

Thyro-A

EN

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1. GENERAL

The Thyro-A is a communication-capable Thyristor Power Controller. It can be used wherever alternating voltages, alternating currents or outputs in thermal process technology need to be controlled. The Thyro-A has several different control and regulation modes, can easily be connected to process and automation technology, has a high degree of control accuracy and is simple to handle.

Thyro-A ...H1

Thyristor power controller with integrated semiconductor fuse, system bus interface, TAKT and VAR operating modes, synchronization option (in TAKT operating mode with Thyro-Power Manager option) and control modes U, U2. Suitable for 3-phase operation in 3-phase circuit. Suitable for visualization and commissioning software from the Thyro-Tool Family.

Thyro-A ...HRL1

Thyristor power controller with integrated semiconductor fuse, system bus interface, additional 24 DC/AC electronic power supply, signaling relay, load monitoring and analog output, channel separation, with operating modes TAKT and VAR, synchronization option (in operating mode TAKT with Thyro-Power Manager), control modes U, U2, I, I2. Suitable for the visualization and commissioning software Thyro-Tool Family.

Thyro-A ...H RLP1

Thyristor power controller with integrated semiconductor fuse, system bus interface, additional 24 VDC/AC electronic power supply, signaling relay, load monitoring and analog output, channel separation, with TAKT and VAR operating modes, synchronization option (in operating mode TAKT with Thyro-Power Manager) and control modes U, U2, I, I2 and P. Suitable for visualization and commissioning software Thyro-Tool Family.

2. SPECIAL FEATURES

- Integrated semiconductor fuse
- Type range 230-600Vs, 16-1500A, single phase, two phase and three phase
- Additional electronic supply, therefore also operation with mains voltages up to 0.43 x Unom possible (only...HRL 1 and ...H RLP1)
- Ohmic load and transformer load, as well as load with high R_{warm} / R_{cold} (≤ 6) peak current limitation of 3 x Inom (only ...H RL1 and ...H RLP1) in operating mode VAR
- Soft start function for transformer load
- Channel separation, necessary with countervoltage
- Load current monitoring (only ...H RL1 and ...H RLP1)

- Signaling relay (only ...H RL1 and ...H RLP1)
- Analog output (only ...H RL1 and ...H RLP1)
- Control modes U, U2; with ...H RL1 additional I, I2, with ...H RLP1 additional P
- Operating modes TAKT, VAR and QTM (with Thyro-A 1A)
- Synchronization option (for TAKT: with Thyro-Power Manager, for QTM: with internal mains load optimization)
- Triggering with analog setpoint via PC or optional bus adapter
- System interface standard
- Safe isolation in acc. with EN 50178 ch. 3
- UL approval (for standard devices 16 – 350A, 495-1500A in preparation)
- Connection for optional visualization and commissioning software Thyro-Tool Family (via PC-Interface RS232)

Options:

- Connection to various bus systems, e.g. Profibus DPV1, Modbus RTU, DeviceNet, CANopen, ProfiNet, Ethernet/IP, Modbus RTU
Other bus systems on request.
- PC-Interface and Thyro-Tool Family (visualization and commissioning software)

3. OPERATING MODES

The user selects the operating mode most suitable for optimum adaptation to the various applications and manufacturing processes, as well as to different electrical loads.

Full wave switch principle TAKT

In this operating mode, the mains voltage is switched periodically, relative to the defined setpoint. Integer multiples of the mains periods are switched to avoid D.C. components. The operating mode full wave switch principle TAKT is particularly suited for loads with thermal inertia. The most important settings for this operating mode are the cycle time (T0) and the transformer load (see page 45, setting the transformer load). The use of this function achieves the lowest mains feedback. Any mains feedback that will be still present (e.g. flicker) can be reduced to an insignificant amount using system load optimization.

Phase angle principle VAR (only A 1A and A 3A)

In this operating mode, the sinus wave of the mains voltage is shifted. The shift depends on the setpoint value. Characteristic of this operating mode are the high control dynamics. When phase angle control VAR is used, harmonics of the mains voltage form. These can be compensated for with various types of circuit.

Half wave switch principle QTM (Quick Takt Mode only 1A)

QTM is applied for a patent fast operating mode which works on the half wave switch principle. QTM is suitable for ohmic loads. Depending on the predetermined setpoint value, mains half waves are switched. DC 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 synchronization, to keep the mains feedback small.

4. CONTROL MODES

The power controller has various different control modes.

Before commissioning the power controller and selecting a control mode, familiarization with the operating procedure and the effect upon the application is important.

Control modes ...H1

Control mode	Control variable
U, U ²	highest conductor voltage

Control modes ...HRL1

Control mode	Control variable
U, U ²	highest conductor voltage
I, I ²	highest phase current

Control modes ...HRLP1

Control mode	Control variable
U, U ²	highest conductor voltage
I, I ²	highest phase current
P	total effective power

Fluctuations in mains voltage and changes in load are compensated directly by bypassing the inert temperature control circuit. This method is therefore particularly fast (secondary control).

Limits

In addition to setting the control mode, it is also possible to set limits for the following variables:

- Voltage limitation (U)
- Current limitation (I) (only for ...H RL1 und ...H RLP1)
- Power limitation (P) (only for ...H RLP1)

Monitoring

Power controller and load circuit are monitored for malfunctions. Messages are sent via LED (see page 29, LED messages), by bus or by fault signaling relay K1.

Limit values for voltage monitoring

The following limit values apply for voltage monitoring:

- Undervoltage monitoring: -57% of type voltage
- Overvoltage monitoring: +10% of type voltage

Only for ...H RL1 and ...H RLP1

In the event of more than 15% below the type voltage, the devices can only be operated right up to the undervoltage limit if the electronics are supplied from an external 24V source.

For ...H1, ...H RL1 and ...H RLP1

In default state, pulse inhibition is switched internally when the undervoltage limit is exceeded, and fault signaling relay K1 de-energizes (both can be set with Thyro-Tool Family).

Load monitoring (only for ...H RL1 and ...H RLP1)

The load can consist of one or more resistors connected in parallel or in parallel-series. It can be monitored up to a freely selectable absolute undercurrent limit value. The measured current is constantly compared with a settable undercurrent limit value. The device can thus detect an increase in load resistance. If the undercurrent limit value is exceeded, a message is sent. Where resistance elements are connected in parallel, a partial load interruption can be selected if the undercurrent limit value is set accordingly.

Device temperature monitoring

The Thyro-A has temperature monitoring. If the temperature is exceeded (90°), a message is sent via LED via the bus module, or via fault signaling relay K1.

Fan monitoring (for ...F...)

The forced ventilated thyristor power controllers have temperature monitoring for the heat sink. The temperature of the heat sink is measured. A temperature overrange of >95° triggers a signal and relay K1 is switched. The device, however, remains switched on (configurable default setting).

Extended functions (with bus module/Thyro-Tool Family)

Certain functions cannot be set via DIP switch or potentiometer. A bus module (e. g. Profibus DP, DeviceNet, Modbus RTU, CANopen, Modbus TCP, Ethernet/IP, Profinet) or a PC can be connected at the system interface X22.

5. TECHNICAL DATA

Type voltage ...H1

230V -57%* +10% > 99V

400V -57%* +10% > 172V

500V -57%* +10% > 215V

600V -57%* +10% > 258V

Type voltage ...H RL1 and ...H RLP1 without additional 24V electronics supply

230V -15% +10% 230V -57%* +10% > 99V

400V -15% +10% 400V -57%* +10% > 172V

500V -15% +10% 500V -57%* +10% > 215V

600V -15%*+10% 600V -57%* +10% > 258V

*Additional electronics supply

The additional control voltage supply can be AC or DC (6 W per device / 15VA / not grounded).

Normally the supply of the Master modules is sufficient.
24VAC +10% /-20%; 24VDC +18V to +32V

Mains frequency

All types 47 Hz to 63 Hz;

Max. frequency change 5% per half wave

Load type

Ohmic load

Ohmic load with R_{warm}/R_{cold} ratio up to 6, peak current limiting to $\hat{I}=3 \times I_{nom}$ (for ...H RLP1 + HRL 1 in VAR operation)

Transformer load

Thyro-A 2A: symmetrical load

Operating modes

TAKT = Full wave switch principle

VAR = Phase angle principle

QTM = Half wave switch principle (Quick Takt Mode) (only for types 1A)

Setpoint inputs

2 setpoint inputs (SELV, PELV), isolated from the system.

- Setpoint 1: analog setpoint input

Signal ranges:

0(4) - 20mA R_i = approx. 250 Ω

0(1) - 5V R_i = approx. 44k Ω

0(2) - 10V R_i = approx. 88k Ω

- Setpoint 2: optional bus interface, connection of higher level PC or automation system.

Control characteristic

Each controller (e.g. temperature controller), with an output signal in the range of 0-20mA / 0-5V / 0-10V, can be adapted to the power controller.

Control input for switching mode

Maximum switching frequency 5Hz

$t_{on\ min}$ =100ms

$t_{off\ min}$ =100ms

Analog output (only for ...H RL1 and ...H RLP1)

Signal level 0-10V, 2-10V 0-20mA, 4-20mA

Maximum load voltage 10V

Control modes

...H1 (without current transformer): voltage control U_{eff} , U_{eff}^2

...H RL1 (with current transformer): voltage control U_{eff} , U_{eff}^2
current control I_{eff} , I_{eff}^2

...H RLP1 (with power control): voltage control U_{eff} , U_{eff}^2
current control I_{eff} , I_{eff}^2
power control P

Accuracy of control

Voltage $\pm 3\%^*$

* In the -15% to +10% range of the type voltage.

Current $\pm 1.5\%$

always based on the end value

Limits

Current limit I_{eff}

Voltage limit U_{eff}

Power limit P (HRLP)

Peak current limit to $\hat{I}=3 \times I_{nom}$

Relay outputs (only for ...H RL1 and ...H RLP1)

Changeover contact, contact material: AgSnO₂ / Au plated

The relay can be used for low load circuits (> 5 V 20 mA), provided it has not been preloaded with 230 VAC.

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

Insulation resistance 4 kV / 8 mm

Ambient temperature

35°C at ...F... (with forced cooling)

45°C with natural air cooling (without fan)

If the maximum ambient temperature is reduced, the maximum load current can be increased up to 110% of the nominal current. The following applies: 1% more current requires a temperature reduction of 1 °C.

The maximum ambient temperature can be increased up to a maximum of 55 °C if the maximum load current is reduced. The following applies: 1 °C more ambient temperature requires a current reduction of 2%. Use of the device in UL conditions up to a maximum ambient temperature of 40 °C.

Type code

The type designation of the thyristor-power controller is derived from the configuration of the power unit as well as from other features.

Thyro-A 1A	Thyristor controller with single phase power unit, suited for single phase loads
Thyro-A 2A	Thyristor controller with two phase power unit, suited for symmetrical loads in three phase operation in three phase saver circuit
Thyro-A 3A	Thyristor controller with three phase power unit, suited for three phase loads

Designation (example)	Characteristics	Different version of the power controller
Thyro-A 3A	Three phase power controller with three phase power unit	
...400-	with 400V type voltage	230 V, 400 V, 500 V, 600 V
...280	with 280A type current	8 ... 1.500 A
H	with integrated semiconductor fuse	
F	with fan (from 280A types)	*
R	with signaling relay	*
L	with load monitoring	*
P	with additional power control (H RLP)	*
1	Identification Thyro-A, series	*

6. TYPE OVERVIEW

Thyro-A 1A...H1(*), ...H RL1, ...H RLP1

Current [A]	Type power				Power loss [W]	Dimensions in mm				
	230V	400V	500V	600V		W	H	D	Weight [kg]	Fuse F1
16	3.7	6.4	8		30	45	131	127	0.7	20
30	6.9	12	15		47	45	131	127	0.7	40
45	10	18	22.5		48	52	190	182	1.7	63
60	14	24	30		80	52	190	182	1.7	80
100	23	40	50		105	75	190	190	1.9	200
130	30	52	65		150	125	320	241	4	200
170	39	68	85		210	125	320	241	4	315
280	64	112	140		330	125	370	241	5	350
350	80	140	175		390	125	400	261	8.4	500
495		198	247	297	603	112	414	345	15	630
650		260	325	390	726	112	414	345	15	900
1000		400	500	600	1396	239	729	516	35	2x 1000
1400			700	840	1715	239	729	516	35	4x900
1500		600			1755	239	729	516	35	4x900

Thyro-A 2A...H1(*), ...H RL1, ...H RLP1

Current [A]	Type power			Power loss [W]	Dimensions in mm					Fuse F1
	400V	500V	600V		W	H	D	Weight [kg]		
16	11	14		60	90	131	127	1.4	20	
30	21	26		94	90	131	127	1.4	40	
45	31	39		96	104	190	182	3.4	63	
60	42	52		160	104	190	182	3.4	80	
100	69	87		210	150	190	190	3.8	200	
130	90	112		300	250	320	241	8	200	
170	118	147		420	250	320	241	8	315	
280	194	242		660	250	393	241	11	350	
350	242	303		780	250	430	261	16.7	500	
495	343	429	514	1206	194	380	345	22	630	
650	450	563	675	1453	194	380	345	22	900	
1000	693	866	1039	2811	417	685	516	54	2x 1000	
1400		1212	1454	3451	417	685	516	54	4x900	
1500	1039			3531	417	685	516	54	4x900	

Thyro-A 3A...H1(*), ...H RL1, ...H RLP1

Current [A]	Type power			Power loss [W]	Dimensions in mm					Fuse F1
	400V	500V	600V		W	H	D	Weight [kg]		
16	11	14		90	135	131.6	127	2.1	20	
30	21	26		141	135	131.6	127	2.1	40	
45	31	39		144	156	190	182	5.1	63	
60	42	52		240	156	190	182	5.1	80	
100	69	87		315	225	190	190	5.7	200	
130	90	112		450	375	320	241	12	200	
170	118	147		630	375	320	241	12	315	
280	194	242		990	375	397	241	15	350	
350	242	303		1170	375	430	261	25.5	500	
495	343	429	514	1822	276	407	345	30	630	
650	450	563	675	2192	276	407	345	30	900	
1000	693	866	1039	4127	583	685	516	74	2x 1000	
1400		1212	1454	5086	583	685	516	74	4x900	
1500	1039			5206	583	685	516	74	4x900	

(*) ...H1 type available up to 350A

7. CONTACT

TECHNICAL QUERIES

If you have any technical queries regarding the subjects dealt with in these operating instructions, please get in touch with our team for power controllers:

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COMMERCIAL QUERIES

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