ADVANCED ENERGY®

BUSMODUL DEVICENET

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

July 2014 DE/EN - V3

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

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1. GENERAL

This bus module is for controlling Advanced Energy thyristor power controllers over DeviceNet. 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 DeviceNet bus module can connect up to 8 Thyro-AX...2, Thyro-A...1 or Thyro-S...1 power controllers in any combination to a DeviceNet scanner. 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 DeviceNet 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 non-industrial applications are not included in these operating instructions.

1.1 TYPE DESIGNATIONS/VALIDITY

These operating instructions describe the bus module DeviceNet (Order No. 2000 000 844). 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 SPECIFIC FEATURES

- The bus module is a slave component with DeviceNet functionality.
- Function control via modulo and network LED
- 8 free application outputs X1 to X8 in each case terminal 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 WARRANTY

In the event of any claims in connection with the DeviceNet, 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.

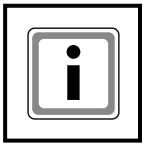
CAUTION
Dangers that can lead to minor damage to property.

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.



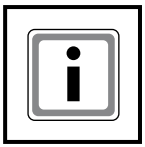
NOTE
Content of note

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 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 opera-tion 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 12, 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 vol-tage 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, for instance, by jolts, knocks and contamination.

3. FUNCTIONS

3.1 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. For this the setpoint is interpreted as operating mode (Table 8.2).

Use setpoint from bus module only if an IO-Connection is established.
> Connect terminal X22.4 of the power controller to one of the terminals X1.1 to X8.1 of the bus module.
– If an IO-Connection is established the setpoint master is used.
If not, the analog signal from control terminal X22.1 is used as setpoint (on/off).

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 between master setpoint and terminal X22.1.

3.2 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.

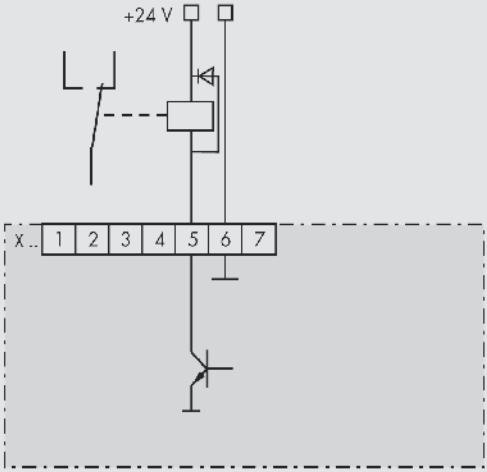
Setpoint from bus module
> Connect ground to terminal X22.1 of the power controller.
– The master setpoint of the bus module is used.

Setpoint from bus module only if an IO-Connection is established
> Connect terminal X22.1 of the power controller to one of the terminals X1.1 to X8.1 of the bus module.
– If an IO-Connection is established the setpoint master is used. If not, the analog signal from control terminal X2.4 is used as setpoint.

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 between master setpoint and terminal X2.4.

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



RELAY CONTROL

4. INSTALLATION

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

4.1 CONNECTION TERMINALS (OVERVIEW)

TERMINAL		DESCRIPTION
X11	.1	24 V (+)
	.2	24 V (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	.1	V-
	.2	CAN_L
	.3	Shield
	.4	CAN_H
	.5	V+

TAB. 4.1 CONNECTION TERMINALS (OVERVIEW)

For further details see chapter 10 Connection diagram

4.2 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

4.3 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.

Attention: For control of all parameter over DeviceNet it is recommend that the Thyro-A/Thyro-AX switches S1.3, S1.4, S1.5 are closed (Thyro-Tool mode).

4.4 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 DeviceNet connection to X20 using a 5-pin open-style connector. Fit both ends of the bus cable with termination resistors of 120 Ω. The DeviceNet cable selection, cable routing, shielding, bus connec-tor, bus termination and transmission times are all described in the "Device-Net specification, volumes I, II", published by ODVA. For connection to the DeviceNet we deliver with the card a standard openstyle connector. Figure 4.1 shows how to connect the bus module to the DeviceNet.

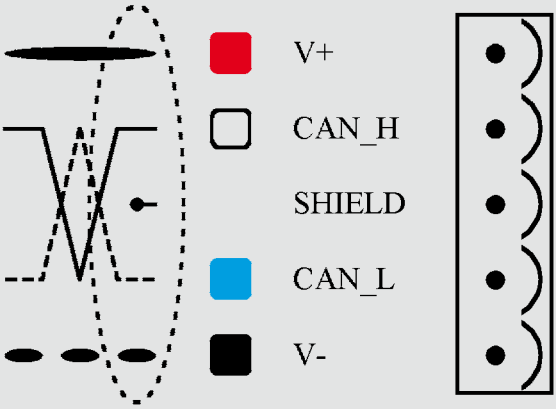


FIG. 4.1 WIRING CONNECTION

5. SETUP

5.1 SETUP THE SLOTS COUNT

With the rotary switch "Slots" the number of power controllers has to be set. After changing the switch "Slots" and power on, the bus module reads all parameters from the power controllers and saves it into nonvolatile memory. After reading the parameter the device starts to communicate via DeviceNet. Therefore all power controllers must be connected und switched on at the first time.
If one power controller is not correctly connected or has no supply the Fault LED starts to flash. The number of flashes reflects the port where the error is. For example when the LED is repeatedly flashing twice the power controller at X2 is not connected and has no power supply.

Attention: The rotary switch "Slots" take effect at the time of power-up. Changes to the switch settings of a powered device do not take effect until the next power-up.
To restart this procedure
- Change the switch "Slots" to a different position
- Switch the power supply on for 2 seconds
- Change the switch "Slots" to the correct position
- Switch the power supply on.

5.2 SETUP THE NODE ADDRESS

All devices connected to the DeviceNet bus must have a unique node address (NA), ranging from 0 to 63 (decimal). The node address can be set by the rotary switches "MSD" and "LSD". Every address greater than 63 will be interpreted as node address 63.

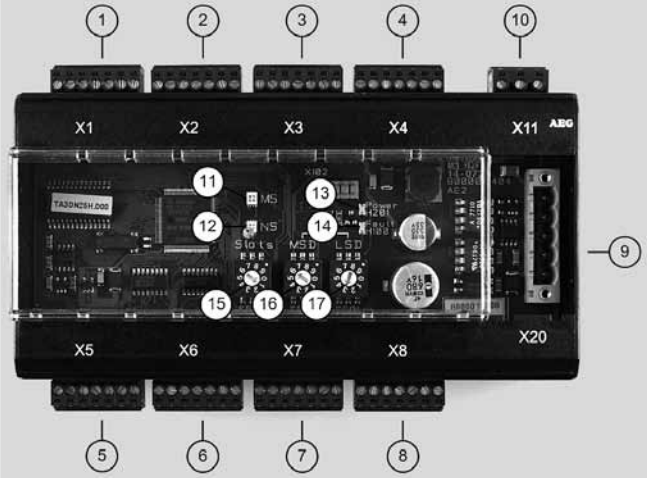


FIG. 5.1 CONFIGURATION & LEDS

1 Terminal X1
2 Terminal X2
3 Terminal X3
4 Terminal X4
5 Terminal X5
6 Terminal X6
7 Terminal X7
8 Terminal X8
9 Terminal X20 DeviceNet
10 Terminal X11
11 Module status LED
12 Network status LED
13 Power LED
14 Fault LED
15 Switch Slots
16 Switch node address MSD
17 Switch node address LSD

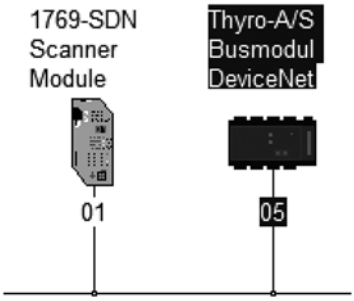
The node address cannot be changed via DeviceNet.

5.3 SETUP THE COMMUNICATION SPEED

This device detects the communication speed of the DeviceNet. So no adjustment has to be made. The communication speed 125, 250 and 500 kBaud are supported.

5.4 DEVICENET SCANNER AND BUS MODULE SETUP

Software configuration of the DeviceNet network and the associated DeviceNet master requires an EDS file (electronic data sheet) for configuring each DeviceNet node. Therefore, register the EDS-file, which is delivered with the bus module, with the configuration tool. After installing the EDS file scan the network for any attached nodes.



Next step is to upload the parameter of the bus module. For this open the bus module properties, click on tab "Module Configuration". In the dialog (figure 5.2) click on upload.

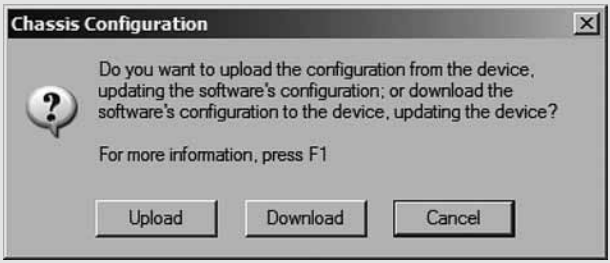


FIG. 5.2 UP-/DOWNLOAD CHASSIS CONFIGURATION

Attention: First of all the user should always initiate an upload before starting any setting-up operation (DeviceNet scanner and bus module).
After uploading the parameter a dialog is shown, like figure 5.3.

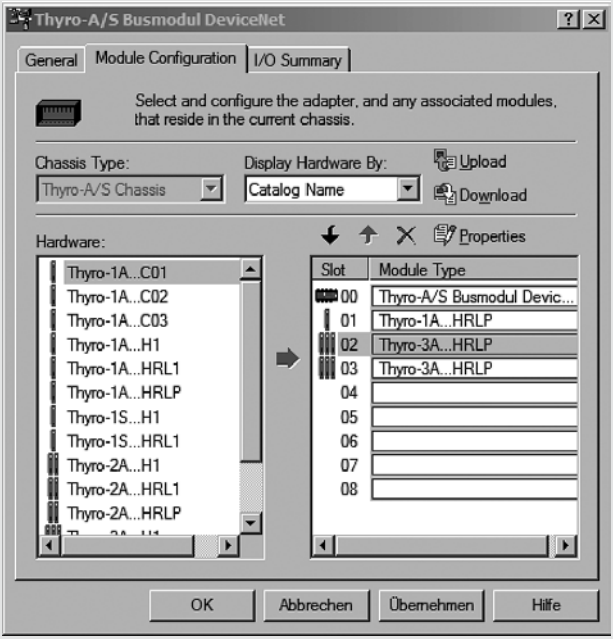


FIG. 5.3 MODULE CONFIGURATION

The slot 00 is always "Thyro-A/S Bus module DeviceNet" (also valid for Thyro-AX). Slot 1-8 depends on the rotary switch "Slots" see chapter 5.1 . In our example we have just 3 power controllers.

For configuration choose the device and click on properties. After changing, the parameter will be stored in non-volatile memory inside the bus module.

Next step is to configure the scanner. Therefore all nodes have to be added to the scanner's scan list. Then for every node the IO-Parameters has to be set. Chapter 8 describes the IO- Parameters. After downloading the configuration to the scanner, the bus module is ready for communication.

6. OBJECT SPECIFICATIONS

6.1 0X01 IDENTITY OBJECT

This object provides identification of and general information about the device.

ATTR ID	ACCESS RULE	NAME	DATA TYPE	DESCRIPTION OF ATTRIBUTE	SEMANTICS OF VALUES	DEFAULT
1	Get	Revision	UINT	Revision of this object.	If updates that require an increase 1 in this value are made, then the value of this attribute increases by 1.	1
2	Get	Max Instance	UINT	Maximum instance number of an object currently created in this class level of the device.	The largest instance number of a created object at this class hierarchy level.	1

TAB. 6.1 IDENTITY OBJECT CLASS ATTRIBUTES

ATTR	ACCESS RULE	NAME	DATA TYPE	DESCRIPTION OF ATTRIBUTE	DEFAULT
1	Get	Vendor ID	UINT	Identification of vendor by number	1017
2	Get	Device Type	UINT	Indication of general type of product. This device is a communications adapter.	12
3	Get	Product Code	UINT	Identification of a particular product of an individual vendor	3
4	Get	Revision	STRUCT of:	Revision of the item the Identity Object represents.	
		Major Revision	USINT		1
		Minor Revision	USINT		1
5	Get	Status	WORD	Summary status of device	1
6	Get	Serial Number	DINT	Serial number of device	1
7	Get	Product Name	SHORT_ STRING	Human-readable identification	Busmodule DeviceNet Thyro-S/Thyro-A/ Thyro-AX
8	Get	State	USINT	Present state of the device	
10	Get/Set	Heartbeat Interval	USINT	The nominal interval between heartbeat messages in seconds	0

TAB. 6.2 IDENTITY OBJECT INSTANCE ATTRIBUTES

SERVICE CODE	SUPPORTED CLASS	SUPPORTED INSTANCE	SERVICE NAME	DESCRIPTION OF SERVICE
0x0E	Yes	Yes	Get_Attribute_Single	Returns the content of the specified attribute.
0x10	N/A	Yes	Set_Attribute_Single	Modifies a DeviceNet Object attribute value.
0x05	N/A	Yes	Reset	Invokes the Reset service for the device.

TAB. 6.3 IDENTITY OBJECT SERVICES

6.2 0X02 MESSAGE ROUTER OBJECT

The Message Router is implemented as an Object that has no externally visible Attributes or Services. It only implements a behavior.

6.3 0X03 DEVICENET OBJECT

The DeviceNet Object provides the configuration and status of a DeviceNet port.

ATTR ID	ACCESS RULE	NAME	DATA TYPE	DESCRIPTION OF ATTRIBUTE	SEMANTICS OF VALUES	DEFAULT
1	Get	Revision	UINT	Revision of the DeviceNet Object Class Definition upon which the implementation is based.	If updates that require an increase in this value are made, then the value of this attribute increases by 1.	2

TAB. 6.4 DEVICENET OBJECT CLASS ATTRIBUTES

ATTR	ACCESS RULE	NAME	DATA TYPE	DESCRIPTION OF ATTRIBUTE	DEFAULT
1	Get/Set	MAC ID	USINT	Node address.	
2	Get/Set	Baud Rate	USINT	Baud rate.	
3	Get/Set	BOI			
	BOOL	Bus-Off interrupt.			
4	Get/Set	Bus-Off Counter	USINT	Number of times DeviceNet went to the Bus–Off state.	
5	Get	Allocation Information	STRUCT of:		
		Allocation Choice Byte	BYTE	Refer to DeviceNet specification.	
		Master's MAC ID	USINT	MAC ID of Master (from Allocate).	

TAB. 6.5 DEVICENET OBJECT INSTANCE ATTRIBUTES

SERVICE CODE	SUPPORTED CLASS	SUPPORTED INSTANCE	SERVICE NAME	DESCRIPTION OF SERVICE
0x0E	Yes	Yes	Get_Attribute_Single	Returns the content of the specified attribute.
0x10	N/A	Yes	Set_Attribute_Single	Modifies a DeviceNet Object attribute value.
0x4B	N/A	Yes	Allocate_Master/Slave_ Connection_Set	Requests the use of the Predefined Master/Slave Connection Set.
0x4C	N/A	Yes	Release_Group_2_ Identifier_Set	Indicates that the specified connections within the Predefined Master/Slave Connection Set are no longer desired. These connections are to be released (Deleted).

TAB. 6.6 DEVICENET OBJECT SERVICES

6.4 0X04 ASSEMBLY OBJECT

The Assembly Object binds attributes of multiple objects, which allows data to or from each object to be sent or received over a single connection.

ATTR ID	ACCESS RULE	NAME	DATA TYPE	DESCRIPTION OF ATTRIBUTE	SEMANTICS OF VALUES	DEFAULT
1	Get	Revision	UINT	Revision of this object.	If updates that require an increase in this value are made, then the value of this attribute increases by 1.	2
3	Get	Number of Instances	UINT	Number of object instances currently created at this class level of the device.	The number of object instances at this class hierarchy level.	6

TAB. 6.7 ASSEMBLY OBJECT CLASS ATTRIBUTES

ATTR	ACCESS RULE	NAME	DATA TYPE	DESCRIPTION OF ATTRIBUTE	DEFAULT
3	Get	Data	ARRAY	The data contained in the assembly object (Assembly).	

TAB. 6.8 ASSEMBLY OBJECT INSTANCE ATTRIBUTES

SERVICE CODE	SUPPORTED CLASS	SUPPORTED INSTANCE	SERVICE NAME	DESCRIPTION OF SERVICE
0x0E	Yes	Yes	Get_Attribute_Single	Returns the content of the specified attribute.

TAB. 6.9 ASSEMBLY OBJECT SERVICES

6.5 0X05 CONNECTION CLASS

CONNECTION INSTANCE ID	CONNECTION
1	Explicit Connection
2	Polled I/O Connection
3	COS/Cyclic I/O Connection
4-8	Dynamic Explicit Connections

TAB. 6.10 CONNECTION CLASS INSTANCES

ATTR ID	ACCESS RULE	NAME	DATA TYPE	DESCRIPTION OF ATTRIBUTE	SEMANTICS OF VALUES	DEFAULT
1	Get	Revision	UINT	Revision of this object.	If updates that require an increase in this value are made, then the value of this attribute increases by 1.	1

TAB. 6.11 CONNECTION CLASS ATTRIBUTES

ATTR ID	ACCESS RULE	NAME	DATA TYPE	DESCRIPTION OF ATTRIBUTE
1	Get	State	USINT	State of the object.
2	Get	Instance_type	USINT	Indicates either I/O or Messaging Connection
3	Get/Set[4]	TransportClass_ trigger	BYTE	Defines behavior of the Connection.
4	Get/Set[4]	DeviceNet_ produced_ connection_id	UINT	Placed in DeviceNet Identifier Field when the Connection transmits on a DeviceNet subnet. Described in Vol. 3, DeviceNet Adaptation of CIP.
5	Get/Set[4]	DeviceNet_ consumed_ connection_id	UINT	DeviceNet Identifier Field value that denotes message to be received on a DeviceNet subnet. Described in Vol. 3, DeviceNet Adaptation of CIP.
6	Get14/ Set[4]	DeviceNet_ initial_comm_ characteristics	BYTE	Defines the Message Group(s) across which productions and consumptions associated with this Connection occur on a DeviceNet subnet. Described in Vol. 3, DeviceNet Adaptation of CIP.
7	Get	Produced_ connection_size	UINT	Maximum number of bytes transmitted across this Connection.
8	Get	Consumed_ connection_size	UINT	Maximum number of bytes received across this Connection.
9	Get/Set	Expected_ packet_rate	UINT	Defines timing associated with this Connection
12	Get	Watchdog_ timeout_action	USINT	Defines how to handle Inactivity/Watchdog timeouts
13	Get	Produced_ connection_ path_length	UINT	Number of bytes in the produced_connection_path attribute
14	Get/Set[2 3 4]	Produced_ connection_path	Packed EPATH	Specifies the Application Object(s) whose data is to be produced by this Connection Object. See Appendix C.
15	Get	Consumed_ connection_ path_length	UINT	Number of bytes in the consumed_connection_path attribute
16	Get/Set[2 3 4]	Consumed_ connection_path	Packed EPATH	Specifies the Application Object(s) that are to receive the data consumed by this Connection Object. See Appendix C.
17	Get/Set[2 3 4]	Production_ inhibit_time	UINT	Defines minimum time between new data production. This attribute is required for all I/O Client connections, except those with a production trigger of Cyclic.

TAB. 6.12 CONNECTION CLASS INSTANCE ATTRIBUTES

SERVICE CODE	SUPPORTED CLASS	SUPPORTED INSTANCE	SERVICE NAME	DESCRIPTION OF SERVICE
0x0E	Yes	Yes	Get_Attribute_Single	Returns the content of the specified attribute.
0x10	N/A	Yes	Set_Attribute_Single	Modifies a DeviceNet Object attribute value.
0x05	N/A	Yes	Reset	Used to reset the Inactivity/Watchdog Timer associated with a Connection Object. When a Connection in the Timed Out or Deferred Delete state receives a Reset request it also transitions back to the Established state.
0x08	Yes	N/A	Create	Used to instantiate a Connection Object.
0x09	N/A	Yes	Delete	Used to delete a Connection Object and to release all associated resources.
0x0D	N/A	Yes4	Apply_Attributes	Used to deliver the Connection Object to the application, which performs the set of tasks necessary to create the specified connection.

TAB. 6.13 CONNECTION CLASS SERVICES

1 Only Explicit Connection, 2 Only Polled I/O Connection, 3 Only COS/Cyclic I/O Connection, 4 Only Dynamic Explicit Connections

6.6 0X0F PARAMETER OBJECT

ATTR ID	ACCESS RULE	NAME	DATA TYPE	DESCRIPTION OF ATTRIBUTE	SEMANTICS OF VALUES	DEFAULT
1	Get	Revision	UINT	Revision of this object.	If updates that require an increase in this value are made, then the value of this attribute increases by 1.	1
2	Get	Number of Instances	UINT	Maximum instance number of an object currently created in this class level of the device.	The largest instance number of a created object at this class hierarchy level.	0
8	Get	Parameter Class Descriptor	UINT	Bits that describe parameters.		0x0C
9	Get	Configuration Assembly Instance	UINT	Instance number of the configuration assembly.	This attribute shall be set to zero if a configuration assembly is not supported.	0

TAB. 6.14 PARAMETER CLASS ATTRIBUTES

SERVICE CODE	SUPPORTED CLASS	SUPPORTED INSTANCE	SERVICE NAME	DESCRIPTION OF SERVICE
0x0E	Yes	N/A	Get_Attribute_Single	Returns the content of the specified attribute.
0x15	Yes	N/A	Restore	Restores all parameter values from non-volatile memory.
0x16	Yes	N/A	Save	Saves all parameter values to non–volatile memory.

TAB. 6.15 PARAMETER CLASS SERVICES

6.7 0X64 VENDOR SPECIFIC CLASSES OF THE BUS MODULE

These classes are for control of the bus module. It has only one instance. The following table shows an overview of all attributes. For more details refer to chapter 9.

CLASS ID	GROUPS OF ATTRIBUTES	DESCRIPTION
0x64	Configured device type	For every slot the configured power controller is shown.
	Current device type	For every slot the current connected power controller is shown.
	Bus module setup	Configuration of the bus module.

TAB. 6.16 BUS MODULE ATTRIBUTES

ATTR ID	ACCESS RULE	NAME	DATA TYPE	DESCRIPTION OF ATTRIBUTE	SEMANTICS OF VALUES	DEFAULT
1	Get	Revision	UINT	Revision of this object.	If updates that require an increase in this value are made, then the value of this attribute increases by 1.	1
2	Get	Max Instance	UINT	Maximum instance number of an object currently created in this class level of the device.	The largest instance number of a created object at this class hierarchy level.	1

TAB. 6.17 VENDOR SPECIFIC OBJECTS CLASS ATTRIBUTES

SERVICE CODE	SUPPORTED CLASS	SUPPORTED INSTANCE	SERVICE NAME	DESCRIPTION OF SERVICE
0x0E	Yes	Yes	Get_Attribute_Single	Returns the content of the specified attribute.
0x10	N/A	Yes	Set_Attribute_Single	Modifies a DeviceNet Object attribute value.

TAB. 6.18 VENDOR SPECIFIC OBJECT SERVICES

6.8 0X65-0X66 VENDOR SPECIFIC CLASSES FOR Thyro-S/Thyro-A/Thyro-AX

These two classes are for control of the Thyro-S, Thyro-A and Thyro-AX. Each class has one instance for every slot. For example, if you choose 3 slots (power controllers), then every class has 3 instances. Table 6.19 shows an overview of all attributes. For more details refer to chapter 9.

CLASS ID	GROUPS OF ATTRIBUTES	DESCRIPTION
0x65	Actual values	This values showing the actual state of the Thyro-S/Thyro-A/Thyro-AX.
	Functions	Via these output values certain functions in the Thyro-S/Thyro-A/Thyro-AX can be executed.
	Hardware	Detail description of the Thyro-S/Thyro-A/Thyro-AX hardware.
0x66	Operating mode	Configuration of the operation modes.
	Times	Specified time depending on operation mode.
	Controls	Configuration of the regulation.
	Limit	Limit configuration for voltage, current and power.
	Control characteristic	Control of the setpoint characteristic.
	Analog outputs	Configuration of the analog outputs.
	Monitoring	Monitoring of mains voltage and load.
	Miscellaneous	Some other configurations.

TAB. 6.19 Thyro-S, Thyro-A AND Thyro-AX ATTRIBUTES

ATTR ID	ACCESS RULE	NAME	DATA TYPE	DESCRIPTION OF ATTRIBUTE	SEMANTICS OF VALUES	DEFAULT
1	Get	Revision	UINT	Revision of this object.	If updates that require an increase in this value are made, then the value of this attribute increases by 1.	1
2	Get	Max Instance	UINT	Maximum instance number of an object currently created in this class level of the device.	The largest instance number of a created object at this class hierarchy level.	1-8

TAB. 6.20 VENDOR SPECIFIC OBJECTS CLASS ATTRIBUTES

SERVICE CODE	SUPPORTED CLASS	SUPPORTED INSTANCE	SERVICE NAME	DESCRIPTION OF SERVICE
0x0E	Yes	Yes	Get_Attribute_Single	Returns the content of the specified attribute.
0x10	N/A	Yes	Set_Attribute_Single	Modifies a DeviceNet Object attribute value.

TAB. 6.21 VENDOR SPECIFIC OBJECT SERVICES

7. DEVICENET STATUS LEDS

For trouble shooting the DeviceNet card has two LEDs. The meaning of these LEDs is described in the DeviceNet specifications. An LED test is performed at power-up to allow a visual inspection to be performed.

Module Status LED
This bi-color (green/red) LED provides device status. It indicates whether or not the device has power and is operating properly. Table 7.1 defines the Module Status LED states. The states shown reflect the device states specified in the Identity Object.

FOR THIS STATE	LED IS:	TO INDICATE
No Power	Off	There is no power applied to the device.
Device Operational	Green	The device is operating in a normal condition.
Device in Standby (The Device Needs Commissioning)	Flashing Green	The device needs commissioning due to configuration missing, incomplete or incorrect. The Device may be in the Standby state. Refer to the Identity Object in Volume 1, CIP Common, Chapter 5: Object Library.
Minor Fault	Flashing Red	Recoverable Fault
Unrecoverable Fault	Red	The device has an unrecoverable fault; may need replacing.
Device Self Testing	Flashing Red & Green	The Device is in Self Test. Refer to the Identity Object in Volume II for Device states.

TAB. 7.1 MODULE STATUS LED

Network Status LED
This bi-color (green/red) LED indicates the status of the communication link. Table 7.2 defines the Network Status LED states. The states shown reflect the network access state machine.

FOR THIS STATE	LED IS:	TO INDICATE
Not Powered Not On-line	Off	Device is not on-line. - The device has not completed the Dup_MAC_ID test yet. - The device may not be powered, look at Module Status LED.
On-line, Not Connected	Flashing Green	Device is on–line but has no connections in the established state. - The device has passed the Dup_MAC_ID test, is on-line, but has no established connections to other nodes. - For a UCMM capable device it means that the device has no established connections.
Link OK On-line, Connected	Green	The device is on-line and has connections in the established state. - For a Group 2 Only device it means that the device is allocated to a Master. - For a UCMM capable device it means that the device has one or more established connections.
Connection Time-Out	Flashing Red	One or more I/O Connections are in the Timed–Out state.
Critical Link Failure	Red	Failed communication device. The device has detected an error that has rendered it incapable of communicating on the network (Duplicate MAC ID, or Bus-off).
Communication Faulted and Received an Identify Comm. Fault Request - Long Protocol	Flashing Red & Green	A specific Communication Faulted device. The device has detected a Network Access error and is in the Communication Faulted state. The device has subsequently received and accepted an Identify Communication Faulted Request - Long Protocol message.

TAB. 7.2 NETWORK STATUS LED

8. ASSEMBLY

8.1 ASSEMBLY 101: SETPOINT (OUTPUT FOR POLL)

BYTE	TYPE	VALUE
0-1	UINT	Setpoint master X1 (4096 == 100[%])
2-3	UINT	Setpoint master X2 (4096 == 100[%])
…	…	…
…	UINT	Setpoint master X "Slots" (4096 == 100[%])

TAB. 8.1 OUTPUT ASSEMBLY 101

With Thyro-S the setpoint is interpreted as the operating mode.

SETPOINT	OPERATING MODE	TOTAL SETPOINT
0 to 409	Off	0
410 to 1091	1/5	819
1092 to 1706	1/3	1365
1707 to 3071	1/2	2047
3072 to 4096	ON	4096

TAB. 8.2 INTERPRETATION OF THE MASTER SETPOINT FOR Thyro-S

8.2 ASSEMBLY 102: SETPOINT, STATE... (INPUT FOR POLL)

BYTE	TYPE	VALUE	PORT
0-1	UINT	Total setpoint (4096 == 100[%])	X1
2-3	UINT	Thyro-AS error (Table ???)	
4-5	UINT	Thyro-AS state (Table ???)	
6-7	UINT	Total setpoint (4096 == 100[%])	X2
8-9	UINT	Thyro-AS error (Table ???)	
10-11	UINT	Thyro-AS state (Table ???)	
…	…	…	…
…	UINT	Total setpoint (4096 == 100[%])	Xmax
…	UINT	Thyro-AS error (Table ???)	
…	UINT	Thyro-AS state (Table ???)	

TAB. 8.3 INPUT ASSEMBLY 102

8.3 ASSEMBLY 103: ACTUAL VALUE POWER

BYTE	TYPE	VALUE	PORT
0-3	REAL	Power L1	X1
4-7	REAL	Power L3	2 phase
8-11	REAL	Power L1	X2
			1 phase
…	…	…	…
…	REAL	Power L1	Xmax
…	REAL	Power L2	3 phase
…	REAL	Power L3	

TAB. 8.4 INPUT ASSEMBLY 103

8.4 ASSEMBLY 104: ACTUAL VALUE VOLTAGE LOAD

BYTE	TYPE	VALUE	PORT
0-3	REAL	Voltage Load L1	X1
4-7	REAL	Voltage Load L3	2 phase
8-11	REAL	Voltage Load L1	X2
			1 phase
…	…	…	…
…	UNIT	Voltage Main L1	Xmax
…	UNIT	Voltage Main L2	3 phase
…	REAL	Voltage Main L3	

TAB. 8.5 INPUT ASSEMBLY 104

8.5 ASSEMBLY 105: ACTUAL VALUE CURRENT

BYTE	TYPE	VALUE	PORT
0-3	REAL	Current L1	X1
4-7	REAL	Current L3	2 phase
8-11	REAL	Current L1	X2
			1 phase
…	…	…	…
…	REAL	Current L1	Xmax
…	REAL	Current L2	3 phase
…	REAL	Current L3	

TAB. 8.6 INPUT ASSEMBLY 105

8.6 ASSEMBLY 106: VOLTAGE MAIN

BYTE	TYPE	VALUE	PORT
0-1	UINT	Voltage Main L1	X1
2-3	UINT	Voltage Main L3	2 phase
4-5	UINT	Voltage Main L1	X2
			1 phase
…	…	…	…
…	UINT	Voltage Main L1	Xmax
…	UINT	Voltage Main L2	3 phase
…	UINT	Voltage Main L3	

TAB. 8.7 INPUT ASSEMBLY 106

9. VENDOR SPECIFIC ATTRIBUTES

All attributes are listed in the following tables. The attributes are split into 3 objects (0x64-0x66). The epath to a parameter is "20 Class.ID 24 Instance ID 30 Attr.ID" for example the epath to the "Setpoint Master X1" is 20 65 24 01 30 64 (all values hex).

9.1 ATTRIBUTES OF CLASS 0X64

This class has just 1 instance.

ATTR ID	VALUE	TYPE	VALUE RANGE	R/W
100	X1 configured device type	USINT	See Table 9.3	r
101	X2 configured device type	USINT	See Table 9.3	r
102	X3 configured device type	USINT	See Table 9.3	r
103	X4 configured device type	USINT	See Table 9.3	r
104	X5 configured device type	USINT	See Table 9.3	r
105	X6 configured device type	USINT	See Table 9.3	r
106	X7 configured device type	USINT	See Table 9.3	r
107	X8 configured device type	USINT	See Table 9.3	r

TAB. 9.1 CONFIGURED DEVICE TYPE

ATTR ID	VALUE	TYPE	VALUE RANGE	R/W
108	X1 current device type	USINT	See Table 9.3	r
109	X2 current device type	USINT	See Table 9.3	r
110	X3 current device type	USINT	See Table 9.3	r
111	X4 current device type	USINT	See Table 9.3	r
112	X5 current device type	USINT	See Table 9.3	r
113	X6 current device type	USINT	See Table 9.3	r
114	X7 current device type	USINT	See Table 9.3	r
115	X8 current device type	USINT	See Table 9.3	r

TAB. 9.2 CURRENT DEVICE TYPE

VALUE	TYPE
0	None
4	Thyro-S 1S...H1
5	Thyro-S 1S...HRL1
20	Thyro-A 1A...H1
21	Thyro-A 1A...HRL1/Thyro-AX 1A...HRL2
22	Thyro-A 1A...HRLP1/Thyro-AX 1A...HRLP2
24	Thyro-A 2A...H1
25	Thyro-A 2A...HRL1/Thyro-AX 2A...HRL2
26	Thyro-A 2A...HRLP1/Thyro-AX 2A...HRLP2
28	Thyro-A 3A...H1
29	Thyro-A 3A...HRL1/Thyro-AX 3A...HRL2
30	Thyro-A 3A...HRLP1/Thyro-AX 3A...HRLP2
129	Thyro-A 1A...C01
130	Thyro-A 1A...C02
131	Thyro-A 1A...C03

TAB. 9.3 POWER CONTROLLER TYPE

ATTR ID	VALUE	TYPE	VALUE RANGE	COMBO-OPT	R/W	DEFAULT
130	Actual values average	USINT	0…3	Off, 5, 10, 20 values	r/w	Off
131	Without IO connection	BYTE	(Bit 0 Setpoint master = 0)	No, Yes		No
			(Bit 1 Digital out = 0)	No, Yes	r/w	No

TAB. 9.4 BUS MODULE SETUP

ATTR ID	VALUE	TYPE	VALUE RANGE	COMBO-OPT	R/W
120	Digital out	BYTE	Bit 0 == X1.5		
			Bit 1 == X2.5		
			…	Off, On	r/w

TAB. 9.5 DIGITAL OUT

9.2 ATTRIBUTES OF CLASS 0X65

This class has 1 instance for every power controller.

ATTR ID	SETPOINT	TYPE	UNIT	R/W
100	Setpoint master	UINT	4096 == 100[%]	r/w

TAB. 9.6 SETPOINTS

						Thyro-S 1S		Thyro-A 1A/Thyro-AX 1A			Thyro-A 2A/Thyro-AX 2A			Thyro-A 3A/Thyro-AX 3A			Thyro-A 1A		
P. ID	ATTR ID	ACTUAL VALUE	TYPE	UNIT	R/W	H1	HRL1	H1	HRL1/HRL2	HRLP1/HRLP2	H1	HRL1/HRL2	HRLP1/HRLP2	H1	HRL1/HRL2	HRLP1/HRLP2	C01	C02	C03
33	110	Power L1	REAL	W	r					x			x			x	x		x
34	111	Voltage Load L1	REAL	V	r	x	x	x	x	x	x	x	x	x	x	x	x	x	x
35	112	Current L1	REAL	A	r		x		x	x		x	x		x	x	x	x	x
37	114	Voltage Main L1	UINT	V	r	x	x	x	x	x	x	x	x	x	x	x	x	x	x
39	120	Power L2	REAL	W	r											x			
40	121	Voltage Load L2	REAL	V	r									x	x	x			
41	122	Current L2	REAL	A	r										x	x			
43	124	Voltage Main L2	UINT	V	r									x	x	x			
45	130	Power L3	REAL	W	r								x			x			
46	131	Voltage Load L3	REAL	V	r						x	x	x	x	x	x			
47	132	Current L3	REAL	A	r							x	x		x	x			
49	134	Voltage Main L3	UINT	V	r						x	x	x	x	x	x			
51	140	Total power	REAL	W	r					x			x			x	x		x
52	141	Temperature	INT	°C	r	x	x	x	x	x	x	x	x	x	x	x	x	x	x
53	142	Total setpoint	UINT	4096 == 100%	r	x	x	x	x	x	x	x	x	x	x	x	x	x	x
55	144	Setpoint terminal X2.4	UINT	4096 == 100%		x	x	x	x	x	x	x	x	x	x	x	x	x	x
57	146	On-angle alpha	UINT	18000 == 180°el	r			x	x	x	x	x	x	x	x	x	x	x	x
58	147	On-time value	UINT	period	r	x	x	x	x	x	x	x	x	x	x	x	x	x	x
59	148	Period time	UINT	µs	r	x	x	x	x	x	x	x	x	x	x	x	x	x	x
63	153	Thyro-AS state	WORD	see table ???	r	x	x	x	x	x	x	x	x	x	x	x	x	x	x
64	154	Thyro-AS error	WORD	see table ???	r	x	x	x	x	x	x	x	x	x	x	x	x	x	x

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 and Load Fault LED flash fast simultaneously	dropped out	Test LED and Load Fault LED flash fast simultaneously	dropped out
Mains Undervoltage (< AD_P_SPG_MIN)	Bit5	Pulse Inhibit LED, Load Fault LED and 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	---

Thyro-S, Thyro-A AND Thyro-AX ERROR

DESCRIPTION Thyro-S, Thyro-A and Thyro-AX	BIT	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
Device disconnected	Bit9	---	---	---	---
Wrong device	Bit10	---	---	---	---
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 and Load Fault LED flash slowly alternately	dropped out
Failure in rotating field/phase (only Thyro 2A or 3A)	Bit15	Pulse Inhibit LED and Test LED flash slowly simulta-neously	energised	only with Thyro-A/Thyro-AX	---

Thyro-S, Thyro-A AND Thyro-AX STATE

* The table only shows the default configuration of the relay function.
The relay only exists in the H RL1, H RLP1, H RL2 or H RLP2 device, not in the H1 types.

ATTR ID	VALUE	TYPE	VALUE RANGE	COMBO-OPT	UNIT	R/W	DEFAULT
170	Regulator suppressor	BOOL	0...1	Off, On		r/w	Off

TAB. 9.7 FUNCTION

ATTR ID	VALUE	TYPE	VALUE RANGE	COMBO-OPT	UNIT	R/W	DEFAULT
180	Power controller rated current	UINT	0...65535		A	r	Type
181	Power controller connection voltage	UINT	0...1000		V	r	Type
182	Power controller rated power	UDINT	0…		W	r	Type
183	Device	UINT	0...65535			r	Type
184	Equipment	UINT	0...65535			r	Type
185	Special edition	UINT	0...65535			r	Type

TAB. 9.8 HARDWARE PARAMETER

9.3 ATTRIBUTES OF CLASS 0X66

This class has 1 instance for every power controller.

								Thyro-S 1S		Thyro-A 1A/Thyro-AX 1A			Thyro-A 2A/Thyro-AX 2A			Thyro-A 3A/Thyro-AX 3A			Thyro-A 1A			
P. ID	ATTR ID	VALUE	TYPE	VALUE RANGE	COMBO-OPT	UNIT	R/W	H1	HRL1	H1	HRL1/HRL2	HRLP1/HRLP2	H1	HRL1/HRL2	HRLP1/HRLP2	H1	HRL1/HRL2	HRLP1/HRLP2	C01	C02	C03	DEFAULT
100	100	Operating mode	USINT	0…3	res., TAKT, VAR, QTM		r/w*			x	x	x	x	x	x	x	x	x	x	x	x	Type
101	101	Load mode	BYTE	bitwise			r/w									x	x	x				14

OPERATING MODE

								Thyro-S 1S		Thyro-A 1A/Thyro-AX 1A			Thyro-A 2A/Thyro-AX 2A			Thyro-A 3A/Thyro-AX 3A			Thyro-A 1A			
P. ID	ATTR ID	VALUE	TYPE	VALUE RANGE	COMBO-OPT	UNIT	R/W	H1	HRL1	H1	HRL1/HRL2	HRLP1/HRLP2	H1	HRL1/HRL2	HRLP1/HRLP2	H1	HRL1/HRL2	HRLP1/HRLP2	C01	C02	C03	DEFAULT
110	110	Phase angle of the 1st half-wave	USINT	0…180		°el	r/w*			x	x	x	x	x	x	x	x	x	x		x	Type
111	111	Soft-start time (setting)	UINT	0…100		period	r/w*			x	x	x	x	x	x	x	x	x	x	x	x	6
112	112	Soft-down time (setting)	UINT	0…100		period	r/w			x	x	x	x	x	x	x	x	x	x	x	x	6
113	113	Cycle period	UINT	0…1000		period	r/w*	x	x	x	x	x	x	x	x	x	x	x	x		x	50
114	114	Max. cycle on-time	UINT	1…1000		period	r/w			x	x	x	x	x	x	x	x	x	x		x	50
115	115	Min. cycle on-time	UINT	0…1000		period	r/w			x	x	x	x	x	x	x	x	x	x		x	0
116	116	Min. pause	USINT	0…10		period	r/w*			x	x	x	x	x	x	x	x	x	x		x	3
117	117	Syncronous cycle address	UINT	0...65535		period/2	r/w			x	x	x	x	x	x	x	x	x	x		x	100

TIMES

P. ID	ATTR ID	VALUE	TYPE	VALUE RANGE	COMBO-OPT	UNIT	R/W	Thyro-S 1S		Thyro-A 1A/Thyro-AX 1A			Thyro-A 2A/Thyro-AX 2A			Thyro-A 3A/Thyro-AX 3A			Thyro-A 1A			DEFAULT
								H1	HRL1	H1	HRL1/HRL2	HRLP1/HRLP2	H1	HRL1/HRL2	HRLP1/HRLP2	H1	HRL1/HRL2	HRLP1/HRLP2	C01	C02	C03	
120	120	Regulation	USINT	0…8	Uload^2, Uload eff, Iload^2, Iload eff, res. Real power res. res. Without regulation		r/w*			x	x	x	x	x	x	x	x	x	x	x	x	Type
121	121	PID-regulator, I-part	UINT	0...65535, 0 = Off			r/w			x	x	x	x	x	x	x	x	x	x	x	x	Type
122	122	PID-regulator, P-part	UINT	0...65535, 0 = Off			r/w			x	x	x	x	x	x	x	x	x	x	x	x	Type
123	123	PID-regulator, counter P-part	UINT	0...65535			r/w			x	x	x	x	x	x	x	x	x	x	x	x	Type

CONTROLS

								Thyro-S 1S		Thyro-A 1A/Thyro-AX 1A			Thyro-A 2A/Thyro-AX 2A			Thyro-A 3A/Thyro-AX 3A			Thyro-A 1A			
P. ID	ATTR ID	VALUE	TYPE	VALUE RANGE	COMBO-OPT	UNIT	R/W	H1	HRL1	H1	HRL1/HRL2	HRLP1/HRLP2	H1	HRL1/HRL2	HRLP1/HRLP2	H1	HRL1/HRL2	HRLP1/HRLP2	C01	C02	C03	DEFAULT
130	130	Max. r.m.s. voltage setpoint	UINT	0...65535		V	r/w*			x	x	x	x	x	x	x	x	x	x	x	x	Type
131	131	Max. r.m.s. current setpoint	UINT	0...65535		0,1 A	r/w*				x	x		x	x		x	x	x	x	x	Type
132	132	Max. power setpoint	UDINT	0…		W	r/w*					x			x			x	x		x	Type
133	133	Front pulse limit position	USINT	0...180		°el	r/w			x	x	x				x	x	x	x	x	x	180°el
134	134	Back pulse limit position	USINT	0...180		°el	r/w			x	x	x				x	x	x	x	x	x	0°el
135	135	Factor peak current limitation	UINT	0…4096			r/w			x	x	x	x	x	x	x	x	x	x	x	x	Type

LIMIT

								Thyro-S 1S		Thyro-A 1A/Thyro-AX 1A			Thyro-A 2A/Thyro-AX 2A			Thyro-A 3A/Thyro-AX 3A			Thyro-A 1A			
P. ID	ATTR ID	VALUE	TYPE	VALUE RANGE	COMBO-OPT	UNIT	R/W	H1	HRL1	H1	HRL1/HRL2	HRLP1/HRLP2	H1	HRL1/HRL2	HRLP1/HRLP2	H1	HRL1/HRL2	HRLP1/HRLP2	C01	C02	C03	DEFAULT
140	140	Setpoint select	USINT	0…3	X2.4, Bit1 Master		r	x	x	x	x	x	x	x	x	x	x	x	x	x	x	Terminal X2.4
141	141	Control start terminal X2.4	UINT	0…4096		20/4096 mA	r/w*			x	x	x	x	x	x	x	x	x	x	x	x	0 mA
142	142	Control end terminal X2.4	UINT	0…4096		20/4096 mA	r/w			x	x	x	x	x	x	x	x	x	x	x	x	20 mA

CONTROL CHARACTERISTIC

								Thyro-S 1S		Thyro-A 1A/Thyro-AX 1A			Thyro-A 2A/Thyro-AX 2A			Thyro-A 3A/Thyro-AX 3A			Thyro-A 1A			
P. ID	ATTR ID	VALUE	TYPE	VALUE RANGE	COMBO-OPT	UNIT	R/W	H1	HRL1	H1	HRL1/HRL2	HRLP1/HRLP2	H1	HRL1/HRL2	HRLP1/HRLP2	H1	HRL1/HRL2	HRLP1/HRLP2	C01	C02	C03	DEFAULT
150	150	Averaging	UINT	0…65535			r/w				x	x		x	x		x	x	x	x	x	100
151	151	Configuration register analog output 1	USINT	0…10	0-5 Reserved, Ueff, Ieff, Total power, Setpoint, Ueff main		r/w				x	x		x	x		x	x	x	x	x	Ueff
152	152	Offset output 1	UINT	0…4096		20/4096 mA	r/w*				x	x		x	x		x	x	x	x	x	0 mA
153	153	Scaling factor output 1	UINT	0…4096		1/819	r/w*				x	x		x	x		x	x	x	x	x	1
154	154	Configuration register analog output 2	USINT	0…10	0-5 Reserved, Ueff, Ieff, Total power, Setpoint, Ueff main		r/w												x		x	Ieff
155	155	Offset output 2	UINT	0…4096		20/4096 mA	r/w												x		x	0 mA
156	156	Scaling factor output 2	UINT	0…4096		1/819	r/w												x		x	1
157	157	Configuration register analog output 3	USINT	0…10	0-5 Reserved, Ueff, Ieff, Total power, Setpoint, Ueff main		r/w												x		x	Total power
158	158	Offset output 3	UINT	0…4096		20/4096 mA	r/w												x		x	0 mA
159	159	Scaling factor output 3	UINT	0…4096		1/819	r/w												x		x	1

								Thyro-S 1S		Thyro-A 1A/Thyro-AX 1A			Thyro-A 2A/Thyro-AX 2A			Thyro-A 3A/Thyro-AX 3A			Thyro-A 1A			
P. ID	ATTR ID	VALUE	TYPE	VALUE RANGE	COMBO-OPT	UNIT	R/W	H1	HRL1	H1	HRL1/HRL2	HRLP1/HRLP2	H1	HRL1/HRL2	HRLP1/HRLP2	H1	HRL1/HRL2	HRLP1/HRLP2	C01	C02	C03	DEFAULT
170	170	Mains voltage monitoring minimum	UINT	0...1000		V	r/w	x	x	x	x	x	x	x	x	x	x	x	x	x	x	320
171	171	Mains voltage monitoring maximum	UINT	0...1000		V	r/w	x	x	x	x	x	x	x	x	x	x	x	x	x	x	480
172	172	Undercurrent monitoring	BOOL	0...1	Off, On		r/w*		x		x	x		x	x		x	x	x	x	x	Off
173	173	Undercurrent monitoring value	USINT	0..4505		100/ 4096%	r/w*		x		x	x		x	x		x	x	x	x	x	0
174	174	Output voltage monitoring min.	UINT	0...65535, 0 = Off		V	r/w			x	x	x	x	x	x	x	x	x	x		x	Off
175	175	Output voltage monitoring max.	UINT	0…65535, max = Off		V	r/w			x	x	x	x	x	x	x	x	x	x		x	Off
176	176	Output current monitoring min.	UINT	0...65535, 0 = Off		0.1 A	r/w				x	x		x	x		x	x	x		x	Off
177	177	Output current monitoring max.	UINT	0…65535, max = Off		0.1 A	r/w				x	x		x	x		x	x	x		x	Off
178	178	Output power monitoring min,.	UDINT	0...65535, 0 = Off		W	r/w					x			x			x	x		x	Off
179	179	Output power monitoring max.	UDINT	0…65535, max = Off		W	r/w					x			x			x	x		x	Off

MONITORING

								Thyro-S 1S		Thyro-A 1A/Thyro-AX 1A			Thyro-A 2A/Thyro-AX 2A			Thyro-A 3A/Thyro-AX 3A			Thyro-A 1A			
P. ID	ATTR ID	VALUE	TYPE	VALUE RANGE	COMBO-OPT	UNIT	R/W	H1	HRL1	H1	HRL1/HRL2	HRLP1/HRLP2	H1	HRL1/HRL2	HRLP1/HRLP2	H1	HRL1/HRL2	HRLP1/HRLP2	C01	C02	C03	DEFAULT
190	190	Relay K1 config 1	WORD	bitwise			r / w				x	x		x	x		x	x	x	x	x	447
191	191	Relay K1 config 2	WORD	bitwise			r / w				x	x		x	x		x	x	x	x	x	32768
192	192	Pulse switch-off on error register	WORD	bitwise			r / w			x	x	x	x	x	x	x	x	x	x	x	x	307
193	193	Version year	UINT	0…65535			r	x	x	x	x	x	x	x	x	x	x	x	x	x	x	Type
194	194	Version month	USINT	1...12			r	x	x	x	x	x	x	x	x	x	x	x	x	x	x	Type
195	195	Version day	USINT	1...31			r	x	x	x	x	x	x	x	x	x	x	x	x	x	x	Type

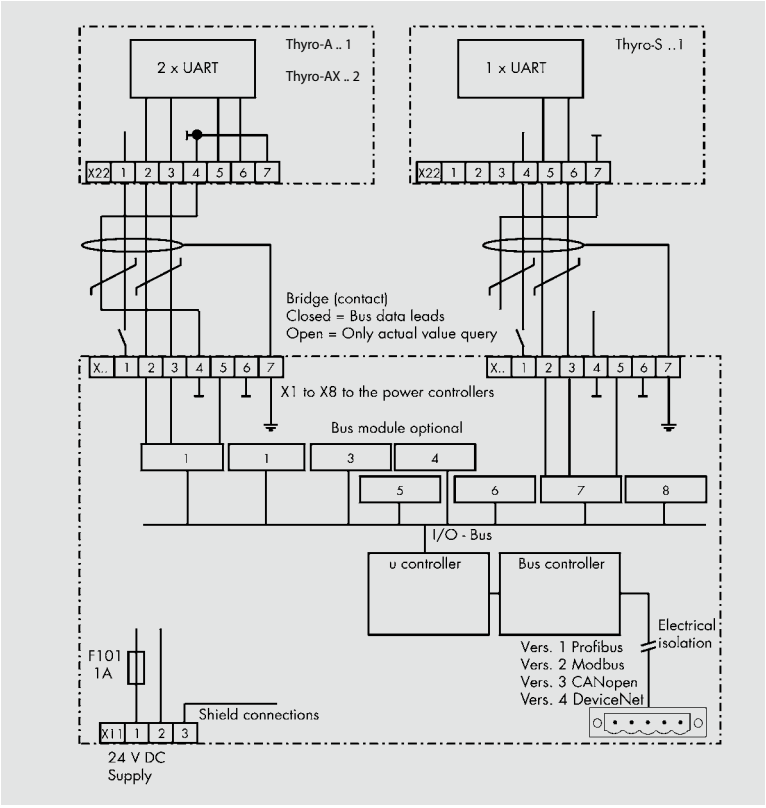
MISCELLANEOUS

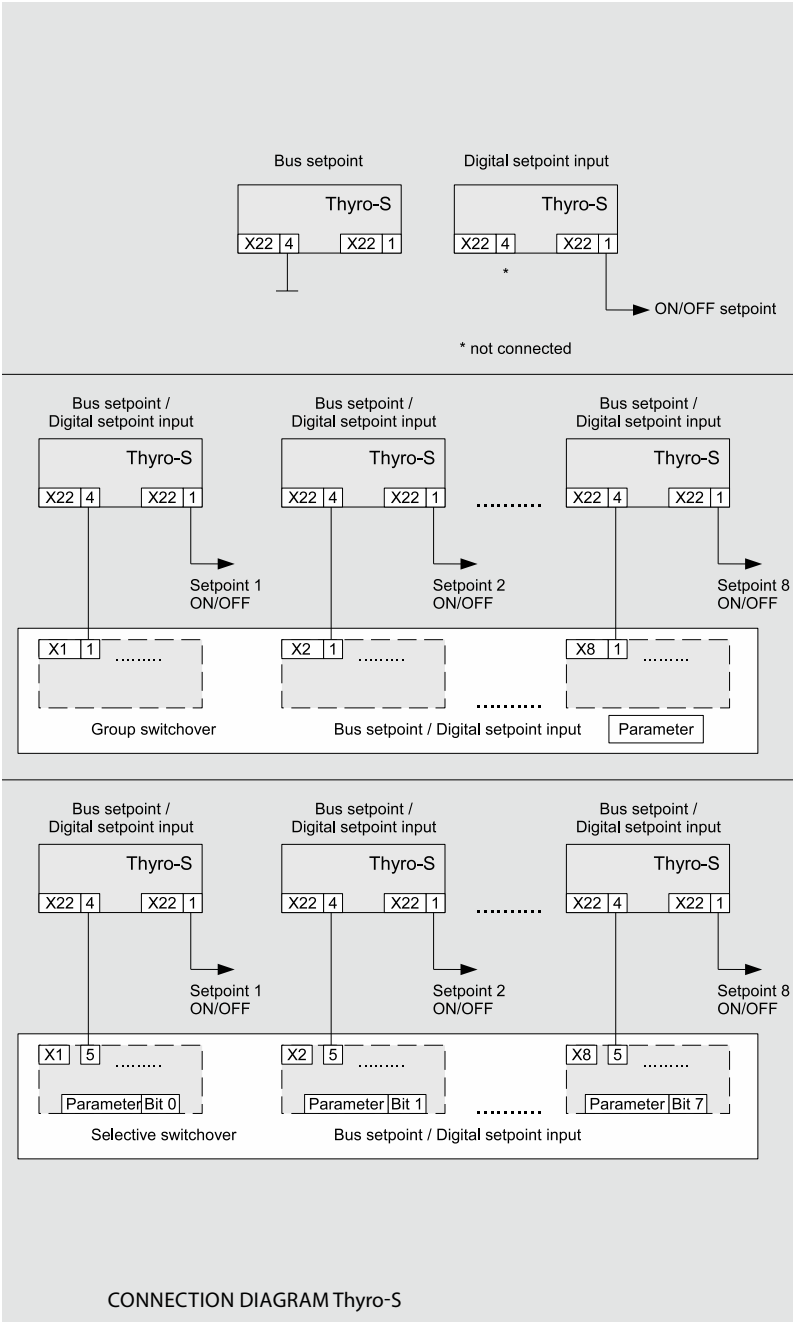
* In "Thyro-Tool mode" (switch S1.3-5 "On") the parameters marked with * are not preset by the switches and potis, instead, the stored values are used.

With some controller types not all settings are possible.

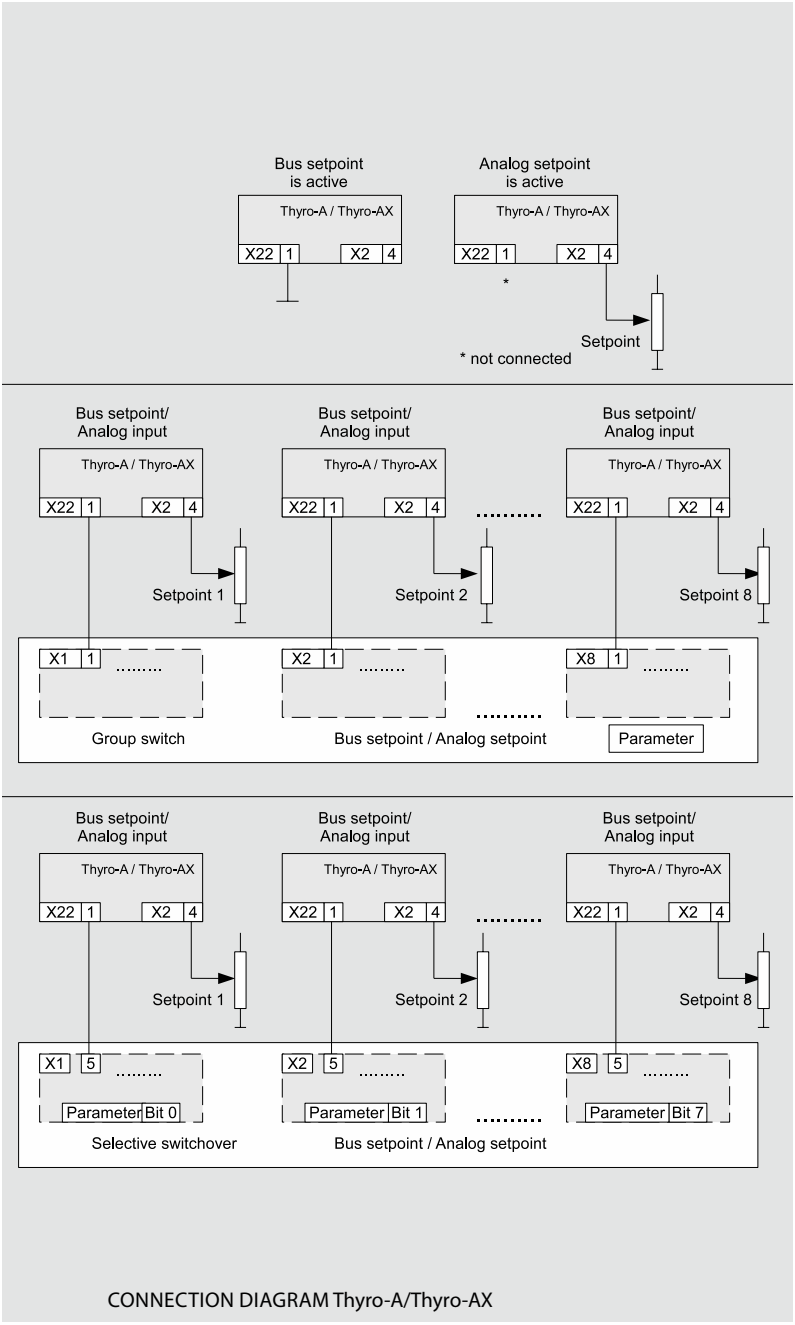
Setting depends on type voltage, type current and type output. After setting to default, please check!

10. CONNECTION DIAGRAMS





CONNECTION DIAGRAM Thyro-S



CONNECTION DIAGRAM Thyro-A/Thyro-AX

11. 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:
LED Power is off
> Check 24VDC power supply at X11
LED Fault is flashing
> Check connection between all power controllers and bus modules.
> Check power supply for all power controllers.
LED Module Status is flashing red
> Check 24VDC power supply at X20
LED Module Status is red
> Hardware defect
LED Network Status is flashing green (baud rate detection)
> Check DeviceNet connection X20
> Check DeviceNet scanner is running

12. TECHNICAL DATA

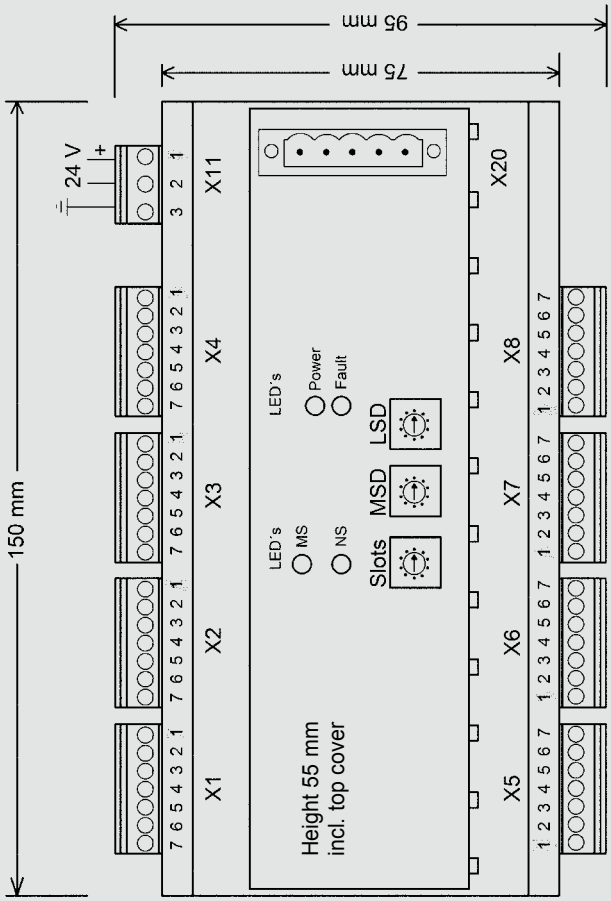
Busmodul	
Voltage range	20-28 V DC
Inrush current (28V)	2.8 A for 10 ms
Operation current	150 mA max
Ambient temperature	Max. 65 °C
DeviceNet	
Address range	0-63 (63-99 => 63)
Communication speed	125, 250 and 500 kBaud
Connector	Open-style connector
DeviceNet Supply	
Voltage range	11-25 V DC
Inrush current (25 V)	0.1 A
Operation current	5 mA max

Features

- Auto baud detection
- Module Status LED
- Network Status LED
- Complete control of all Thyro-S, Thyro-A and Thyro-AX attributes
- Mounting on DIN rail
- 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.

13. DIMENSIONAL DRAWING

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



DIMENSIONAL DRAWING

14. 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

15. 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

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

970.221.4670 Main
970.221.5583 Fax

www.advanced-energy.com

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