

- Power controller

THYRITOP 30

H RL1 ----- MODEL

ENGLISH

User's manual



**CHAUVIN
ARNOUX**

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

Obligation to give instructions

The following safety and operating instructions must be carefully read before initial assembly, installation and commissioning of Thyritop 30 by those persons working with or on Thyritop 30.

These operating instructions are part of the Power Controller Thyritop 30

The operator of this device is obliged to provide, without restriction, these operating instructions to all persons transporting, commissioning, maintaining or performing other work on this device.

In accordance with the Product Liability Act, the manufacturer of a product has an obligation to provide explanations and warnings as follows:

- the use of the product other than for the intended use,
- the residual product risk,
- operating error and its consequences.

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

Proper use

- The Thyristor Power Controller is a component which may only be used for control and regulation of electrical energy.
- The Thyristor Power Controller may at most be operated using the maximum admissible connected load according to information on the type plate.
- The Thyristor Power Controller may only be operated in connection with a suitable and series connected power supply disconnecting device (e.g. switch, VDE 0150 T1).
- As a component, the Thyristor Power Controller is unable to operate alone and must be projected for its intended use to minimize residual risks.

The Thyristor Power Controller may only be operated in the sense of its intended use; otherwise personal hazards, (e.g. electric shocks, burns) and hazards for systems (e.g. system overload) may arise.

Residual hazards of the product

- Even in proper use, should a fault occur, it is possible that control of currents, voltages and power is no longer performed in the load circuit by the Thyristor Power Controller.

In case of destruction of the power components (e.g. break-down or high resistance), the following situations are possible: power interruption, half-wave operation, continuous power flow.

If such a situation occurs, then load voltages and currents are produced from the power circuit. It must be ensured by system design that no uncontrolled large currents, voltages or power occur.

Malfunction and the results

With malfunction it is possible that power, voltage or flow levels which are higher than planned reach the Thyristor Power Controller or load. In principle, this can lead to the Power Controller or load being damaged.

Transport

Thyristor power controllers are only to be transported in their original packaging (protection against damage e.g. due to jolting, knocking, soiling).

Installation

If the Thyristor Power Controller is brought into the operation room from a cold environment, moisture due to condensation can occur. Prior to it being commissioned, the Thyristor Power Controller must be absolutely dry. Therefore, wait for a minimum of two hours before commissioning.

Connection

Prior to connection, it must be ensured that the voltage information on the type plate corresponds with the mains voltage.

- The electrical connection is carried out at the designated points with the required cross section cable and the appropriate screw cross sections.

Operation

The Thyristor Power Controller may only be connected to the mains voltage if it has been ensured that any hazard to people and system, especially in the load section, has been eliminated.

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

Maintenance, service, malfunctions



CAUTION

For maintenance and repair work the Power Controller must be disconnected from all external voltage sources and protected against restarting. The voltage-free state is to be determined by means of suitable measuring instruments. This work is only to be carried out by a skilled electrician. The electrical regulations which are locally valid are to be adhered to.



CAUTION

The Thyristor Power Controller contains dangerous voltages. Repairs may only be carried out by qualified and trained maintenance personnel.



CAUTION

Danger of electric shocks. Even after disconnection from the mains voltage, capacitors may still contain a dangerously high power level.



CAUTION

Danger of electric shocks. Even when the Thyristor Power Controller is not triggered, the load circuit is not disconnected from the mains.



ATTENTION

Different components in the power section are screwed into place using exact torques. For safety reasons, power component repairs must be performed by CHAUVIN ARNOUX.

➔	Safety instructions	50
➔	Safety regulations	56
➔	Remarks on the present operating instructions and Thyritop	58
➔	1. Introduction	60
	1.1 General	60
	1.2 Specific characteristics	60
	1.3 Type designation	61
➔	2. Functions	61
	2.1 Operating modes	61
	2.2 Set point control characteristic	62
	2.3 Control types	63
	2.3.1 Controlled value	64
	2.3.2 Limitations	64
	2.3.3 Controller response	64
	2.4 Indications	64
	2.4.1 LED indications	64
	2.4.2 Alarm relay K1	65
	2.5 Monitoring	65
	2.5.1 Monitoring of load and mains voltage	65
	2.5.2 Absolute value monitoring current	65
	2.5.3 Equipment temperature monitoring	65
	2.5.4 Ventilator monitoring	66
➔	3. Operation	66
	3.1 Configuration switch S1	66
	3.1.1 Operating mode	66
	3.1.2 Control types	66
	3.1.3 Live zero set point	66
	3.1.4 Analog input	67
	3.1.5 Analog output	67
	3.2 Potentiometer	67
	3.2.1 Phase angle 1. half wave operation TAKT	67
	3.2.2 Control end set point input	68
	3.2.3 Current limitations	68
	3.2.4 Increased analog output	69
	3.2.5 Load monitoring (undercurrent monitoring)	69
	3.3 Diagnosis / status indications	71










4.	4. External connections	71
4.1	Power supply for Thyritop30	71
4.2	Power supply for the control device	71
4.3	Additional control voltage input	72
4.4	Pulse lock	72
4.5	Analog set point value input	72
4.6	Digital set point value input	72
4.7	Analog output	73
4.8	Current transformer	73
4.9	Voltage transformer	73
4.10	Block connection diagram	74
4.11	Operating elements and terminal strips	75
	5. Interfaces	77
	6. Mains load optimization	77
6.1	Synchronization SYT-9 (operating mode TAKT)	78
6.2	Synchronization in operating mode QTM (1A)	78
6.3	Software synchronization (operating mode TAKT)	78
	7. Connecting plans	79
	8. Special remarks	82
8.1	Installation	82
8.2	Commissioning	82
8.3	Service	83
8.4	Checklist	84
	9. Type overview	84
9.1	Thyritop 30 1A ... H RL 1	85
9.2	Thyritop 30 2A ... H RL 1	85
	10. Technical data	86
	11. Dimensional drawings	89
	12. Accessories and options	95
	13. Approvals and conformities	95
	Addresses	100

Fig. 1	Control characteristic	62
Fig. 2	Set point inputs and total set point	63
Fig. 3	Block connecting diagram	74
Fig. 4	Terminal plan	75
Fig. 5	Operating elements	76
Fig. 6	Thyritop 30 ... H RL1	77
Fig. 7	Connecting diagram 1A	79
Fig. 8	Connecting diagram 2A	80
Fig. 9	Connecting diagram for auxiliary supply and bus module	81
Fig. 10	Connecting diagram for QTM	81
Tab. 1	Behaviour with load change	64
Tab. 2	Load monitoring	70
Tab. 3	Allocation of message register	71
Tab. 4	Default values DIP switch S1	82
Tab. 5	Default values potentiometer	83

Important instructions and explanations

Operation and maintenance according to regulations, as well as observance of the listed safety regulations is required for the protection of the staff and to maintain readiness to operate. Personnel assembling/disassembling the devices, commissioning them, operating them and maintaining them must know and observe these safety operations.

In the present operating instructions important instructions are marked using the terms **“CAUTION”**, **“ATTENTION”** and **“REMARK”** as well as using the icons explained below.



CAUTION

This instruction indicates work and operating procedures to be observed exactly to exclude hazards to persons.



ATTENTION

This instruction refers to work and operating procedures to be observed exactly to avoid damage or destruction of Thyritop 30 or parts thereof.



NOTE

This is where remarks on technical requirements and additional information is given which the user must observe.

Accident prevention rules

It is imperative that the accident prevention rules of the country of application and the generally applicable safety regulations are observed.



CAUTION

Before starting any work on Thyritop 30, the following safety regulations must be observed:

- switch voltage-free
- secure against switching on
- determine voltage-free state
- ground and short-circuit device
- cover or block neighbouring parts under voltage

Qualified personnel

Thyritop 30 may only be transported, installed, connected, commissioned, maintained and operated by specialists in command of the respective applicable safety and installation regulations. All work must be monitored by the responsible specialist personnel.

Intended use



CAUTION

The Thyristor Power Controller may only be employed in the sense of its purpose of use (see the section of the chapter on safety instructions under the same name), otherwise hazards to persons (e.g. electric shocks, burns) and systems (e.g. overload) may occur.

Any unauthorized reconstruction and modification of Thyritop30, use of spare and exchange parts not approved by Chauvin Arnoux as well as any other use of Thyritop30 not permitted.

The person responsible for the system must ensure that:

- safety and operating instructions are available and observed,
- operating conditions and specifications are observed,
- protective installations are used,
- maintenance personnel are immediately notified or Thyritop 30 is immediately put out of commission if abnormal voltages or noises, higher temperatures, vibrations or similar occur to determine the causes.

These operating instructions contain all information required by specialists for the use of Thyritop 30. Additional information and notes for unqualified persons and for the use of Thyritop 30 outside of industrial installations are not contained in these operating instructions.

The warranty obligation of the manufacturer applies only if these operating instructions are observed.

Warranty

No liability is assumed when using Thyritop 30 for applications not provided for by the manufacturer. The responsibility for the necessary measures to avoid hazards to persons and property is borne by the operator or the user. In case of complaints on Thyritop 30, please notify us immediately stating:

Type name, production number, complaint, ambient conditions, operating mode, duration of use.

Remarks on the present operating instructions and Thyritop 30

Validity

These operating instructions correspond to the technical state of Thyritop 30 at the time of publication. The contents are not subject matter of the contract, but serve only as information. Modification of information contained in these operating instructions, especially technical data, operation, dimensions and weights, remain reserved at any time. Chauvin Arnoux reserves the right to content modifications and technical changes within the present operating instructions without obligation of notification. Chauvin Arnoux is not obliged to update these operating instructions constantly.

Handling

These operating instructions for Thyritop 30 are set out so that all work required for commissioning, maintenance and repair may be performed by corresponding specialist personnel.

Abbreviations

In this description the following specific abbreviations are used:

SYT	= synchronized clock
TAKT	= full wave switch mode Thyrotakt®
VAR	= phase-angle mode Thyrovar®

Loss of warranty

Our supplies and services are subject to the general terms and conditions of delivery of the electrical industry as well as our general sales conditions. Any complaints on goods delivered are to be submitted, together with the delivery note, within eight days of receipt.

All guarantees made by Chauvin Arnoux and its dealers will be cancelled without prior notice if other than original Chauvin Arnoux spare parts or spare parts purchased by Chauvin Arnoux are used for maintenance and repair.

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1. Introduction

Thyritop 30 has been conceived to meet the demands for simple assembly, speedier commissioning and safer operation.

For transport, assembly, installation, commissioning, operation and decommissioning, it is essential that the safety instructions included in these operating instructions are observed and made available to all persons handling this product.

In case of uncertainties or missing information, please contact your supplier.

The described operating mode QTM is in preparation.

1.1 General

Thyritop 30 is a Thyristor Power Controller with the ability to communicate. It will also simply be referred to as Power Controller or Controller. It can be used wherever voltages or currents need to be controlled or regulated in processing technology.

Thyritop 30's distinguishing features are its several operating and control modes, good coupling ability to process and automation technology, high control precision and simple handling through a 16-Bit processor.

1.2 Specific characteristics

Thyritop 30 has a wide range of distinguishing features, for instance:

- easy handling
- type range 230-500 Volts, 8-280 A, single and double phase with additional 24V control voltage power supply also for mains voltages $\geq 0.43 \times U_{nom}$
- ohmic load and transformer load, as well as load with large $R_{hot} / R_{cold} (\leq 6)$ peak current limit to $3 \times I_{nom}$
- soft start function for transformer load
- channel separation
- load circuit monitoring
- relay indication
- control modes U , U^2 , I , I^2
- operating modes TAKT, as well as VAR and QTM with Thyro-A 1A
- control with analog set points and / or via optional bus adapter
- series system interface
- electrical separation according to EN 50178 chapt. 3

Options:

- bus connections via bus adapter.

Coupling to different bus systems, e.g. Profibus DP, Modbus RTU, other bus systems on request.

1.3 Type designation

The type designation of the Thyristor Power Controllers is derived from the construction of its power section:

Thy 30 1A	Thyristor controller with single phase power section suited for single phase loads
Thy 30 2A	Thyristor controller with double phase power section suited for symmetrical loads in three phase operation in three phase saver circuit

Example

Thy 30 1A	Thyristor controller with single phase power section
...400-	with 400 Volt type voltage
...280	with 280 Ampere type current
H	with integrated semi-conductor fuse
F	with ventilator (only 280 Ampere types)
R	with indication relay
L	with load monitoring
1	designation Thyro-A, 2002 series

The complete type range can be found in chapter 9, TYPE OVERVIEW.

➔ 2. Functions

To enable Thyritop 30 to adjust optimally to the desired application, it is equipped with a wide range of functions. These are described below. Further functions are possible by applying Thyritop 30 within a bus system. See also chapter 5 INTERFACES.

2.1 Operating modes

For optimum adjustment to different applications and production processes, as well as different electrical loads, the most favourable operating mode can be set.

Full wave switch TAKT (for 1A, 2A)

Depending on the prescribed set point, the mains voltage is periodically switched. In this operating mode almost no harmonics are created. Whole multiples of the mains periods are switched, thus avoiding d.c. components. The full wave switch mode is especially suited for loads with thermal inertia. Depending on the function angle 1. half wave, the phase frequency is adjusted independently to 5 or 50 mains periods = T_0 .

the IAKI operating mode creates minimal mains reactions. Should there be a flicker, this can be minimized with the aid of the mains load optimization.

Phase-angle principle VAR (for 1A)

Depending on the prescribed set point, the sine oscillation of the mains voltage is gated using a larger or smaller control angle α . This operating mode is characterized by high control dynamics. With phase-angle control harmonics of the mains voltage occur. It is possible to compensate these by using circuit variants.

Half-wave switch mode QTM (Quick-Takt-Mode for 1A)

QTM is the patented fast operating mode which works on the half wave switch principle. Depending on the prescribed set point, mains half waves are switched. D.c. components are avoided for the phase duration. The fast phase control is particularly suited for IR beams as an alternative to phase-angle control. When using several controllers it is possible, by synchronisation, to keep the mains reactions small.

2.2 Set point control characteristic

The set point control characteristic of Thyritop 30 can easily be adapted to the control output signal of an upstream process controller or automation system. All signals customary on the market may be used. The adaption is made by changing the starting and ending points of the control characteristic.

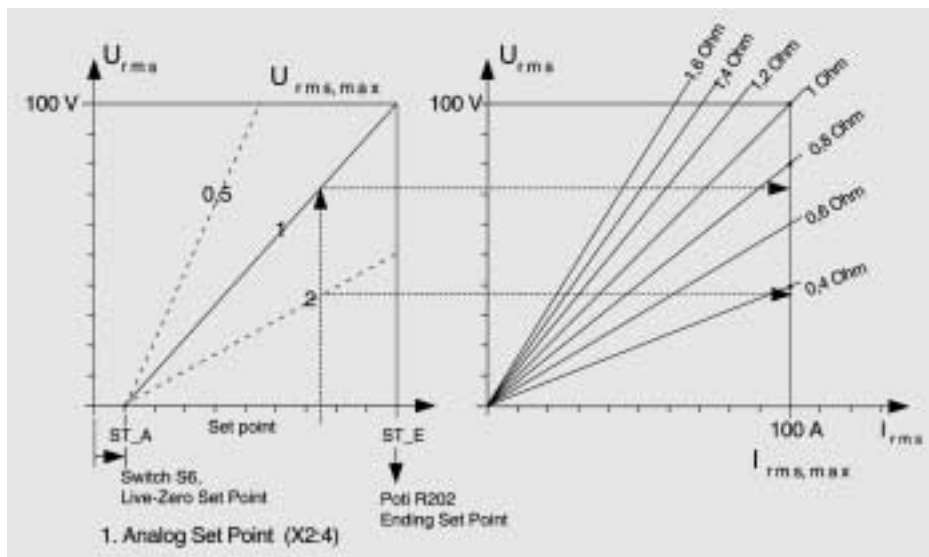


Fig. 1 Control characteristic

If the controller is within a limit (U_{\max} , I_{\max}), both LED PULSE INHIBIT and LOAD FAULT blink alternatively in second intervals (chapt. 3.3).

Input set points

The Power Controller Thyritop 30 is equipped with two input set points which are isolated from the mains.

- Set point 1 analog (X2.4 – X2.3 ground)
- Set point 2 via bus module

The analog input can be adapted to the various process controllers by means of the set point and live zero switches as well as the potentiometer controlling set point input. The following signal ranges can be set:

0(4)-20 mA ($R_i = \text{ca. } 250 \, \Omega$), 0-5 V ($R_i = \text{ca. } 44 \, \text{k}\Omega$), 0-10 V ($R_i = \text{ca. } 88 \, \text{k}\Omega$).

+5V supply voltage can be taken for a set point potentiometer from terminal X2.8. ($5 \, \text{k}\Omega \leq R_{\text{Poti}} \leq 10 \, \text{k}\Omega$)

The effective set point is the patched through set point. Within the stated input ranges these values with the control characteristic may be adjusted to any common signal characteristic.

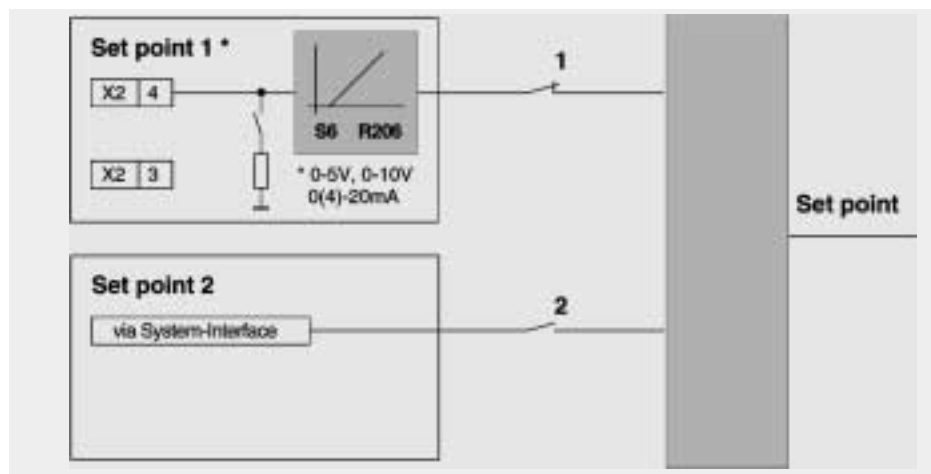


Fig. 2 Set point inputs and total set point

2.3 Control types

Thyritop 30 ...H RL1 has four control types. Mains voltage variations and load changes are directly and quickly adjusted by bypassing the sluggish temperature control system.

Before commissioning the Power Controller and selecting a control mode, familiarisation with the operating procedure and the effect upon the application is important.

2.3.1 Controlled value

The controlled value effective on the load is proportionate to the total set point, depending on the control type:

Control type	Control value (proportionate to the total set point)
U	output voltage, U_{rms}
U^2	output voltage, U_{rms}^2
I	output current, I_{rms}
I^2	output current, I_{rms}^2

2.3.2 Limitations

Independent of the output voltage control, limiting current values can additionally be set (chapt. 3.2.3).

2.3.3 Controller response

If the load resistance changes, e.g. due to temperature effect, ageing or load fault, the values effective on the load change as follows:

Underlying control		Load resistance decreases			Load resistance increases			Effective limitations
	limit	P	U_{Load}	I_{Load}	P	U_{Load}	I_{Load}	
U	$U_{rms\ max}$	larger	=	larger	smaller	=	smaller	$I_{rms\ max}$
$U^2\ (U \times U)$	$U_{rms\ max}$	larger	=	larger	smaller	=	smaller	$I_{rms\ max}$
I	$I_{rms\ max}$	larger	smaller	=	smaller	larger	=	$U_{rms\ max}$
$I^2\ (I \times I)$	$I_{rms\ max}$	larger	smaller	=	smaller	larger	=	$U_{rms\ max}$

Tab. 1 Behaviour with load change

2.4 Indications

2.4.1 LED indications

The LEDs on the front signal the following states:

• ON	green	operating indication, power supply for controller device
• PULSE INHIBIT	red	pulse lock active
• LOAD FAULT	red	fault present

Blinking indications are described in chapter 3.3.
Activation of the integrated semiconductor fuse can be signalled using the K1 fault indicating relay (undercurrent detection).

2.4.2 Alarm relay K1

The relay K1 is activated if a fault is detected in the system. (Chapt. 3.3)
This has a relay. The following table shows the configuration of the corresponding terminals.

	Root	Closer	Opener
Alarm relay K1	X3.1	X3.2	X3.3

2.5 Monitoring

Faults occurring in the Power Controller and the load circuit are signalled. Signalling ensues via LED (LOAD FAULT) and via the K1 relay.

2.5.1 Monitoring of load and mains voltage

The limiting values of the voltage are -57% of the type voltage for undervoltage monitoring and +10% of the type voltage for overvoltage monitoring. This produces the following absolute limiting values:

Type	Undervoltage	Overvoltage
230V	99 V	253 V
400V	172 V	440V
500V	215 V	550V



NOTE

The devices may only be operated up to the undervoltage limit if the electronics are supplied by an ext. 24V voltage. If the undervoltage limit is undercut the pulse lock is activated and relay K1 is released.

2.5.2 Absolute value monitoring current

This function allows monitoring of a freely selectable absolute current limit. The value is set by potentiometer R205. During the setting procedure an instrument connected to the analog output indicates the monitoring value. (Chapt 3.2) This absolute value monitoring lends itself to one or more load resistances arranged in parallel. Generally, the effective current value measured is continuously compared with a presettable absolute current limit for undercurrent. If this limit is undercut, an indication shows. In the case of resistance elements arranged in parallel, it is possible to select a partial load interruption by setting the undercurrent limit accordingly. (Chapt 3.2.5).

2.5.3 Equipment temperature monitoring

The control board is equipped with a temperature monitor.

If a fault occurs the LED LOAD FAULT blinks and the alarm relay is released.

2.5.4 Ventilator monitoring

The separately ventilated power controllers (..F..) are fitted with thermal monitoring. The temperature of the heat sink is measured. In case of a temperature overrange a fault indication ensues and relay K1 switches default settings.

3. Operation

This chapter describes the operating elements of Thyritop 30. For default settings see chapter 8.2.

3.1 Configuration switch S1

A 10-pole DIP switch is situated at the front behind the hood. The individual switches are marked from 1-10 starting from the bottom and must be set before operation according to application. They are only read in by the Power Controller once when switched on or with mains recovery. For safety reasons further operation is carried out with the hood closed. (3.2).

3.1.1 Operating mode

<u>S1-</u>	<u>1</u>	<u>2</u>	<u>Operating mode</u>
	0	0	none
	1	0	TAKT - full wave switch operation
	0	1	VAR - phase-angle operation
	1	1	QTM - Quick takt operation

3.1.2 Control types

<u>S1-</u>	<u>3</u>	<u>4</u>	<u>5</u>		<u>Control types</u>	<u>Analog output</u>
	0	0	0	U ²	(UxU) Control	U - Display
	1	0	0	U	(U) Control	U - Display
	0	1	0	I ²	(IxI) Control	I - Display
	1	1	0	I	(I) Control	I - Display
	0	0	1	I	(I) Control	U - Display

3.1.3 Live zero set point

<u>S1-</u>	<u>6</u>	<u>Signal level</u>
	0	0 - (20) mA
	1	4 - (20) mA

3.1.4 Analog input

<u>S1-</u>	<u>7</u>	<u>8</u>	<u>Signal level</u>	<u>Input resistance</u>
	0	0	0 - 10 V	88k Ω
	1	0	undefined	undefined
	0	1	0 - 5 V	44k Ω 44 (e.g for set point potentiometer)
	1	1	0 - 20mA	250 Ω

3.1.5 Analog output

The analog output allows the display of U_{rms} or I_{rms} as in 3.1.2

<u>S1-</u>	<u>9</u>	<u>10</u>	<u>Output signal level</u>
	0	1	0 - 10V
	1	1	2 - 10V
	0	0	0 - 20 mA
	1	0	4 - 20mA

3.2 Potentiometer

The description of the settings proceeds from the upper (R201) to the lower (R205) potentiometer. A 19 mm potis with 20 revolutions is being referred to.

A setting guide exists for all potentiometers via the analog output (X2:9 against X2:5 ground). If a poti is changed, this is recognised by the Thyritop 30. It then switches the analog output over so that instead of the actual value, the poti value is read out.

During the setting procedure the red LEDs flicker. As the analog output is designed for 0-20mA / 10V, 10mA (=5V) = 100% is set. This allows the set points to be read directly or in a percentage of the nominal value:

Analog output (setting guide):

10	V or	20.0mA =	200%		
5	V or	10.0mA =	100%	or	100°el.
2.5	V or	5.0mA =	50%	or	50°el.
1.25V	or	2.5mA =	25%	etc.	

If the poti is not substantially changed within 30 seconds, the Thyro-A automatically switches back to the output of the chosen actual value.

3.2.1 Phase angle 1. half wave operation TAKT

Potentiometer R201 serves to set the transformer load. At works it is set at 60° el with Thyritop 30 1A and at 90° el with Thyritop 30 2A.

Transformer loads with a nominal induction > 1.2 T, as well as wound core and toroidal core transformers optimization is necessary. With Thyritop 30 1A generally 80°el turn (to the right), with Thyritop 30 2A turn at smaller angles (to the left). An optimal setting is achieved when the rush current is minimal.

the soft start time SST is set at the same time. The also applies to the operating mode **VAR**. Depending on AN1 the soft start time has the following value:

AN [1°el]	<30	<33.7	>=33.7	>=41.2	>=48.7	>=56.2	>=61.5	>=64.5	>=67.4	>=70.5	>=73.5
SST [ms]	0	120	140	160	180	200	220	260	300	400	600

With an ohmic resistance load the poti can be turned to the left limit stop, at > 30°el Thyritop 30 independently switches to a faster pulse operation with To = 5 periods without SST. In this configuration the terminal X2.7 can be used as an additional digital “set point value” (24V d.c.). This also permits the controller to be driven by a 2-point controller.

Analog output (setting guide):

10V / 20.0mA = 200 - limit value 100°el is applied.
3V / 6.0mA = 60 °el
1.5V / 3.0mA = 30 °el
1.25V / 2.5mA = 0 °el

3.2.2 Control end set point input

Potentiometer R202 allows the control characteristic to be adapted to the operation. In central position the factor is = 1, right-hand stop = 2, left-hand stop = 0. Default setting.

With set point full modulation (20mA, 10V, 5V see 3.1.4) wird $U_{rms\ max}$, i.e. nominal voltage + 10% or $I_{rms\ max}$, i.e. nominal current is reached, depending on the type of underlying control.

Analog output (setting guide):

				<u>Factor</u>	<u>Control end</u>			
10 V	or	20.0mA	=	2	20 V	or	40mA (theor.)	
5 V	or.	10.0mA	=	1	10 V	or	20mA	
2.5 V	or.	5.0mA	=	0.5	5 V	or	10mA	
1.25V	or	2.5mA	=	0.25	2.5V	or	5mA	

Factors > 1 result in a shallower characteristic. Full modulation can no longer be reached. See also Fig. 1 Control characteristic.

3.2.3 Current limitations

Potentiometer R203 enables the load current to be limited to a given value. Default setting: nominal current as on type plate.
At reduced ambient temperature the controller can be operated with up to 110% of its nominal current (effective value).

Analog output (setting guide):

10 V / 20.0mA = 200% - values > 110% are limited to 110%
5 V / 10.0mA = 100%
2.5 V / 5.0mA = 50%
1.25V / 2.5mA = 25%

The permissible peak currents are derived from the fuse layout.

See type table and text: definitions and dimensions of Thyristor power controllers.

If the limit has been reached, the red LEDs blink in 1 sec. intervals.

3.2.4 Increased analog output

The analog output is set at 0-20 mA. 20mA corresponds to the effective current which corresponds to the nominal current of the integrated current transformer.

A scale is available from the manufacturers for this.

Power controller to	30A	$\ddot{U} = 40$
	45 - 100A	$\ddot{U} = 100$
	130 - 170A	$\ddot{U} = 200$
	280A	$\ddot{U} = 300$

It is possible to adapt with potentiometer R204, e.g. if the scaling does not correspond to the nominal data or the output is set to voltage reading. The increase can be set to between 0 and 2.

Analog output (setting guide):

	<u>Factor</u>	<u>Comment</u>
10 V / 20.0mA =	2	i.e. for 50A scale of a 100A appliance
5 V or 10.0mA =	1	see table above
2.0V or 4.0mA =	0.4	i.e. for 100A scale of a 40A appliance

3.2.5. Load monitoring (undercurrent monitoring)

Thyritop 30 ... HRL1 is suited for monitoring loads which consist of one or several resistors in parallel or in series parallel connection.

Thyritop 30 recognises an increase in load resistance. The load monitor works as an undercurrent monitor and is suitable for application in all operating and control modes. Load monitoring is delivered with the default setting OFF = left stop R205.

For all other settings the following applies:

If the load current undercuts the set level, the fault relay is released. The incident is indicated through a bus system which can optionally be installed.

A setting can be made according to the following table:

e.g. parallel load resistances	Resistance increase in case of fault	$I_{\text{Load nom}} / I_{\text{Type controller}}$	Recommended setting for Poti R205		Analog output signal during poti setting	
Number					U_{output} or I_{output}	
1	∞	100%	50.0%	->	5.00V	10.0mA
2	100.0%	100%	25.0%	->	2.50V	5.0mA
2		80%	20.0%	->	2.00V	4.0mA
2		60%	15.0%	->	1.50V	3.0mA
2		40%	10.0%	->	.00V	2.0mA
2		20%	5.0%	->	0.50V	1.0mA
3	50.0%	100%	16.7%	->	1.67V	3.3mA
3		80%	13.3%	->	1.33V	2.7mA
3		60%	10.0%	->	1.00V	2.0mA
3		40%	6.7%	->	0.67V	1.3mA
4	33.3%	100%	12.5%	->	1.25V	2.5mA
4		80%	10.0%	->	1.00V	2.0mA
4		60%	7.5%	->	0.75V	1.5mA
4		40%	5.0%	->	0.50V	1.0mA
5	25.0%	100%	10.0%	->	1.00V	2.0mA
5		80%	8.0%	->	0.80V	1.6mA
5		60%	6.0%	->	0.60V	1.2mA

Tab. 2 Load monitoring

Value deviations can be converted by percentage. The set monitoring value must lie “in the middle” between the nominal load current value and the value after outage.



NOTE

ESettings above 90% and below 10% are not practical. If low load currents are required, check if a controller with a lower type current can be used.

In the VAR operating mode monitoring with large trigger delay angles $\alpha > 140^\circ$ el. is locked.

3.3 Diagnosis / status indications

Faults can occur in the load circuit and in the controller itself or from the mains. Diagnosis of unexpected operating behaviour is performed by LEDs on the front panel of the control device.

Description	LEDs	Relay K1	Description
Frequency fault	PULSE INHIBIT blinks	open	Outside 47Hz to 63 Hz
SYNC fault	PULSE INHIBIT blinks	open	when switching on or Zero crossing outside permissible tolerance range in operation
Temperature monitoring	LOAD FAULT blinks	open	Temp. monitoring responded (control board or control section)
Load fault	LOAD FAULT on	open	Load fault: none or under current
Flash values invalid	2 red LEDs	open	Controller fault
Correction values invalid	synchron. blinks		
Undervoltage		open	Mains fault
Overvoltage		--	Mains fault
Pulse lock active	PULSE INHIBIT	closed	Bridge X2: 1.2 opened
U-limitation	2 red LEDs blink slowly, alternatively	none	U limit value exceeded
I-limitation	2 red LEDs blink slowly, alternatively	none	I limit value exceeded

Tab 3 Allocation of message register

4. External connections

4.1 Power supply for Thyritop 30

Connecting the power supply is carried out as shown in the figures and technical data. With Thyritop 30 2A a right rotational field in the power circuit is required.

4.2 Power supply for the control device

The control device is supplied directly from the power section (terminals U1, X1:1.2). This voltage also serves as mains synchronization. The mains connection is equipped for input voltages of $U_{Nnom} -15\%$ to $+10\%$ and nominal frequencies of 47Hz to 63Hz. Both terminals (X1:1.2 1.5mm² grid 3.81) are internally bridged. If a phase is connected to X1, a fused connection is necessary (figs. 3, 7).

4.3 Additional control voltage input

The Thyristor Power Controller is equipped with an additional 24V a.c./d.c. power supply input. (X11:1.2 1.5mm² grid 3.5).

If required, the control device can additionally be supplied with 24V a.c. or d.c., when operating with bus, for instance, or with voltages below the tolerance (e.g. with undervoltage of a 440V supply with a 500V Thyro-A).

The 24V voltage must be ungrounded (SELV) and may not be connected to the control ground. Several Thyritop 30 devices can be operated from a 24V supply. The input is reverse protected. The connection output for the control device is ca. 2W (5VA) per controller.

The 24V connecting lines must be fuse protected under valid regulations. A soldered fuse protects the device should internal short circuits occur.

4.4 Pulse lock

The pulse lock (PULSE INHIBIT; terminals X2.1 - X2.2 1.5mm², grid 3.5) is activated by opening the pulse-lock bridge, i.e. the power section is no longer triggered. If the pulse lock is activated the LED "PULSE INHIBIT" lights up red. A mains outage sets off the pulse lock internally.

It is imperative to use the pulse lock with transformer load in order to activate the Soft Start function. It may only then be released when there is a voltage supply to the power section. With Thyritop 30 2A the pulse lock is only wired to the master (L1, left).

4.5 Analog set point value input

The set point value input (terminal X2: 3 ground - X2:4 + 1.5mm² grid 3.5) is suitable for process controllers with output signals of 0(4) - 20mA, 0-5V, 0-10V.

4.6 Digital set point value input

Under particular conditions terminal X2.7 can be used as additional digital "set point value input" (24V d.c.) so that, for instance, Thyritop 30 can be triggered by a 2-point regulator. Further information is available on this in chapter 3.2.1.

4.7 Analog output

The electrical values for current and voltage at the load are recorded by the Thyritop Power Controller and can be displayed using an external measuring device or a graph recorder. Connection to terminals X2:9 (+), against X2:5 ground 1.5mm² grid 3.5. The selectable signal levels are 0-10 Volt, 0-20mA, 4-20mA. The analog output is updated with new data every 200ms (default value).

This timing can be parameterized via the interface.

The following values may be given:

- load voltage
- load current

4.8 Current transformer

All Thyritop 30 ... H RL 1 types have one current transformer per path in their power section. The current transformer only has local mode wiring.

4.9 Voltage transformer

The load voltage is recorded by the measuring signal given by the supply voltage.

This value is linked with the control angle α or the pulse ratio

$U_{\text{rms}} = U_{\text{mains}} * \sqrt{(T_S/T_O)}$. The voltage transformer only has local mode wiring.

4.10 Block connection diagram

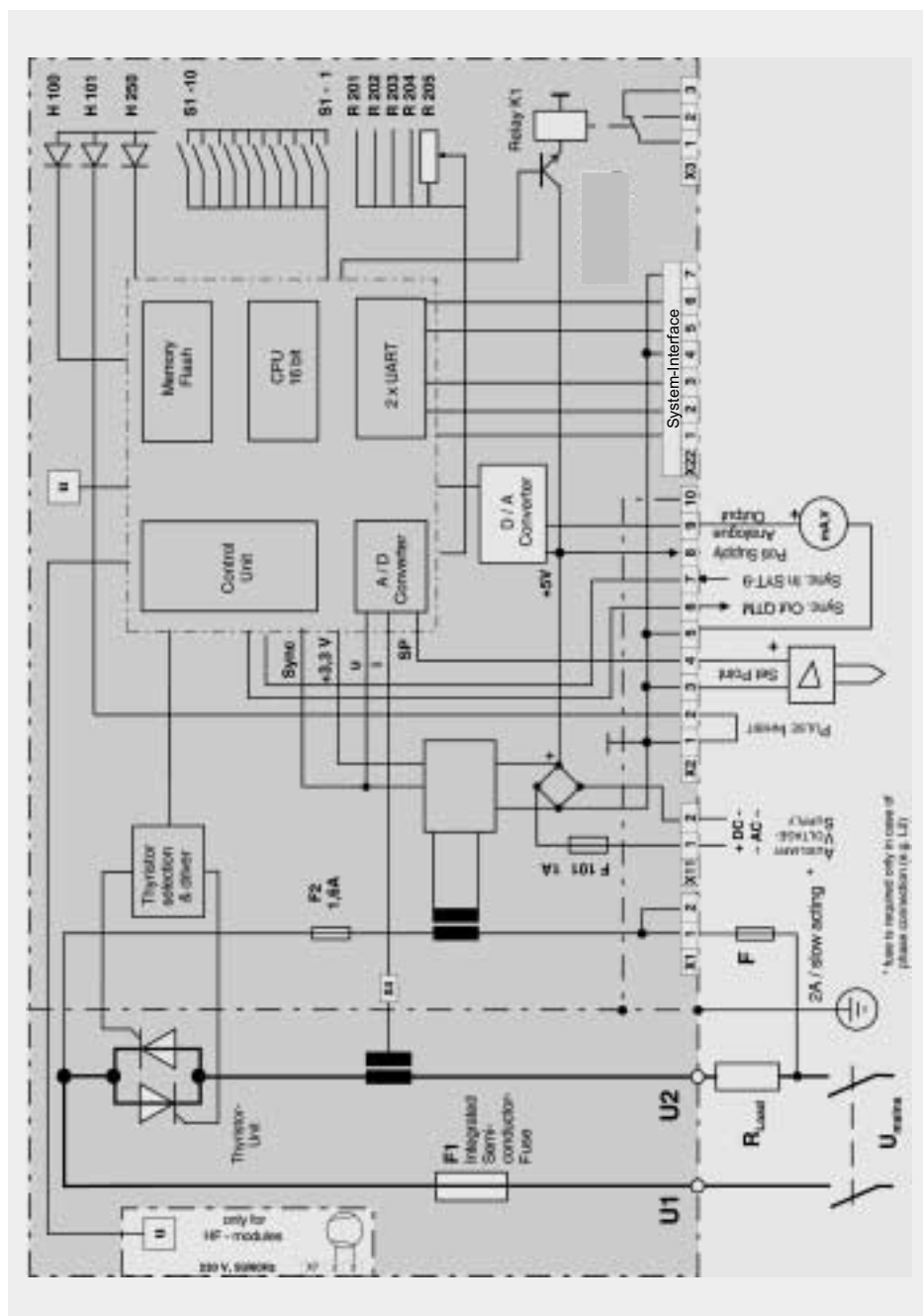


Fig. 3 Block connecting diagram

The above block connection diagram shows the essential functions of Thyritop 30.

4.11 Operating elements and terminal strips

This chapter describes all terminal strips and jumpers.

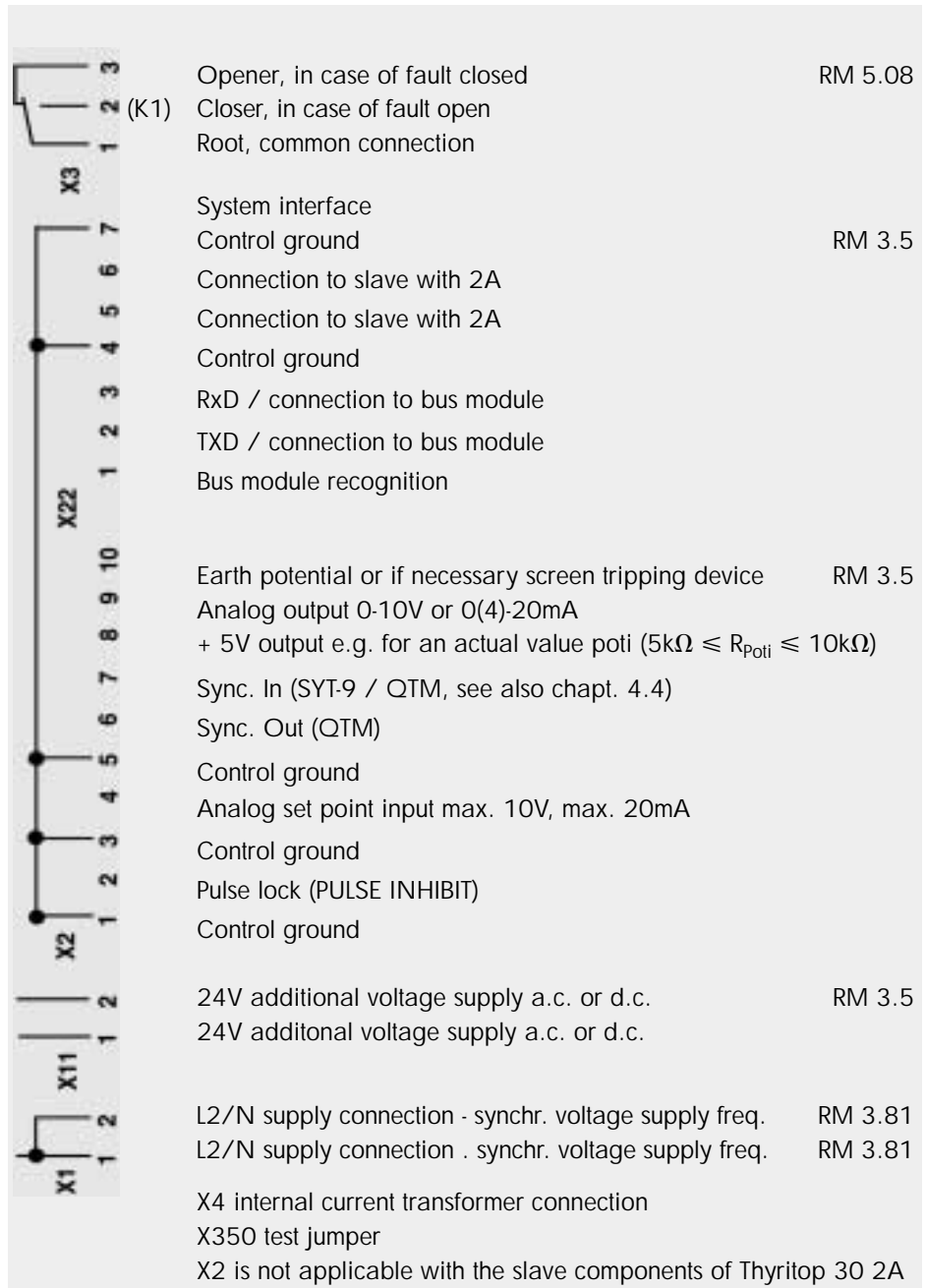


Fig. 4 Terminal plan



















	H 100	LED	gn	ON	
	H 101	LED	rt	PULSE INHIBIT	
	H 250	LED	rt	LOAD FAULT	
	S1-10	Analog output 10V / 20 mA			Chap. 3.1.5
	S1- 9	Live zero analog output			
	S1- 8	Set point value input			Chap. 3.1.4
	S1- 7	Set point value input			
	S1- 6	Live zero set point			Chap. 3.1.3
	S1- 5	Control type			Chap. 3.1.2
	S1- 4	Control type			
	S1- 3	Control type			
	S1- 2	Operation mode			Chap. 3.1.1
	S1- 1	Operation mode			
	R 201	Phase angle	TRAFO ADAPTION	Chap. 3.2.1	
	R 202	Control ende	SCALE SETPOINT	Chap. 3.2.2	
	R 203	Current limit	CURRENT LIMIT	Chap. 3.2.3	
	R 204	Increase	SCALE OUTPUT	Chap. 3.2.4	
	R 205	Load monitoring	LOAD FAULT	Chap. 3.2.5	

Fig. 5 Operating elements



5. Interfaces

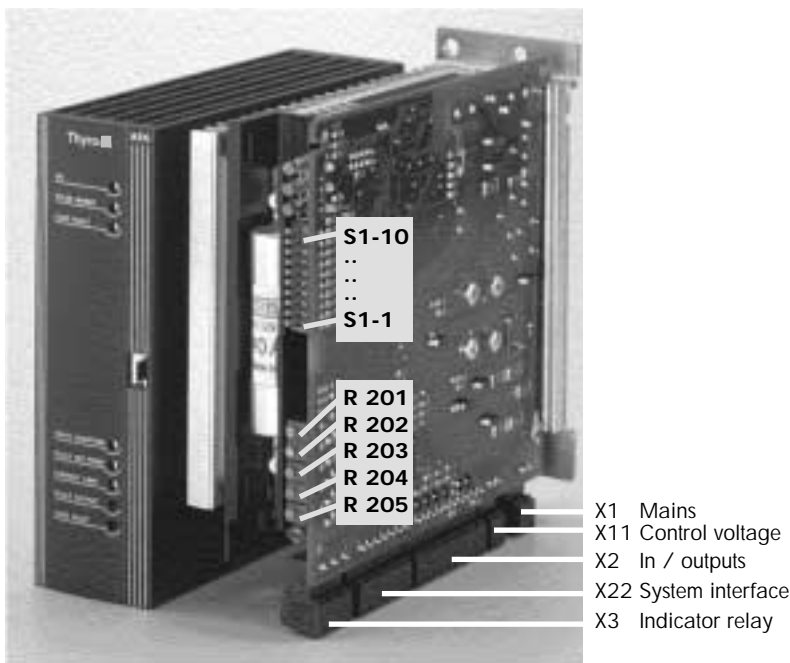


Fig 6 Thyritop 30 ... HRL 1

With its system interface terminal strip X22 the Power Controller Thyritop 30 can be connected via an optional bus module to, for example, Profibus DP or Modbus RTU (other bus modules available on request). Description and connections can be taken from the instructions of the respective components.



NOTE

The access to set value, actual values and parameters made possible through bus provides further useful functions for application, e.g. determining load resistance and software synchronization. The corresponding operating instructions provide further information on this.



6. Mains load optimization

The application of mains load optimization offers substantial advantages, e.g. reduction of mains load peaks and mains reactions.

Mains load optimization is possible in multiple controller applications in which either the operating mode TAKT (slow pulse at AN_1 = > 30°el) or operating mode QTM is applied.

6.1 Synchronization SYT-9 (operating mode TAKT)

SYT-9 is a process for static load optimization. It minimizes main load peaks and associated mains reaction shares. Set points and load changes are not automatically included in mains load optimization.

The SYT-9 process requires an additional component. It can also be employed in connection with controllers already installed of type Thyritop 40. Then the pulse must be connected to terminal X2.7 and the +5V for the SYT-9 card must be connected to X2.8.

The operating mode TAKT contains a high pulse frequency ($AN1 < 30^\circ\text{el}$ for ohmic load, $T_o = 5$ supply periods) as well as a low pulse frequency ($T_o = 50$ supply periods).

The low pulse frequency is also suitable for switching transformers and is activated independently at phase angle $> 30^\circ\text{el}$.

Only in this operating mode is the input X2:7 scanned. Is a pulse recognised, the Power Controller switches on and the pulse time T_o applies from here.

The impulse is switched by the Synchrotakt component via an optoelectronic coupler. Energy comes from its own controller X2.8.

Please observe the operating instructions of the SYT-9 component.

6.2 Synchronization in operating mode QTM (1A)

The operating mode QTM works in rapid half-wave frequency with a pattern of switched and locked half waves at particular intervals < 1 sec, also designated as T_o . To achieve a balance in supply from the outset (not after T_o) the individual controllers synchronize themselves by staggering by one supply period. With the first connected controller the SYT input X2.7 is jumped to +5V X2.8.

The following controllers receive their impulses at X2.7 from sync. output X2.6 of the previous controller. With the last controller X2.6 remains free (series connection). This synchronization method is only possible with Thyritop 30 (refer to Fig. 9).

6.3 Software synchronization (operating mode TAKT)

The application of an optional bus module activates the software synchronization.

7. Connecting diagrams

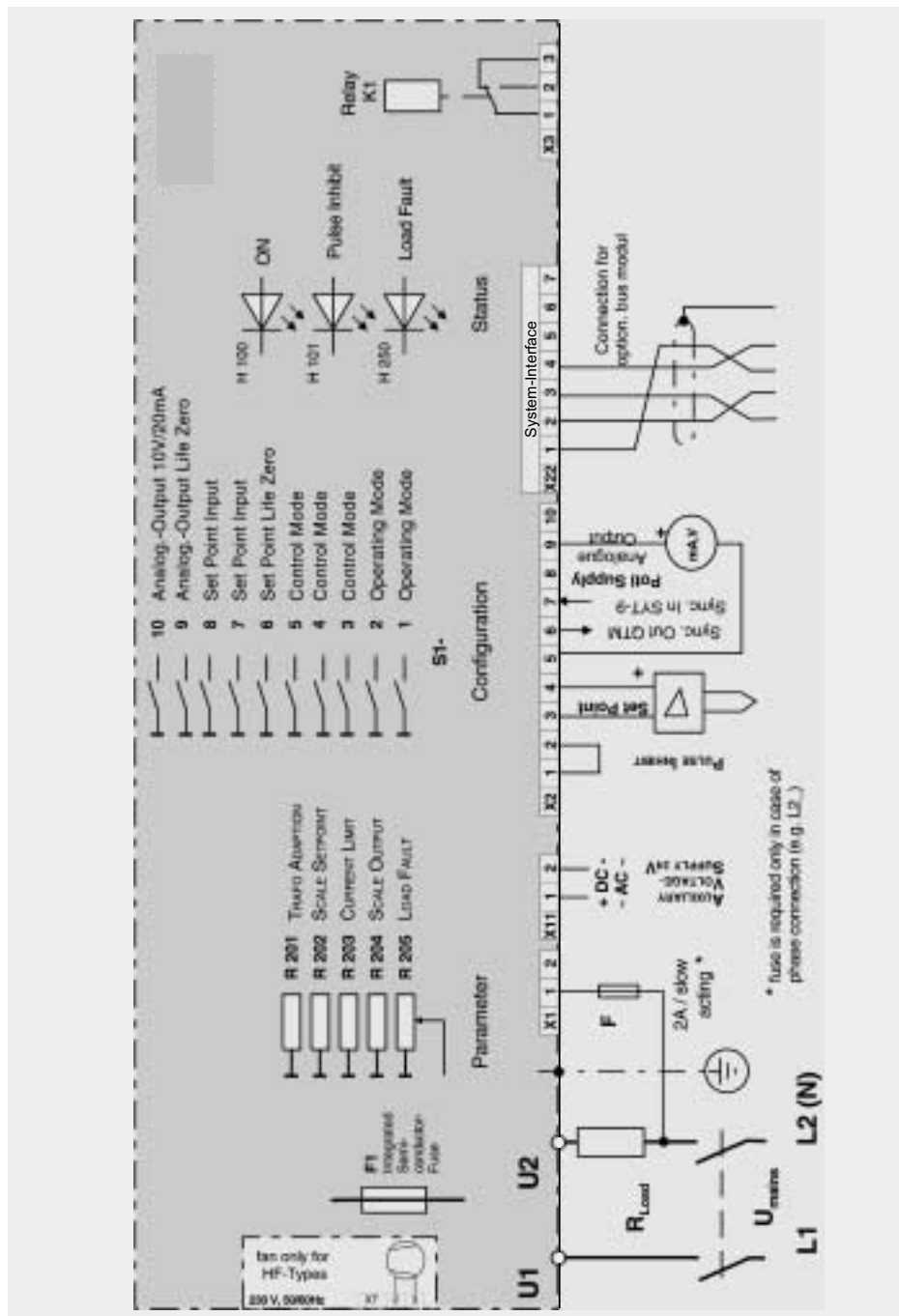


Fig. 7 Connecting diagram 1A

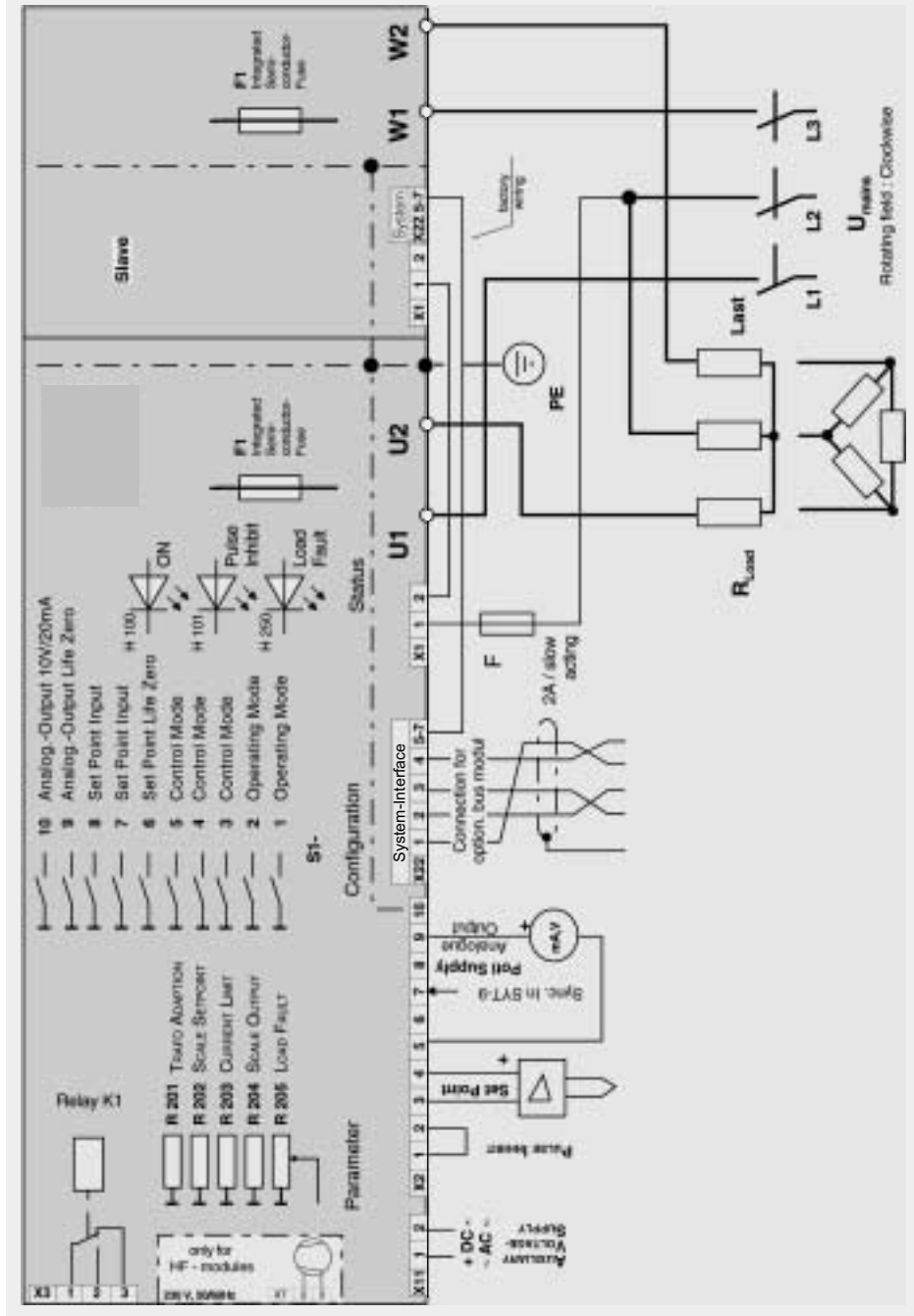


Fig. 8 Connecting diagram 2A

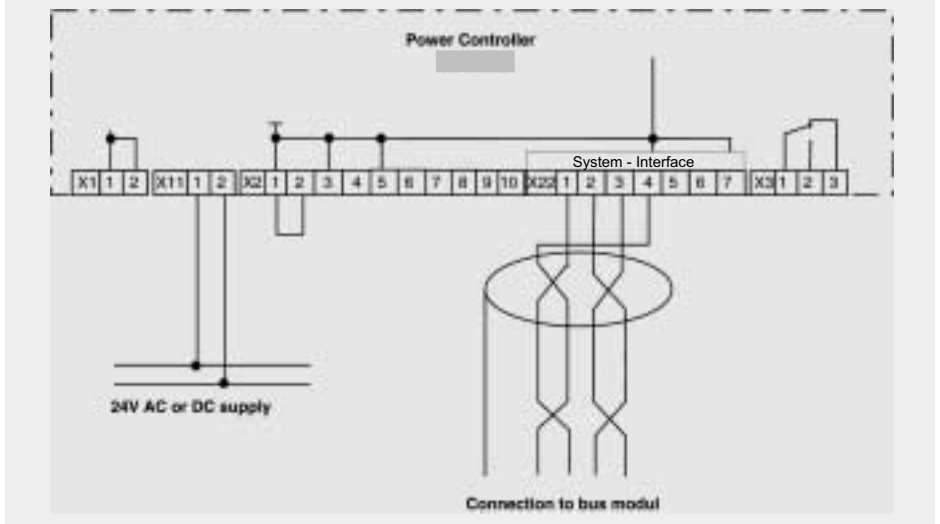


Fig. 9 Connecting diagram for auxiliary supply and connection to bus module

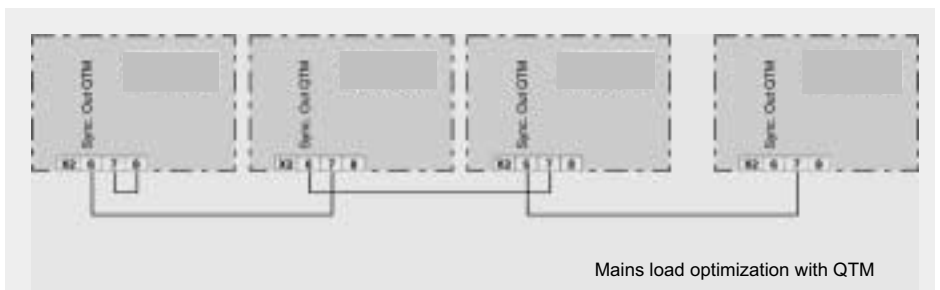


Fig. 10 Connecting diagram for QTM



8. Special remarks

8.1 Installation

Thyritop 30 requires a vertical fitting position. With cabinet mounting sufficient ventilation of the cabinet must be ensured. The distance between the Power Controller and the cabinet ceiling or other mountings should be at least 150mm. The distance below the Power Controller should be at least 100mm. Heating up of the device by heat sources must be avoided. The dissipation of the Power Controller is stated in the Type overview table.



ATTENTION

Grounding must be carried out according to local regulations! (a grounding screw is provided for protective conductor connection on fastening adapter). The grounding also serves EMV devices (Y capacitor 4.7 nF).

For single-phase devices with type currents 8, 16 or 30A an adapter can be delivered for the 35mm top-hat rail assembly.

8.2 Commissioning

The device must be connected to the mains and the associated load according to the corresponding connecting plans.

On delivery the device is parameterized and adjusted to the respective power section. The operating mode TAKT (S1-1, S1-2) for transformer load (R201) is set. If a different operating mode is desired, then it must be set by the user. The following table shows the default settings of the DIP switch.

Analog output		Default	Setting act. Setting	Chapter No.
S1-10 S1-9	Signal level	0-20mA		3.1.5
Set point value				
S1-8 S1-7	Signal level	0-20mA		3.1.4
S1-6	Live Zero	0mA		3.1.3
Control mode				
S1-5 S1-4 S1-3	Control mode	U ²		3.1.2
Operating mode				
S1-2 S1-1	Oper. Mode	TAKT		3.1.1

Tab. 4 Default values DIP switch S1

The default settings of the potentiometer can be taken from the following table.

Phase angle 1. half wave		Default	Setting act. Setting	Chapter No.
R201		Thy 30 1A: 60°el Thy 30 2A: 90°el		3.2.1
Set point value input control end				
R202		U-Control: U _{Type} +10%		3.2.2
Current limit				
R203		I _{Type}		3.2.3
Load monitoring				
R205		OFF		3.2.5

Tab 5 Default values potentiometer

All standard settings should be checked by the user as a matter of course and adjusted to the operating conditions (e.g. operating mode, control mode, limits, monitoring, control characteristics, actual value output, fault indications etc.)



ATTENTION

Apart from the load and current supply to X1.1, certain control signals must be connected too. The following signals are essential for operating the device:

Set point (terminal 4 or by bus option)

Pulse lock (on ground, on terminal 1,2; jumper)

If the pulse lock jumper is not connected, the device is in a locked state and will not operate. Communication via interface is still possible. Further details on the pulse lock are described in the chapter of the same name.



ATTENTION

Heat sinks and neighbouring plastic parts are hot during operation!

8.3 Service

The devices delivered have been produced under quality standard ISO 9001. Should nevertheless faults or problems occur, Tel. +33(0)4 72 14 15 40

8.4 Checklist

• LED ON green does not light up

- Check fuse control 500V 1.6 A, if defective check external wiring, also applies to faults of external fusing, check Power Controller fusing.
- If fuse is defective then check load and wiring to load. Synchronization voltage is supplied to X1.1 supply(load) voltage must also be supplied by 24V current supply.
- With transformer load, check phase angle 1 (TRAFO ADAPTION) - fuse release caused by rush current is possible if setting is incorrect.
- Check 5 Volt to X2.8. If this voltage is absent or too low, there is a defective component.

• Supply available but no load current

- Check that pulse lock is cleared (jumped) terminal X2.1,2
- Check set point
- Check for load interruption
- Check blinking LED indications (chapt. 3.3))

• Load current does not have expected value

- Check set point Terminal X2.4 against X2.3 ground or
Bus set point (with optional bus module)
- Set point/controller value, max. value correctly parameterized (Poti R203)
- Check all parallel load resistances for current conduction
- Check that end control setting is correct

• Load current flows without triggering

- Check that current transformer is correctly connected with I / I² control (X4)
- Check limit values for correct setting
- Check control characteristic adjustment (U, I, live-zero)
- Check control end for correct setting

➔ 9. Type overview

The type key comprises from left to right:

Type range	Thyritop 30
Number of controlled phases	1A, 2A
Mains supply voltage	230, 400, 500 (V)
Type current	30 ... 280 (A)
and designation	H(F) RL 1

for incorporated semiconductor (H), with increased ventilation (F), indication relay (R), load current recording (L) and characteristic I for "series 2002".

9.1 Thyritop 30 1A

Thyristor controller with incorporated semiconductor, system bus interface, additional 24 V d.c./a.c. control voltage supply, relay indication, load current monitoring and analog output, channel separation, synchronization option (for TAKT: with SYT9 for QTM integrated), with operating modes TAKT, VAR, Quick-Takt Mode (T-V-Q) and the control types U - U² - I - I²

Type 1A	Cur- rent	Type capacity [kW]			Dissi- pation [W]	Dimensions in mm/kg				Dim. draw.	Current tranf.	Fuse F1
		230 V	400 V	500 V		W	H	D	Weight			
H RL 1	8	1.8	3.2	4		40	121	127	0.5	910		12
H RL 1	16	3.7	6.4	8	30	45	121	127	0.7	911	40	20
H RL 1	30	6.9	12	15	47	45	121	127	0.7	911	40	40
H RL 1	45	10	18	22.5	48	52	190	182	1.7	943	100	63
H RL 1	60	14	24	30	80	52	190	182	1.7	944	100	100
H RL 1	100	23	40	50	105	75	190	190	1.9	944	100	180
H RL 1	130	30	52	65	150	125	320	237	4	946	150	200
H RL 1	170	39	68	85	210	125	320	237	4	946	200	315
HF RL 1	280	64	112	140	330	125	370	237	5	947	300	350

9.2 Thyritop 30 2A

Thyristor controller with incorporated semiconductor, system bus interface, additional 24 V d.c./a.c. control voltage supply, relay indication, load current monitoring and analog output, channel separation, synchronization option (for TAKT: with SYT9). Suitable for 3-phase operation in rotary current saver circuit with operating mode TAKT (T) and the control types U - U² - I - I²

Type 2A	Cur- rent	Type capacity [kW]			Dissi- pation [W]	Dimensions in mm/kg				Dim. draw.	Current tranf.	Fuse F1
			400 V	500 V		W	H	D	Weight			
H RL 1	8		5.5	7		80	121	127	1	000		12
H RL 1	16		11	14	60	90	121	127	1.4	001	40	20
H RL 1	30		21	26	94	90	121	127	1.4	001	40	40
H RL 1	45		31	39	96	104	190	182	3.4	002	100	63
H RL 1	60		42	52	160	104	190	182	3.4	003	100	100
H RL 1	100		69	87	210	150	190	190	3.8	003	100	180
H RL 1	130		90	112	300	250	320	237	8	004	150	200
H RL 1	170		118	147	420	250	320	237	8	004	200	315
HF RL 1	280		194	242	660	250	393	237	11	005	300	350



Type voltage 230 Volt -15% +10% > 99 V with addit. 24 V supply
400 Volt -15% +10% > 172 V with addit. 24 V supply
500 Volt -15% +10% > 200 V with addit. 24 V supply

Mains frequency all models 47Hz to 63Hz; $\Delta f = 6 \text{ Hz}$;
max. frequency change 5% per half wave

Load description ohmic load
ohmic load with $R_{\text{hot}} / R_{\text{cold}}$ ratio up to 6,
limit to $\hat{i} = 3 \times I_{\text{nom}}$
transformer load



ATTENTION

The induction of the load side transformer should not exceed 1.45T in case of mains overvoltage when using grain-oriented, cold-rolled plates = 1.2T nominal induction.

Betriebsarten

TAKT = full wave pulse = default (T_0 : 0.1 sec / 1.0 sec)

VAR = phase-angle control (only for types 1A)

QTM = fast half wave pulse (only for types 1A)

Set point inputs

The Power Controller Thyritop 30 has 2 set point inputs. The set point inputs are indirectly connected to the mains (SELV, PELV).

Set point 1: External set point input signal ranges:

0(4) - 20 mA $R_i = \text{ca. } 250 \text{ k}\Omega$

0 - 5 V $R_i = \text{ca. } 44 \text{ k}\Omega$

0 - 10 V $R_i = \text{ca. } 88 \text{ k}\Omega$

Set point 2: Optional bus interface, connection from superset PC or automation system.

Analogue output

Output: Signal level 0-10 Volt, 0-20 mA, 4-20 mA

Maximum burden voltage 10 V

Control characteristic

The control characteristic is established by the maximum value of the dimensions to be controlled and the key values of the set point. Using these key values, the linear control characteristic may be set as desired.

Each controller (e.g. temperature controller) whose output signal lies within the range 0-20mA / 0-5 V / 0-10 V, can easily be adapted to the Power Controller.

Control types

Voltage control U_{rms} , U^2_{rms} = standard setting

Current control I_{rms} , I^2_{rms}

Precision of control

Voltage $\pm 2,5\%$ and ± 2 Digit

Current $\pm 1,5\%$ and ± 2 Digit

both with reference to the end value

Limitations

Current limitation I_{rms}

Relay outputs

Change-over contact, contactor material: AgSnO₂ / Au plated

The relay can be used for weak load circuits ($> 5V$ 20mA),

but not after a prior load with 230V a.c.

Max. values: 250V 6A 180W, 1500VA

Insulation strength 4kV / 8mm

Ambient temperature

35°C external cooling (F model with integrated ventilator)

45°C self air cooling

At higher temperatures it is possible to operate with reduced type current:

Temperature range up to 55°C: type current -2% / °C

Connector data

	Connector U1,W1,U2,W2	Earthing screw	Conductor cross sect.
8A	Screw plug-in terminal	Bracket / M4	max. 4 mm ²
16 / 30 A	Bracket / M4	Bracket / M4	max. 6 mm ²
45 A	M 6	M 6	max. 50 mm ²
60 / 100 A	M 6	M 6	max. 50 mm ²
130 / 170 A	M 8	M 10	95 / 120 mm ²
280 A	M 10	M 10	150 / 185 mm ²

With UL applications only use 60°/75° copper conductors!

Torques in Nm

Screw	Min	Rated	Max
M 2	0.22	0.25	0.28 (Phönix Screws)
M4	0.85	1.3	1.7
M6	2.95	4.4	5.9
M8	11,5	17	22.5
M10	22	33	44

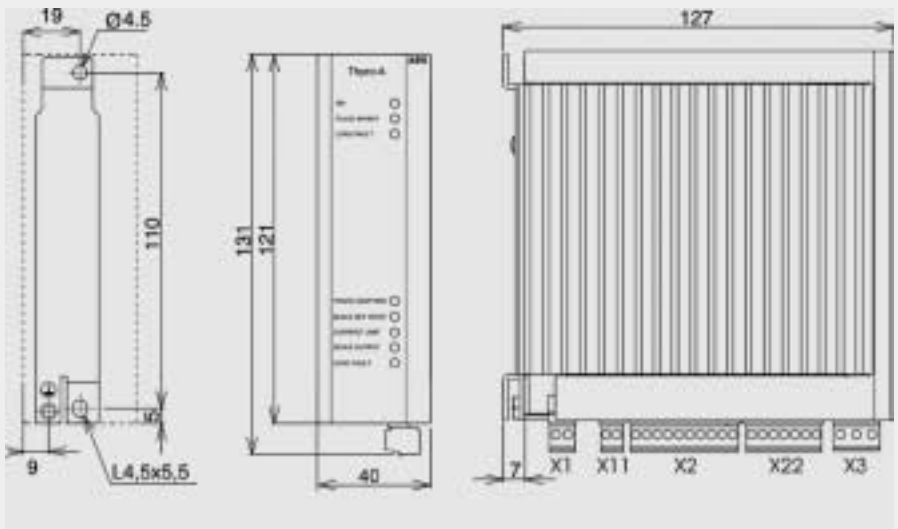
Ventilation data

230V, 50-60Hz

Thyritop 30	Type	current 50 Hz	Type	current 60 Hz	Air volume
1A 280 F	0.13 A		0.13 A		120 m³/h
2A 280 F	0.25 A		0.26 A		200 m³/h

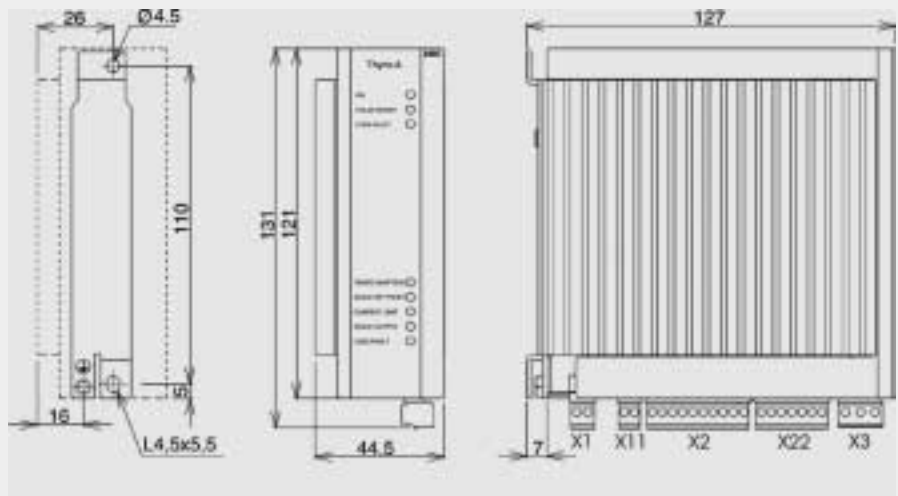
The ventilators must run with Thyritop 30 switched on, connection to X7

11. Dimensional drawings



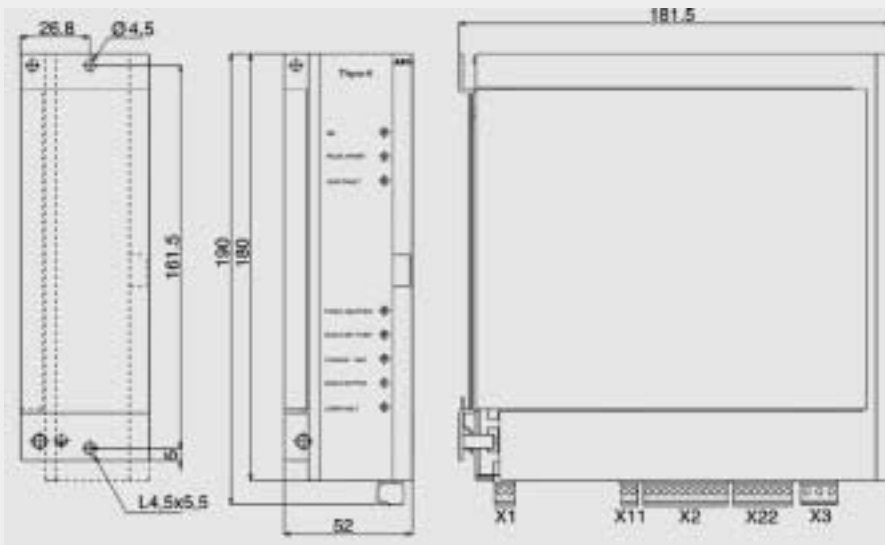
Thyritop 30 1A (8 H)

Dimensional drawing 910



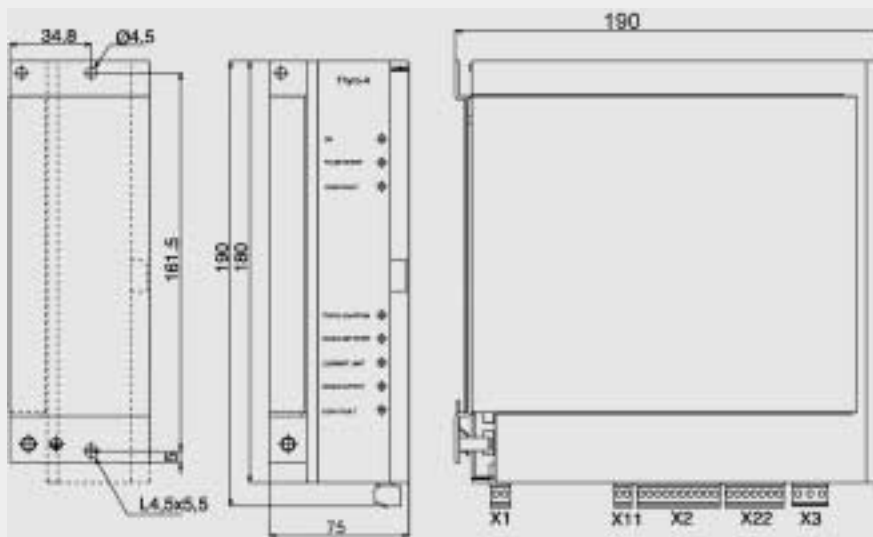
Thyritop 30 1A (16 H, 30 H)

Dimensional drawing 911



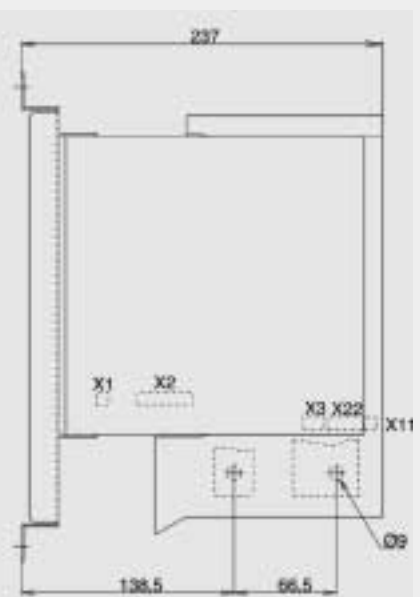
Thyritop 30 1A (45 H, 60H)

Dimensional drawing 943

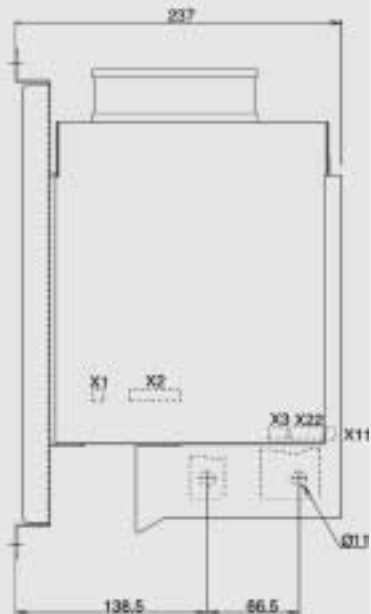


Thyritop 30 1A (100 H)

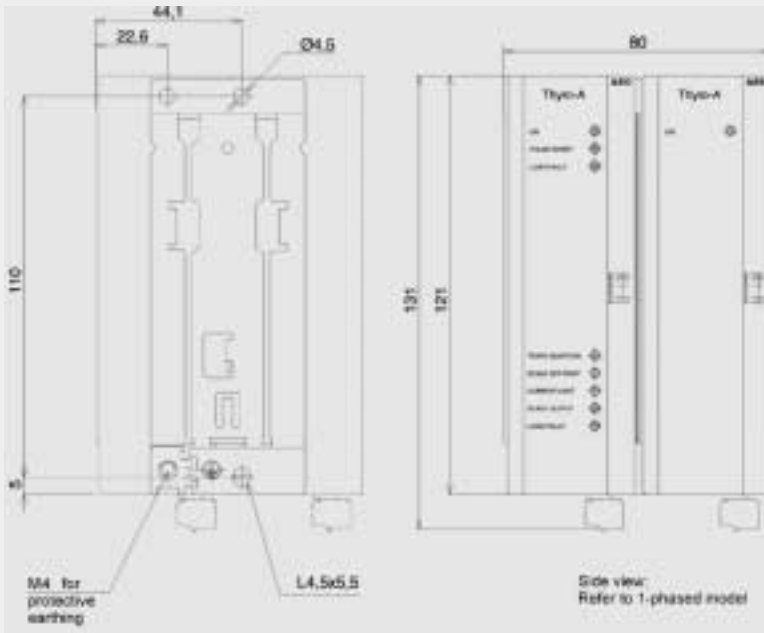
Dimensional drawing 944



Dimensional drawing 946

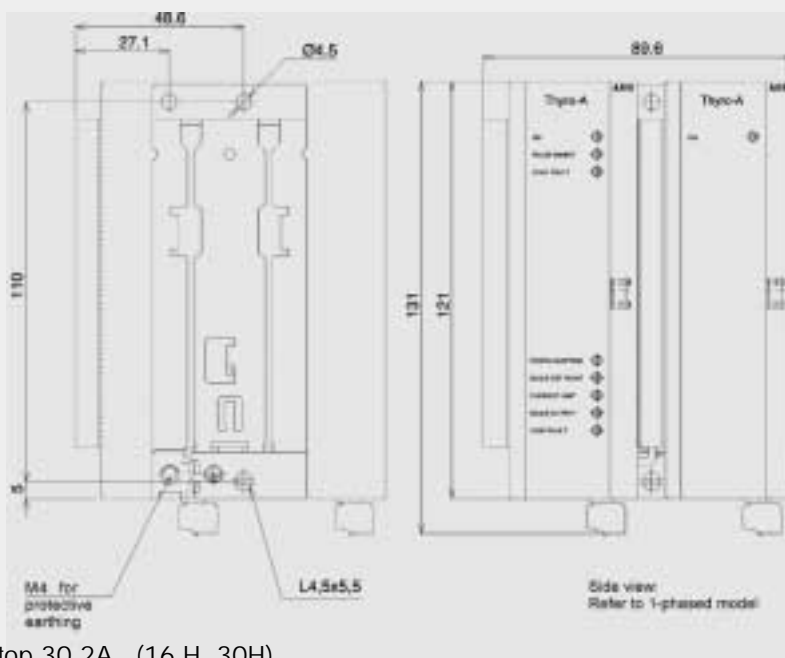


Dimensional drawing 948



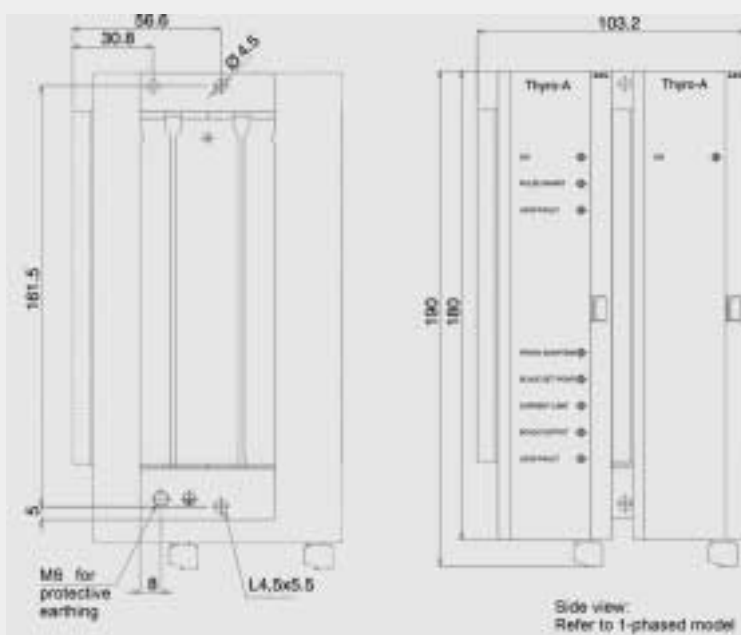
Thyritop 30 2A (8 H)

Dimensional drawing 000



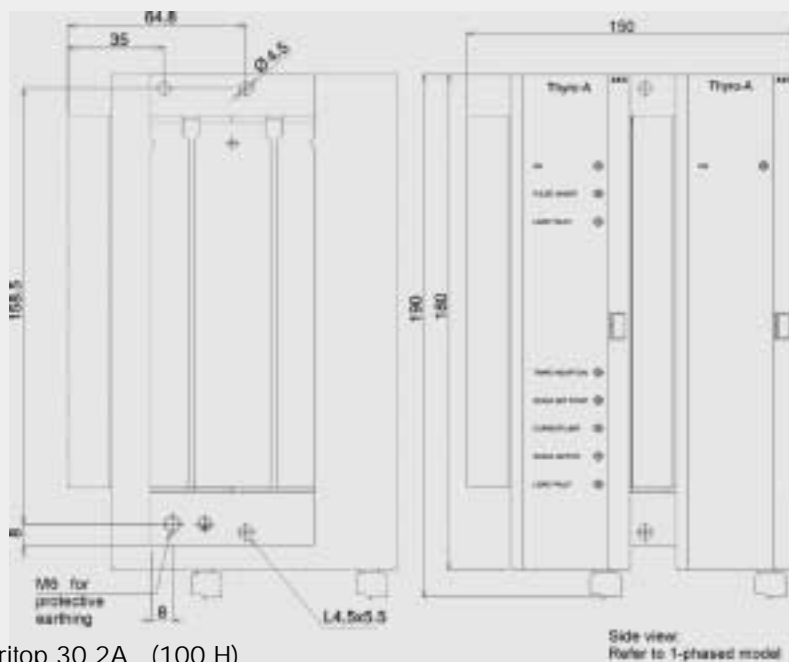
Thyritop 30 2A (16 H, 30H)

Dimensional drawing 001



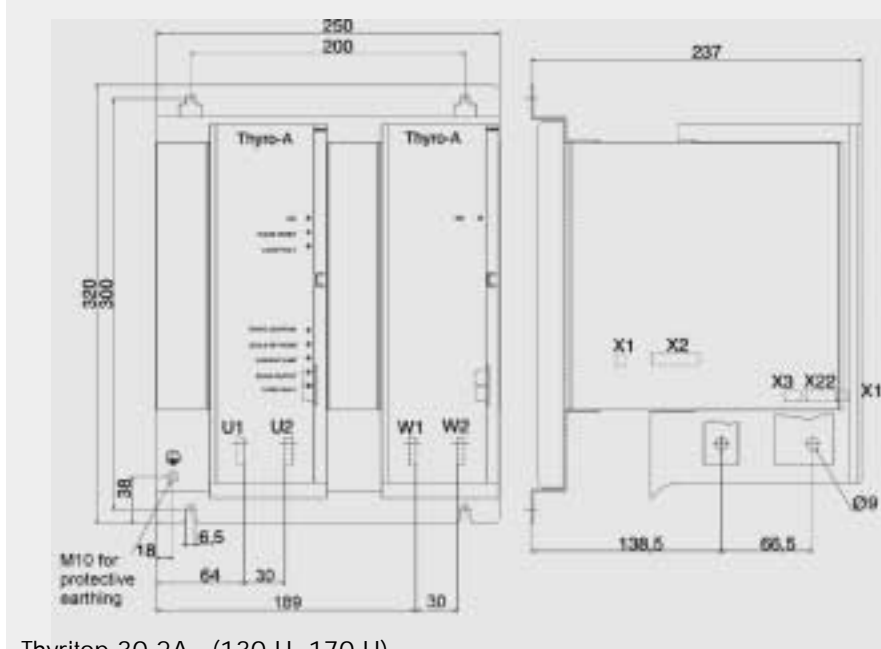
Thyritop 30 2A (45 H, 60H)

Dimensional drawing 003



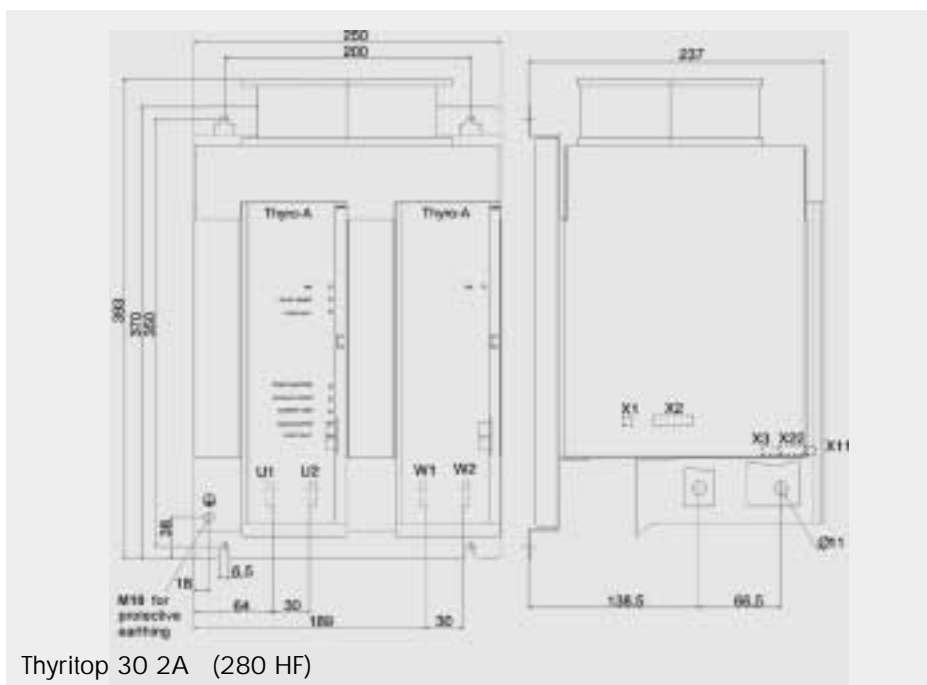
Thyritop 30 2A (100 H)

Dimensional drawing 004



Thyritop 30 2A (130 H, 170 H)

Dimensional drawing 006



Thyritop 30 2A (280 HF)

Dimensional drawing 008

12. Accessories and options

Support for 35 mm snap-on assembly
for 8A, 16A und 30A

Bus module Profibus DP

Bus module Modbus RTU

➔ 13. Approvals and conformities

The following approvals and conformities are available for Thyritop 30

- Quality standard according to DIN EN ISO 9001
- UL registration, file no. E 135074, under preparation, with consideration to Canadian National Standard, project no. 02ME08043
- CE conformity
- Low voltage directive 73/23 EEC
- EMV directive 89/336 EEC; 92/31 EEC
- Marking directive 93/68 EEC

Guidelines

The CE mark on the device confirms observation of the EC general guidelines for 72/23 EEC - low voltage and for 89/339 EEC electromagnetic compatibility if the instructions on installation and commissioning set out in the operating instructions are observed.

There is no product norm for Thyristor power controllers so that a sensible norm structure must be set up which ensures safe application and opportunity for comparison.



CAUTION

Thyristor power controllers are not devices for disconnection in the sense of DIN VDE 0105 T1 and may therefore be operated only in connection with a suitable mains isolating device (e.g. switch, isolating link).

Additional to the following table further norms are adhered to, e.g. voltage dips according to 61000-4-11:8.94 are ignored by the control device or registered by triggering off monitoring. Generally an automatic start is made after the mains returns within the tolerances.

In detail

Conditions for use		DIN EN 50 178
Built-in unit (VDE 0160)		DIN EN 60146-1-1:12.97
General requirements		
Design, vertical installation		
Operating conditions		DIN EN 60 146-1-1; K. 2.5
Operating location, industry sector		CISPR 6
Temperature behaviour		DIN EN 60 146-1-1; K 2.2
Storage temperature D		-25°C - +55°C
Transport temperature E		-25°C - +70°C
Operating temperature better B		-10°C - +35°C
		with external cooling (280A)
		-10°C - +45°C for self air cooling
		-10°C - +55°C
		with reduced type current -2%/°C
Load class	1	DIN EN 60 146-1-1 T.2
Humidity class	B	DIN EN 50 178 Tab. 7 (EN 60 721)
Overvoltage category	III	DIN EN 50 178 Tab. 3 (849V)
Degree of pollution	2	DIN EN 50 178 Tab. 2
Air pressure		900 mbar * 1000m above NN
Protection class	I	DIN EN 50178 Chap. 3
Safe isolation		
Up to 500 V mains voltage		DIN EN 50 178 Chap. 3
Air and creeping distances		casing / mains potential > 5.5 mm
		casing / control potential > 2.5 mm
		mains voltage /contr. potent. ≥ 10 mm
		mains volt. interactive 2.5 mm
Mechanical impact		DIN EN 50 178 Chap. 6.2.1
Test voltage		DIN EN 50 178 Tab. 18
Tests according to		DIN EN 60 146-1-1 4.
EMV noise emission		EN 61000-6-4
Noise suppr. control device	Class A	DIN EN 55011:3.91 CISPR 11
EMV noise resistance		EN 61000-6-2
Compatibility level	Class 3	EN 61000-2-4:7.95
ESD	8 kV (A)	EN 61000-4-2:3.96
Electromagnetic fields	10 V/m	EN 61000-4-3:3.95
Burst mains lines	2 kV (A)	EN 61000-4-4:.95
control lines	2 kV (A)	
Surge mains lines	2 kV unsym.	EN 61000-4-5:.95
	1 kV sym.	EN 61000-4-5:.95
control lines	0.5 kV	
Line-conducted		EN 61000-4-6



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244, avenue Franklin Roosevelt 69120 VAULX-EN-VELIN
France
tél : (33) 04 72 14 15 40 Fax : (33) 04 72 14 15 41
www.pyro-controle.tm.fr