Power Regulator Function Module

Main Characteristics:

Applicable on 3RF21 and 3RF23 devices
Autonomous output regulation
Network/thyristor and load monitoring
Plug-in control terminals
Degree of protection IP 20

Standards / Approvals:

DIN EN 60947-4-3
UL 508 / CSA
CE
C-Tick

Product Description:

Function module for the autonomous output regulation of complex heating systems, for the operation of loads with temperature-dependent resistances or with long-time ageing resistance and for easy indirect temperature control.
The output regulator can be applied on all instantaneous-switching 3RF21 and 3RF23 solid state switching devices. If only the "full-wave control" operating mode is selected, the output regulator can also be applied on zero-switching solid state relays and contactors.

Output regulation

The output regulator continuously adjusts the output in dependence of the taught-in output and the default setpoint value. Any fluctuations of the network voltage or the load resistance are balanced thereby. The autonomous output regulation is carried out between a range of 0 and 100 % of the taught-in output.

Full-wave control

If the left potentiometer tR is set to 0 sec (= left limit stop), the output regulator works in accordance with the full-wave control principle. The set output, whether internal or external, is converted into a pulse-width modulated digital signal. The output regulator controls the ON and OFF duration of the solid state switching device within a fixed period duration of 1 second (at 50 Hz), thereby ensuring that the specified output is applied to the load. The ON LED flashes in the same rhythm as the solid state switching devices switches ON and OFF.

Phase-fired control

If the left tR potentiometer is set to a value higher than 0 sec, the module works in accordance with the phase-fired control principle. Thereby, the half-waves of the current are actuated in a way which ensures that the load complies with the set output setpoint value.
With phase-fired control, a reactor with minimally 200 µH must be applied in the load circuit for compliance with the conducted interference voltage for industrial networks.

Default setpoint value

The default setpoint value is either entered internally via the right P 0 – 100 % potentiometer at the module or externally via the 0 – 10 V analog input.
The taught-in value is the reference value for the default output. Taught-in output = 100 %.
With internal default setpoint value, the module is actuated via the IN terminal. In this context, the 10 V terminal has no function.
With external default setpoint value (P potentiometer at left limit stop), the module is actuated by application of the 0 – 10 V analog voltage. 0 – 10 V correspond to an output of 0 – 100 %. The voltage is converted linearly in a range between 0.1 and 9.9 V. With values below 0.1 V, the switching device remains switched off, voltages above 9.9 V are equaled with an output of 100 %.

Inrush current limiting

Furthermore, with the left tR potentiometer, a ramp time of up to 10 seconds is adjusted for a switch-on voltage ramp for inrush current limiting. The set time refers to an output of 100 %. If, for example, a ramp time of 10 seconds is adjusted and the default output amounts to 60 %, the 60 % output is attained after approx. 6 seconds.

Network, load and thyristor monitoring

The output regulator detects load, network and thyristor faults. If the current exceeds the maximum measuring range a load fault will be detected too.
The faults are signaled by the module's LEDs and the fault output is actuated. The delay time in fault cases amounts to approx. 100 msec.

Ordering Key:

3RF29	**20**	**- 0**	**H**	**A**	**1**	**3**
Function module for 3RF21 and 3RF23	Max. load current 20 = 20 A 50 = 50 A 90 = 90 A	Connection technology 0 = Not relevant	Switching function H = Output regulator	Controlled phases A = Single-phase	Control voltage 1 = 24 V AC/DC 3 = 110 V AC	Operating voltage 3 = 110 ... 230 V 6 = 400 .. .600 V

Main Circuit:

Type		3RF29**20**-0HA**.**	3RF29**50**-0HA**.**	3RF29**90**-0HA**.**
Current detection				
Rated operating current I_e	A	20	50	90
• TEACH range	A	4 ... 20	10 ... 50	18 ... 90
• Measuring range	A	0 ... 22	0 ... 55	0 ... 99

Type		3RF29**..**-0HA**.3**	3RF29**..**-0HA**.6**
Rated operating voltage U_e	V	110 ... 230	400 ... 600
• Tolerance	%	-15/+10	
• Rated frequency	Hz	50/60 ± 2	
Rated insulation voltage U_i	V	600	
Voltage detection			
• Measuring / TEACH range	V	93.5 ... 253	340 ... 660
Compensation Network voltage fluctuation	%	20 (only within the measuring range)	

Control Circuit A1-A2:

Type		3RF29**..**-0HA**1.**		3RF29**..**-0HA**3.**
Rated control supply voltage U_s	V	24 AC/DC		110 V AC
• Current input	mA	< 40		< 20
• Max. control supply voltage	V	26.5 AC	30 DC	121
• Min. control supply voltage	V	20.5 AC	18 DC	90

Control Input IN:

Type		3RF29**..**-0HA**1.**		3RF29**..**-0HA**3.**
Rated operating voltage U_c	V	24 AC/DC		110 AC
• With operating current	mA	< 15		< 15
• Max. operating voltage	V	26.5 AC	30 DC	121
Response voltage	V	20.5 AC	18 DC	79
• With pickup current	mA	> 2	> 2	> 2
Drop-out voltage	V	5	5	15
Rated frequency of the control supply voltage	Hz	50/60 ± 10 %	--	50/60 ± 10 %

Control Input 0 – 10 V:

Type		3RF29**..**-0HA**.**
Analog input	V	0 ... 10
• Permissible range	V	-1 ... 11
Input resistance	kOhm	8
Period duration at 50 Hz	s	1
Period duration at 60 Hz	s	0,83

Auxiliary Circuit 11-12:

Type		3RF29..-0HA**1.**	3RF29..-0HA**3.**
Switching voltage	V	24 AC/DC	110 AC
• Operating current (utilization category)	A	0.5 (-12 DC)	0.5 (-12 AC)
• Max. switching voltage	V	30	121
• Min. switching voltage	V	15	90
Max. thermal current I_{th}	A	1	1

General Data:

Ambient temperature		
During operation	°C	-25 ... 60
During storage	°C	-55 ... 80
Mounting altitude	m	0 ... 1000; at > 1000 m, please contact our Technical Assistance
Impact resistance acc. to DIN IEC 68	g/ms	15/11
Vibration resistance	g	2
Degree of protection		IP20
Electromagnetic compatibility (EMC)		
Interference emission		
o Conducted interference voltage IEC 60 947-4-3		Class A for industrial applications [1]
o Radiated, high-frequency interference voltage IEC 60 947-4-3		Class A for industrial applications
Interference resistance		
o Electrostatic discharge acc. to IEC 61 000-4-2 (corresponds to severity 3)	kV	Contact discharge 4; air discharge 8; performance criterion 2
o Induced HF fields acc. to IEC 61 000-4-6	MHz	0.15 ... 80; 140 dBµV; performance criterion 1
o Burst acc. to IEC 61 000-4-4	kV	2/5.0 kHz; performance criterion 1
o Surge acc. to IEC 61 000-4-5	kV	Phase-to-ground 2; phase-to-phase 1; performance criterion 2
Isolation resistance	MOhm	1,5 (between Main- and Control circuit)

Type		Screw connection
Connection, auxiliary/control contacts		
Conductor cross-section	mm²	1 x (0.5 ... 2.5)
	mm²	2 x (0.5 ... 1.0)
	AWG	20 ... 12
Stripping length	mm	7
Terminal screw		M 3
o Tightening torque	Nm	0.5 ... 0.6
	lb.in	4.5 ... 5.3
Current transformer hole diameter	mm	17

[1] With phase-fired control, a reactor with min. 200 µH must be applied in the load circuit in order to comply with the limit values for conducted interference voltages in industrial networks.

Attention!

This product was constructed as an EMC Class A device. The use of this product in residential applications could lead to radio interferences. In such an application, additional filtering may be required.

Allocation to the Solid State Switching Devices:

Applicable for	Order No.		Control voltage	Terminals
Solid state relays	3RF21..-**1**BA**0**.	3RF21..-**3**BA**0**.	Us = 24 V DC	Screw and ring cable connection
	3RF21..-**1**BA**1**.	3RF21..-**3**BA**1**.	Us = 24 V AC/DC	
	3RF21..-**1**BA**2**.	3RF21..-**3**BA**2**.	Us = 110...230 V AC	
	3RF21..-**1**BA**4**.	3RF21..-**3**BA**4**.	Us = 4...30 V DC	
Solid state contactors	3RF23..-**1**BA**0**.	3RF23..-**3**BA**0**.	Us = 24 V DC	Screw and ring cable connection
	3RF23..-**1**BA**1**.	3RF23..-**3**BA**1**.	Us = 24 V AC/DC	
	3RF23..-**1**BA**2**.	3RF23..-**3**BA**2**.	Us = 110...230 V AC	
	3RF23..-**1**BA**4**.	3RF23..-**3**BA**4**.	Us = 4...30 V DC	
Accessories	**Order No.**			
Sealable caps	3RF2900-0RA88			

With full-wave control, the operation of the output regulator is also permissible on zero-switching solid state switching devices.

SIDAC Reactors for the Phase-Fired Control Operating Mode:

Type	3RF29**20**-0HA.	3RF29**50**-0HA.	3RF29**90**-0HA.
Rated voltage			
Up to 230 V	4EM4700-8CB00	4EM5001-1CB00	4EM6100-5CB00
Up to 480 V	4EM4915-0CB00	4EM6100-6CB00	4EM5316-7CB00
Up to 660 V	4EM5007-7CB00	4EM6204-0CB00	4EM5412-0CB00

Mounting:

The module can be mounted onto all solid state switching devices listed above. After disconnection of the control terminal from the solid state switching device and disconnection of the line to the load from the 2T terminal, the output regulator can be snapped on. All connections to the basic device are realized thereby. Caution: The guide at the transformer must be inserted into the groove of the solid state switching device! The control terminal of the solid state relay or contactor is plugged into the function module's A2-A2 terminal. The line to the load must be routed through the transformer (D 17.0 mm) and reconnected to the solid state switching device.

For dismounting, the two clips fixed to the top of the output regulator must be lifted by means of a small screwdriver. The module must then be manually withdrawn from the basic device in vertical direction.

Commissioning:

When the supply voltage (terminal A1-A2) is first applied, the two THYRISTOR and SUPPLY LEDs flash alternately as no TEACH process has yet been carried out. The fault signal output is not set thereby. The function module can be taught in the controlled or uncontrolled state.

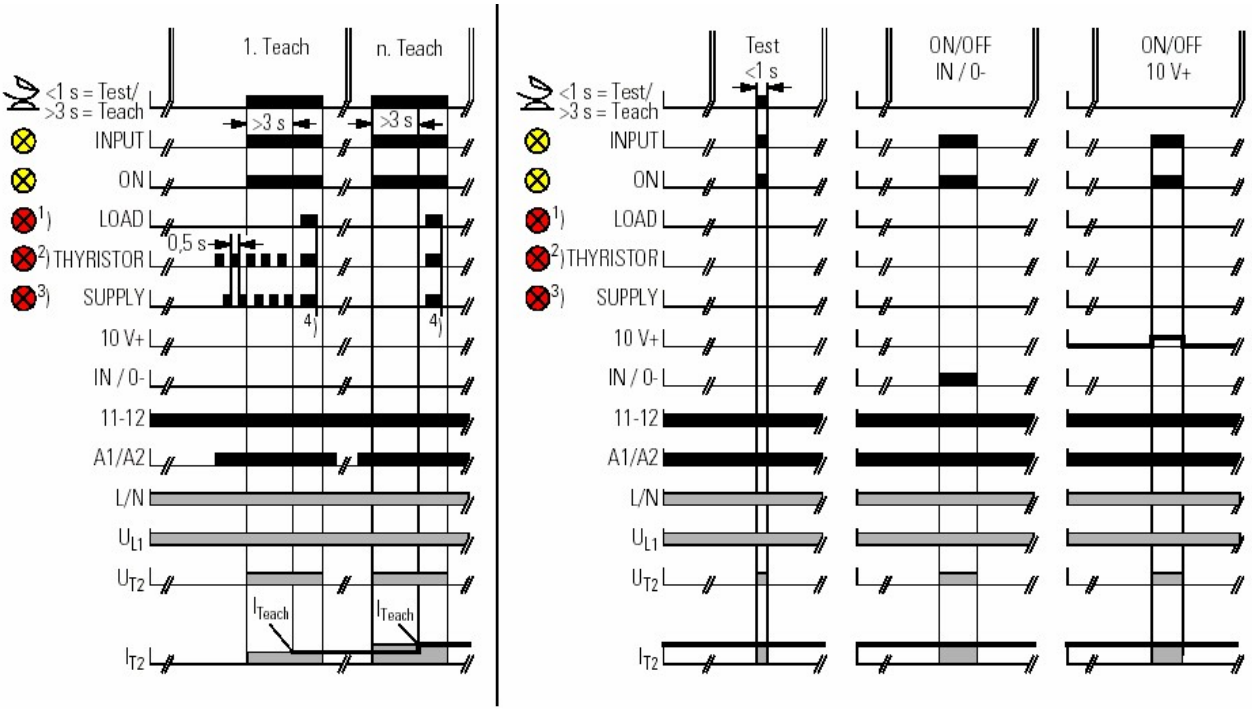
Press the TEACH button for at least 3 seconds. After this time, the load monitoring detects the current flowing through the solid state relay or contactor and stores it as a setpoint value[2]. If an inrush current limit has been set at the module, the output regulator independently passes through the voltage ramp and only detects the reference output at the end of the set time. The position of the P potentiometer has no influence on the TEACH process. The correct completion of the TEACH process is indicated by a simultaneous continuous illumination of the three right LEDs.

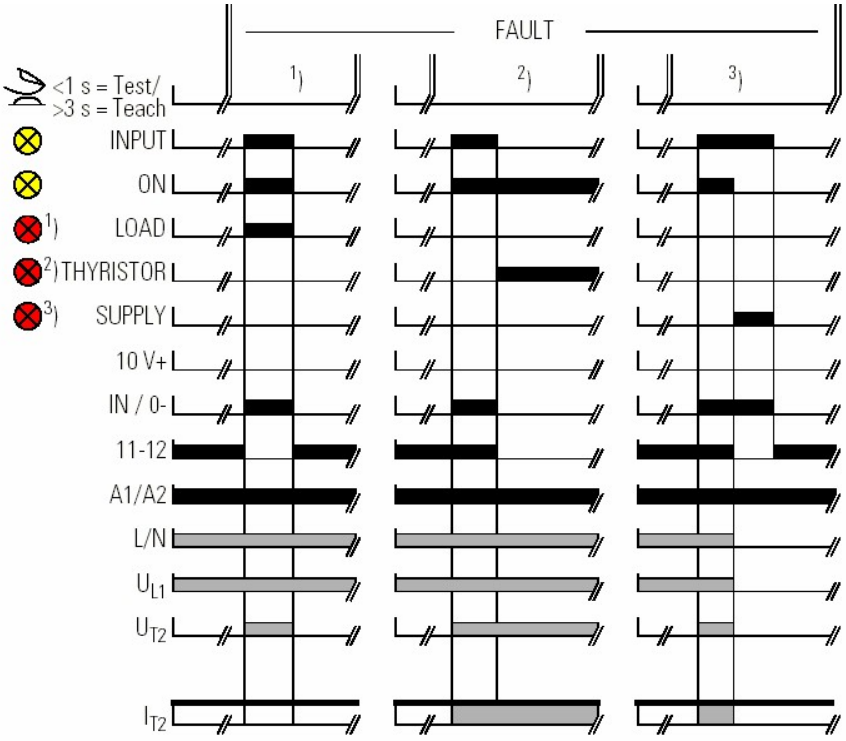
The TEACH process can be repeated at any time.

The output regulator cannot be operated without a TEACH process. With the supply voltage applied, the TEACH button can be pressed shortly, maximum for one second, for test purposes. For this time, the solid state switching device switches through and you can thereby test the arrangement.

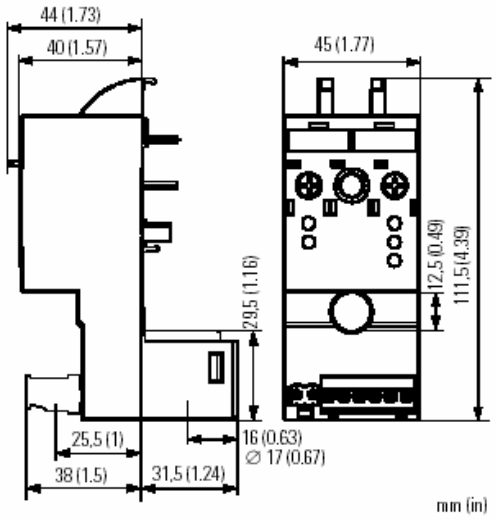
[2] Attention: If the supply voltage **and** the frequency to the module changes the TEACH process must be carried out once again!

Function Diagram:

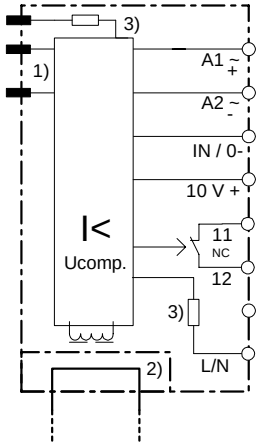




Dimension Drawing:



Device Circuit Diagram:



3RF29**..**-0HA**1.**
U_s = 24 V AC/DC

Example Circuit Diagram:

A1 Control (PLC)
F1, 2 Miniature circuit-breaker main circuit
K1 3RF23 solid state contactor with plugged-on output regulator module
R1 Load resistance
L1 / 6) Reactor 200µH for phase-fired control operation for compliance with limit values for conducted interference voltage acc. to class A

1) Internal connection to the solid state relay / contactor
2) Straight-through transformer
3) Voltage detection not galvanic separated (3 MOhm each path)
4) Connection contact L/N with
- Load monitoring 3RF29**..**-0HA**.3** at the neutral conductor N (e.g. 230 V)
- Load monitoring 3RF29**..**-0HA**.6** at a second phase (e.g. 400 V)

Use of a second m.c.b. recommended
5) Earthing of L- recommended
7) Earthing according local standards