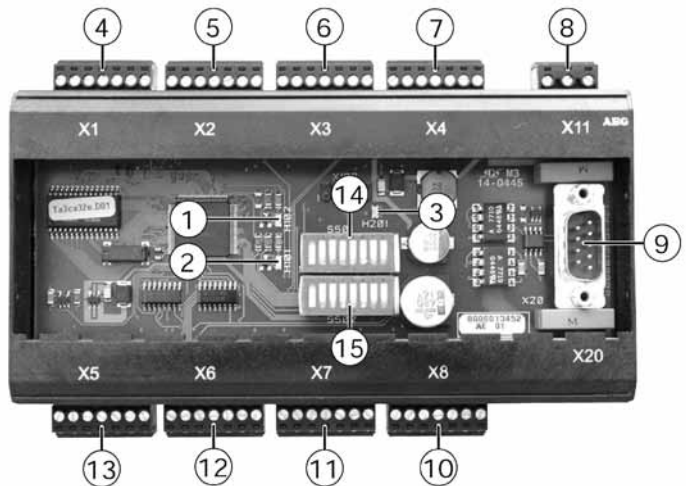
1	RUN-LED (H102)	9	Socket X20
2	Error-LED (H101)	10	Terminal X8
3	Operating state LED (H201)	11	Terminal X7
4	Terminal X1	12	Terminal X6
5	Terminal X2	13	Terminal X5
6	Terminal X3	14	DIP switch S501
7	Terminal X4	15	DIP switch S502
8	Terminal X11		

4.2 SETTING DIP SWITCHES
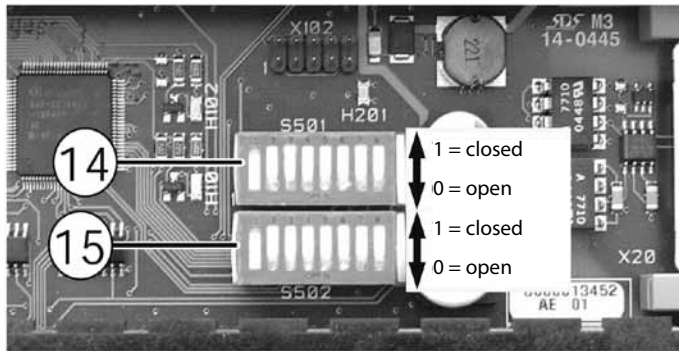
14 DIP switch S501 (Bus address)

15 DIP switch S502 (transmit parameters)

4.2.1 SETTING BUS ADDRESS (NODE-ID)

> Switch off mains supply incl. external 24 V voltage source and secure against accidentally being switched back on.

> Set bus address between 1 and 127 on DIP switch S501.1-7.

EXAMPLE

> Set switch S501.3 and switch S501.4 to position 1=closed.

> Set all other switches to 0=open.

- Switch S501.3 counts 4; Switch S501.4 counts 8; Address = 4+8=12

DIP SWITCH S501	.1	.2	.3	.4	.5	.6	.7	.8
Value at 1 = closed	1	2	4	8	16	32	64	-

CALCULATING THE BUS ADDRESS

Default setting: Bus address = 0 => all switches to 0 = open.

4.2.2 SETTING TRANSMIT PARAMETERS

> Set the transmission rate at DIP switch S502

DIP SWITCH S502								
.1	.2	.3	.4	.5	.6	.7	.8	FUNCTION
0	0	0						20kbit/s*
1	0	0						20kbit/s*
0	1	0						50kbit/s*
1	1	0						125kbit/s*
0	0	1						250kbit/s*
1	0	1						500kbit/s*
0	1	1						800kbit/s*
1	1	1						1000kbit/s*

* Default setting

TRANSMIT PARAMETERS

NOTE

Design of the CANopen interface

The CANopen interface is designed for a transmission rate of up to 1000 kbit/s.

This corresponds to the industrial standard.

The longer the data cable, the more susceptible to faults communication is.

· Adapt transmission rate to the length of the cable (see following table).

TRANSMISSION RATE [kbit/s]	10	20	50	125	250	500	800	1000
Max. Bus length [m]*	5000	2500	1000	500	250	100	50	25

* Take into account during system planning (project planning)!

ADAPTING THE TRANSMISSION RATE FOR A LONG DATA CABLE

4.3 SETTING SETPOINT PROCESSING

4.3.1 SETTING SETPOINT PROCESSING Thyro-S

Analog signal from control terminal X22.1 of the power controller

Do not make any connection at terminal X22.4 of the power controller.
· The bus module is fully functional. The analog signal from control terminal
 X22.1 is used as setpoint (on / off).
· Setpoint from bus module

Connect ground to terminal X22.4 of the power controller.
· The master setpoint of the bus module is used as the setpoint (see chapter
 3.1.1: Setpoint processing Thyro-S).
· Setpoint from bus module only in operating state „OPERATIONAL"

Connect terminal X22.4 of the power controller to one of the terminals X1.1
to X8.1 of the bus module.
· In operating state „OPERATIONAL", the „Setpoint Master" is used. In all other
 operating states, there is a switchover to the signal of the setpoint input of
 the power controller.
· Individual setpoint from the bus module for each power controller

Connect terminal X22.4 of the power controller to one of the terminals X1.5
to X8.5 of the bus module.
· The power controllers can be switched individually (selectively) via the bus
 to „Manual". In the event of faults in the bus line, the last setpoint is automti-
 cally retained.

4.3.2 SETTING SETPOINT PROCESSING Thyro-A/
Thyro-AX

Analog signal from control terminal X2.4 of the power controller
Do not make any connection at terminal X22.1 of the power controller.
· The bus module is fully functional. The analog signal from control terminal
 X2.4 is used as setpoint (on/off).
· Setpoint from bus module

Connect ground to terminal X22.1 of the power controller.
· The master setpoint of the bus module is used as the setpoint (see chapter
 3.1: Setpoint processing Thyro-A/Thyro-AX).
· Setpoint from bus module only in operating state „OPERATIONAL"

Connect terminal X22.1 of the power controller to one of the terminals X1.1
to X8.1 of the bus module.

· In operating state „OPERATIONAL", the „Setpoint Master" is used.

· In all other operating states, there is a switchover to the signal of the set-
  point input of the power controller.

· Individual setpoint from the bus module for each power controller

Connect terminal X22.1 of the power controller to one of the terminals
X1.5 to X8.5 of the bus module.

· The power controllers can be switched individually (selectively) via the bus
  to „Manual". In the event of faults in the bus line, the last setpoint is automti-
  cally retained.

4.3.3 FREELY ADDRESSABLE DIGITAL OUTPUTS

(Thyro-S, Thyro-A AND Thyro-AX)

· Do not occupy terminals X1.5 to X8.5 of the bus module.

· Connect relay with 24 V DC coil voltage for free use.

· The idle circuit is integrated. The drive current is max. 120 mA per output.

· By this it is possible to switch cubicle fans, anti-condensation heating, circuit
  breakers or control lamps, for example via the bus.
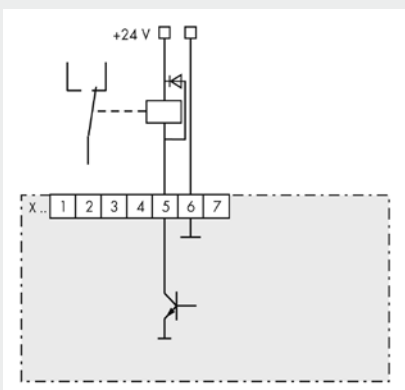
RELAY CONTROL

4.4 MONITORING

4.4.1 SETTING NODE GUARDING

· Set parameters „Guard Time" and „Life Time Factor".

EXAMPLE
Set parameter „Guard Time" to 1000 ms.
· A Node Guarding telegram is sent every second.

Set parameter „Life Time Factor" to 4.
· A monitoring time of 4 seconds is set. Monitoring is started after the first Node Guarding telegram is received. If no Node Guarding telegram is received in the next 4 seconds, the bus module switches to error state.

4.4.2 SETTING HEARTBEAT PRODUCER

Initialise object 0x1017 with the heartbeat time [ms].
· The service is active. The bus module sends a heartbeat telegram in cycles.

4.4.3 SETTING HEARTBEAT CONSUMER

· Initialise object 0x10016:1 with the node ID of the device to be monitored and the heartbeat time [ms].

EXAMPLE
· Initialise object 0x1016:1 with 0x0603E8.
· Receipt of the heardbeat telegram from the device with node ID 6 is monitored every 1000 ms (0x3E8). Monitoring is started after the first heartbeat telegram is received. If no heartbeat telegram is received in the next 1 second, the bus module switches to error state.

4.5 CONFIGURING THE MASTER

The bus module has an EDS configuration file. This file contains all the information on setpoints, actual values and parameters that are supported by the bus module.
· Make the EDS configuration file available to the master.

5. INSTALLATION

DANGER
Dangers during installation
Risk of injury/risk of damage to the device or plant
· Observe all safety regulations in the safety chapter.

5.1 CONNECTION TERMINALS (OVERVIEW)

TERMINAL		DESCRIPTION
X11	.1	24V (+)
	.2	24V (Ground)
	.3	Earthing
X1 - X8	.1	Total ground connected
	.2	RxD
	.3	TxD
	.4	Ground
	.5	Individually connectable ground
	.6	Ground
	.7	Ground potential for shield connection
X20		RS232

Connection diagram see chapter 7.

CONNECTION TERMINAL (OVERVIEW)

5.2 CONNECTING 24 V POWER SUPPLY

· Switch off mains supply incl. external 24 V voltage source and secure against accidentally being switched back on.

· Connect external 24 V DC voltage source (150 mA) to X11.1 (+) and X11.2 (ground) (polarity protection).

· Keep grounding to terminal X11.3 as short as possible (EMC reasons).

NOTE
24V DC supply
Several bus modules can be operated with one power
supply.
· Make 24 V DC supply earth-free in SELV cases.

5.3 CONNECTING POWER CONTROLLER TO X1-X8

· Switch off mains supply incl. external 24 V voltage source and secure against
  accidentally being switched back on.
· Connect interfaces X1 to X8 of the bus module to the system interfaces of
  the power controller (4-wire shielded cable).

NOTE
Characteristics of the system interface
· The transmission rate is 38 400 Baud.
· The asynchronous characters are transmitted with 8 bits, no parity and one
  stop bit.
· The protocol starts with STX, followed by an ID and the data, and is ended
  with a check sum.
· Faulty protocols are ignored

5.4 CONNECTING THE BUS MODULE TO THE MASTER

· Switch off mains supply incl. external 24 V voltage supply and secure against
  accidentally being switched back on
· Make the CANopen connection to X20 using a 9-pin Sub-D connector. Fit
  both ends of the bus cable with termination resistors of 120 Ω.
· The connection provides data lines CAN_L and CAN_H.
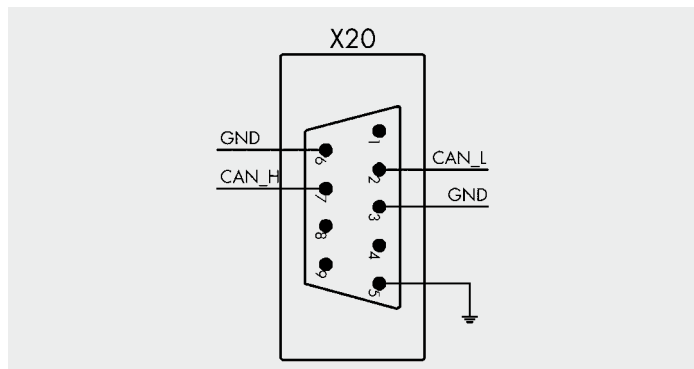
6. OBJECT DIRECTORY

The objects are divided into areas.

AREAS	OBJECT INDEX
Bus module	2000 - 20FF
Power controller on X1	2100 - 21FF
Power controller on X2	2200 - 22FF
Power controller on X3	2300 - 23FF
Power controller on X4	2400 - 24FF
Power controller on X5	2500 - 25FF
Power controller on X6	2600 - 26FF
Power controller on X7	2700 - 27FF
Power controller on X8	2800 - 28FF

OBJECT ASSIGNMENT OF THE BUS MODULE

For the objects of a power controller, the index is indicated in the form 2x00.
The x stands for the port number.

6.1 OBJECTS OF THE BUS MODULE

General information on the bus module (e.g. detecting the stations) can be read out and settings made.

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 1A	11	43	299

DEVICE TYPES

INDEX	NAME	VALUE RANGE	COMBO-OPT.	R/W* Thyro-S	R/W* Thyro-A/ Thyro-AX
2000	Device type at port 1	5, 9, 10, …	S, 1A, 2A,..	r	r
2001	Device type at port 2	5, 9, 10, …	S, 1A, 2A,..	r	r
2002	Device type at port 3	5, 9, 10, …	S, 1A, 2A,..	r	r
2003	Device type at port 4	5, 9, 10, …	S, 1A, 2A,..	r	r
2004	Device type at port 5	5, 9, 10, …	S, 1A, 2A,..	r	r
2005	Device type at port 6	5, 9, 10, …	S, 1A, 2A,..	r	r
2006	Device type at port 7	5, 9, 10, …	S, 1A, 2A,..	r	r
2007	Device type at port 8	5, 9, 10, …	S, 1A, 2A,..	r	r
2008	Device connected	Bit 0-7	Bit 0 = 1 Thyro connected to X1	r	r
2009	Version year (Bus module)	0...9999		r	r
200A	Version month (Bus module)	1...12		r	r
200B	Version day (Bus module)	1...31		r	r
200D	Number of act. val. from which mean value is taken	1...20**		r/w	r/w
200E	Digital outputs X1.5 - X8.5	Bit 0-7***		r/w	r/w

PARAMETERS OF THE BUS MODULE

*r=read; r/w=read + write ** Default = 1 *** Default = 0

6.2 OBJECTS OF THE POWER CONTROLLER

DESIGNATION	FIGURE RANGE
UNSIGNED 16	0-65000
REAL32	0-1E6

FIGURE RANGES

INDEX	SETPOINT	FIGURE RANGE	UNIT	R/W** Thyro-S	R/W** Thyro-A/Thyro-AX
2x00	Setpoint Terminal	UNSIGNED16	4096 == 100[%]	r	r
2x04	Setpoint Master	UNSIGNED16	4096 == 100[%]	r/w	r/w
2x07	Total Setpoint	UNSIGNED16	4096 == 100[%]	r	r
2x0C	Setpoint Active	UNSIGNED16	Bit 0 = 1 (Setpoint Terminal active), Bit 1 = 1 (Setpoint Master active)	r	r
*					

* Default setting = 1   **r=read; r/w=read + write

SETPOINTS OF THE POWER CONTROLLER

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

INDEX	ACTUAL VALUES	FIGURE RANGE	UNIT	R/W**		RESTRICTIONS
				Thyro-S	Thyro-A/ Thyro-AX	
2x10:1	Main voltage L1	UNSIGNED16	V	r	r	
2x10:2	Main voltage L2	UNSIGNED16	V	r	r	only Thyro-A 3A/Thyro-AX 3A
2x10:3	Main voltage L3	UNSIGNED16	V	r	r	only Thyro-A 2A/Thyro-AX 2A and Thyro-A 3A/Thyro-AX 3A
2x11:1	Load voltage L1	UNSIGNED16	0,1V	r	r	
2x11:2	Load voltage L2	UNSIGNED16	0,1V	r	r	only Thyro-A 3A/Thyro-AX 3A
2x11:3	Load voltage L3	UNSIGNED16	0,1V	r	r	only Thyro-A 2A/Thyro-AX 2A and Thyro-A 3A/Thyro-AX 3A
2x12:1	Load current L1	UNSIGNED16	0,1A	r	r	not for H1 types
2x12:2	Load current L2	UNSIGNED16	0,1A	r	r	only Thyro-A 3A/Thyro-AX 3A
2x12:3	Load current L3	UNSIGNED16	0,1A	r	r	only Thyro-A 2A and Thyro-A 3A
2x13:1	Load power L1	REAL32	W	r	r	only Thyro-A ...H RLP1/...H RLP2
2x13:2	Load power L2	REAL32	W	r	r	only Thyro-A 3A 3A...H RLP1/ 3A...H RLP2
2x13:3	Load power L3	REAL32	W	r	r	only 2A, 3A...H RLP1/2A, 3A...H RLP2
2x13:4	Total power	REAL32	W	r	r	only Thyro-A ...H RLP1/...H RLP2
2x18	Phase angle alpha	UNSIGNED16	0,01 °el	r	r	
2x19	Switch on time T_s	UNSIGNED16	Period	r	r	
2x1A	Main period duration	UNSIGNED16	s	r	r	
2x1B	Temperature	UNSIGNED16	°C	r	r	
2x20	Error	UNSIGNED16	Tab. see chapter 6.3	r	r	
2x21	Status	UNSIGNED16	Tab. see chapter 6.3	r	r	

*r=read; r/w=read + write

ACTUAL VALUES OF THE POWER CONTROLLER

INDEX	SYMBOL	NAME	VALUE RANGE	MEANING	UNIT	R/W** Thyro-S	R/W** Thyro-A/ Thyro-AX	DEFAULT	NOTE
2X40	GER	Device type	5, 9, 10	Thyro-S, Thyro-A 1A, Thyro-A 2A, Thyro-AX 1A, Thyro-AX 2A		r	r	Type-dep.	
2X41	I_TYP	Controller type current	0...1000A		A	r	r	Type-dep.	
2X42	U_TYP	Controller type voltage	0...1000V		V	r	r	Type-dep.	
2X43	P_TYP	Controller type power	0...500KW		W		r	Type-dep.	only HRLP1/ HRLP2
2X44	TRANSFOR-MER	Hardware options	0...65535	Bit coded		r	r	Type-dep.	
2X45	BETR	Operating mode Thyro-A/Thyro-AX	0...3	res, TAKT, VAR, QTM			r/w**	TAKT	S1.1-2
2X46	BETR	Operating mode Thyro-S	0...4	OFF, 1/5, 1/3, 1/2, 1/1		r		1/1	S1.1-2
2X47	AN1	Phase angle of 1. half wave	0...100		°el		r/w**	60°el	R201
2X48	SST	Soft start time	0...100		Period		r/w**	6 periods	R201

*r=read; r/w=read + write; **Exception Thyro-Tool mode; *** Depends on control type (please refer to note on page 36)

PARAMETERS OF THE POWER CONTROLLER

INDEX	SYMBOL	NAME	VALUE RANGE	MEANING	UNIT	R/W** Thyro-S	R/W** Thyro-A/ Thyro-AX	DEFAULT	NOTE
2X4A	T0	Cycle period	1...1000		Period	r	r/w**	50 Per.	R201
2X4B	TSMAX	Maximum cycle on time	1...T0		Period		r/w	50 Per.	
2X4C	TSMIN	Minimum cycle on time	0...T0		Period		r/w	0 periods	
2X4D	MP	Min. switch off time	0...10		Period		r/w**	3 periods	R201
2X4E	SYNC_ ADR	Synchronous cycle address	0...65535		Period /2		r/w	100	
2X4F	RE	Control	0...6	U_{load}^2, $U_{load\,eff}$, I_{load}^2, $I_{load\,eff}$ res., Real Power (P) res. res. Without regulation		r/w**	U_{load}^2	S1.3-5 power only for ...H RLP1/ ...H RLP2	
2X50	TI_1	PID controller I part	0 = off 0...4369				r/w	20	
2X51	KP_1	PID controller P part numerator	0 = off 0...13107				r/w	60	
2X52	KR_1	PID controller P part denominator	0...65535				r/w	5	

*r=read; r/w=read + write; **Exception Thyro-Tool mode; *** Depends on control type (please refer to note on page 36)

PARAMETERS OF THE POWER CONTROLLER

INDEX	SYMBOL	NAME	VALUE RANGE	MEANING	UNIT	R/W**		DEFAULT	NOTE
						Thyro-S	Thyro-A/ Thyro-AX		
2X54	UEMA	Maximum r.m.s. voltage setpoint	0...1000		V		r/w***	440V	R202***
2X55	IEMA	Maximum r.m.s. current setpoint	0...10000	0,1A			r/w***	110A	R203
2X56	PMA	Maximum power setpoint	0...		W		r/w***		R202***
2X57	V_IE	Front pulse limit position	0...180°el		°el		r/w	180°el	
2X58	H_IE	Back pulse limit position	0...180°el		°el		r/w	0°el	
2X59	MOSI_FA	Peak load value limit	0...4505		LSB		r/w	Type	
2X5A	STA_RE	Control start terminal	0...65535		20/ 4096mA 10/ 4096V		r/w***		S1.6
2X5B	STE_RE	Control end terminal	0...65535	0...20mA 0...10V	20/ 4096mA 10/ 4096V		r/w		
2X4C	MITTEL	Averaging	0...65535				r/w	100	
2X5D	DAC1_CTRL	Analog output 1 configuration	0...65535	Bit-coded		r/w	r/w		

PARAMETERS OF THE POWER CONTROLLER

*r=read; r/w=read + write; **Exception Thyro-Tool mode; *** Depends on control type (please refer to note on page 36)

| INDEX	SYMBOL	NAME	VALUE RANGE	MEANING	UNIT	R/W** Thyro-S	Thyro-A/ Thyro-AX	DEFAULT	NOTE
2X5E	OF	Analog output 1 offset	0...4096		4096 =20mA 4096 =10V		r/w**	0mA	S9
2X5F	FA	Analog output 1 scale	1...4096		1/819		r/w**	1	R204
2X66	SPG_MIN	Mains voltage monitor min.	0...1000V		V	r/w	r/w		
2X67	SPG_ MAX	Mains voltage monitor max.	0...1000V		V	r/w	r/w		
2X68	UN_S	Undercurrent monitor	0...1	OFF, ON		r	r/w**	OFF	R205
2X6A	LAST-BRUCH_ MIN_ABS	Load fault min.. value ABS	0..65535 4096=100%		LBS	r	r/w**	0	R205
2X6D	RELAIS_ CTRL2	Relay configuration 2	0..65535	Bit-coded			r/w	0	
2X6E	IMAB	Impulse cut off at fault	0..65535	Bit-coded		r/w	r/w	307	
2X70	VERS_Y	Version year	0...9999			r	r		
2X71	VERS_M	Version month	1...12			r	r		
2X27	VERS_T	Version day	1...31			r	r		
2X73	NR_GER	Unit no.				r	r		

PARAMETERS OF THE POWER CONTROLLER

*r=read; r/w=read + write; **Exception Thyro-Tool mode; *** Depends on control type (please refer to note on page 36)

INDEX	SYMBOL	NAME	VALUE RANGE	MEANING	UNIT	R/W** Thyro-S	R/W** Thyro-A/ Thyro-AX	DEFAULT	NOTE
2x74	NR_LFD	Consecutive no.				r	r		
2x75	NR_LK	PCB				r	r		
2x80		Regulator suppressor	0...1	OFF, ON			r/w	OFF	
2x81		Save	0...1	OFF, SAVE		r/w	r/w	OFF	

PARAMETERS OF THE POWER CONTROLLER

*r=read; r/w=read + write; **Exception Thyro-Tool mode; *** Depends on control type
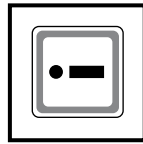
NOTE

Explanation on column „Note"

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 **)

Exceptions:

** In Thyro-Tool mode (Switch S1.3-5 to ON), the values are not determined by the switches and potentiometers; the saved values are used.

*** The assignment of the parameters to the potentiometer depends on the control type selected.
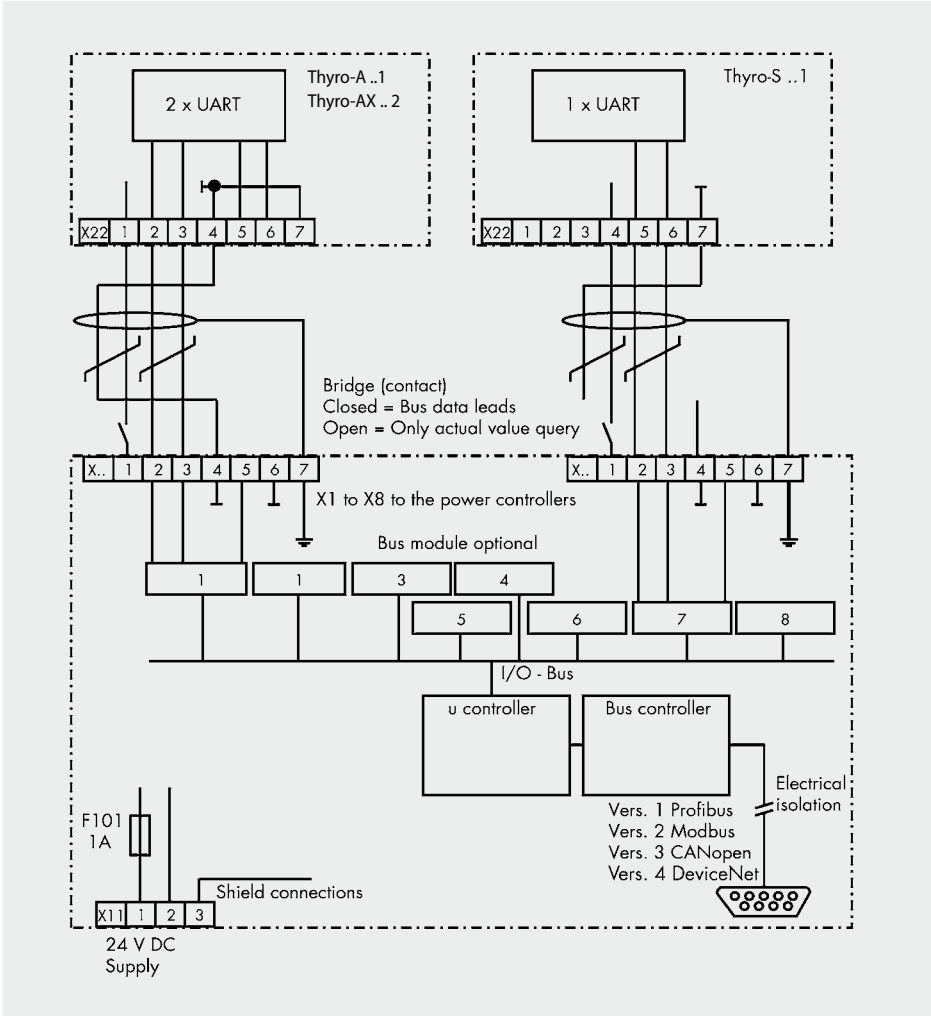
6.3 STATUS AND ERROR TRANSMISSION

DESCRIPTION Thyro-S, Thyro-A and Thyro-AX	Bit	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 a. 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	----

ERROR FLAGS (ERROR 2X20)

| DESCRIPTION | | Thyro-A/Thyro-AX | | Thyro-S | |
Thyro-S, Thyro-A and Thyro-AX	Bit	LEDs	Relay**	LEDs	Relay*
Pulse blocking active (bridge X2.1-X2.2 open)	Bit0	Pulse Inhibit LED on	energised	none	energised
Mains frequency is 60Hz	Bit2	none	energised	none	energised
U limiting active	Bit4	Pulse Inhibit LED a. Load Fault LED flash slowly alternately	energised	only with Thyro-A/ Thyor-AX	----
I limiting active	Bit5	Pulse Inhibit LED a. Load Fault LED lash slowly alternately	energised	only with Thyro-A/ Thyor-AX	----
P limiting active	Bit6	Pulse Inhibit LED a. Load Fault LED flash slowly alternately	energised	only with Thyro-A/ Thyor-AX	----
Relay status (0=Relay off / 1=Relay on)	Bit8	none	on/off	none	on/off
Busmodul active (0 = no bus module/ 1= bus module 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 2A or 3A)	Bit15	Pulse Inhibit LED a. Test LED flash slowly simultaneously	energised	only with Thyro-A/ Thyor-AX	----

ERROR FLAGS (ERROR 2X21)

* 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 HRL1, HRLP1, HRL2 or HRLP2 device, not in the H1 types.

7. CONNECTION DIAGRAMS

Bus setpoint

Digital setpoint input

Thyro-S

X22 4   X22 1

Thyro-S

X22 4   X22 1

*

ON/OFF setpoint

* not connected

Bus setpoint / Digital setpoint input

Thyro-S

X22 4   X22 1

Setpoint 1 ON/OFF

Bus setpoint / Digital setpoint input

Thyro-S

X22 4   X22 1

Setpoint 2 ON/OFF

Bus setpoint / Digital setpoint input

Thyro-S

X22 4   X22 1

Setpoint 8 ON/OFF

X1 1 ....

X2 1 ....

X8 1 ....

Group switchover   Bus setpoint / Digital setpoint input   Parameter

Bus setpoint / Digital setpoint input

Thyro-S

X22 4   X22 1

Setpoint 1 ON/OFF

Bus setpoint / Digital setpoint input

Thyro-S

X22 4   X22 1

Setpoint 2 ON/OFF

Bus setpoint / Digital setpoint input

Thyro-S

X22 4   X22 1

Setpoint 8 ON/OFF

X1 5 ....

X2 5 ....

X8 5 ....

Parameter Bit 0

Parameter Bit 1

Parameter Bit 7

Selective switchover   Bus setpoint / Digital setpoint input

CONNECTION DIAGRAM Thyro-S

40

CONNECTION DIAGRAM Thyro-A/Thyro-AX

8. HELP IN THE EVENT OF PROBLEMS

The devices delivered correspond to quality standard ISO 9001. Should you experience any malfunctions or other problems, please contact our Advanced Energy team for assistance (see chapter CONTACT INFORMATION).

We have listed a few tips below for troubleshooting:

No communication (Master bus module)
> Check DIP switch setting.
> Check X2 connection.

No communication with power controller
(Parameters of the individual power controllers = 0)
> Check the supply voltage of the power controller (incl. additional electronics supply if present).
> Check connection between power controller and bus module.

Setpoint definition by bus module / master does not function
> Check whether the digital setpoint is active (Index 2x0c=2)
Otherwise:
> Check digital setpoint definition (see chapter 4.3: Setting setpoint processing)

9. TECHNICAL DATA

Voltage supply	24 VDC (+/-20%) 150 mA
Possible bus addresses	1 to 127, 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

10. DIMENSIONAL DRAWING

Phoenix EMG 150 housing, 150 x 75 mm without connector upper parts, recommended space
requirement: 150 x 150 mm

DIMENSIONAL DRAWING
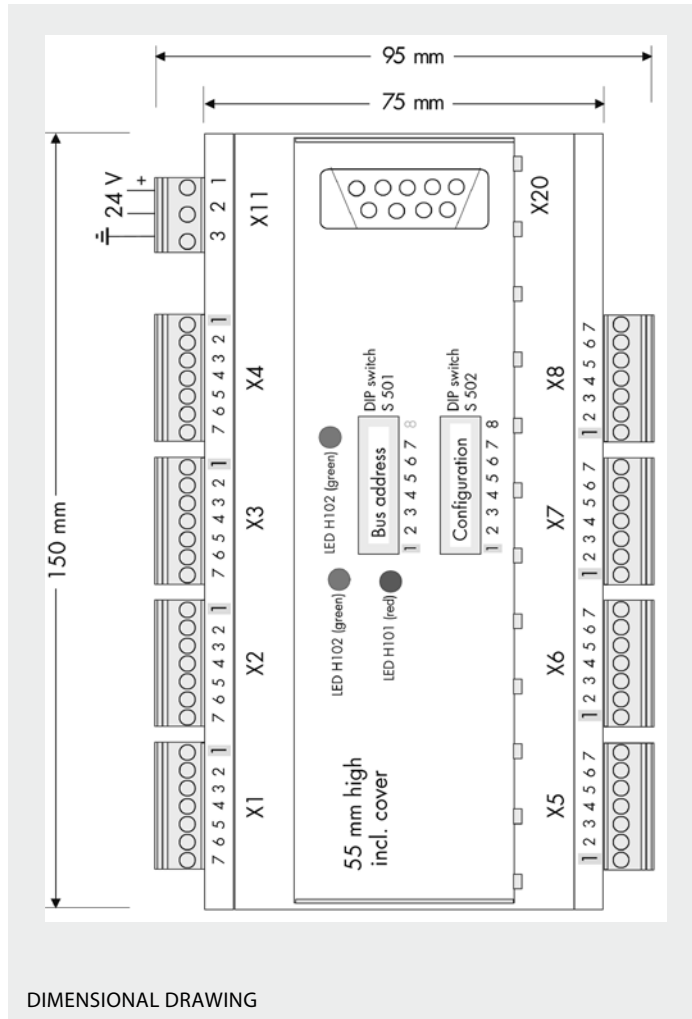
11. ACCESSORIES AND OPTIONS

Shielded cables with preassembled bus module connectors are available.
A cable set consists of 4 connection cables of the same length to connect 4
power controllers.
Order no. 2000 000 848 Bus module connection cable for 4 power
controllers, 2.5 m
Order no. 2000 000 849 Bus module connection cable for 4 power
controllers, 1.5 m

12. 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℃ – +55℃
Transport temperature (E)		-25℃ – +70℃
Operating temperature (better B)	-10℃ – +55℃	
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
Index of protection	IP00	DIN EN 69 529
Protection class	III	DIN EN 50 178 ch. 3
Mechanical jolt		DIN EN 50 178 ch. 6.2.1
Tests in acc. with		DIN EN 60 146-1-1 4.
EMC emitted interference		EN 61000-6-4
Radio interference supression		
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

ΔΞ ADVANCED ENERGY®

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

[Advanced Energy](#):

  [2000000843](#)