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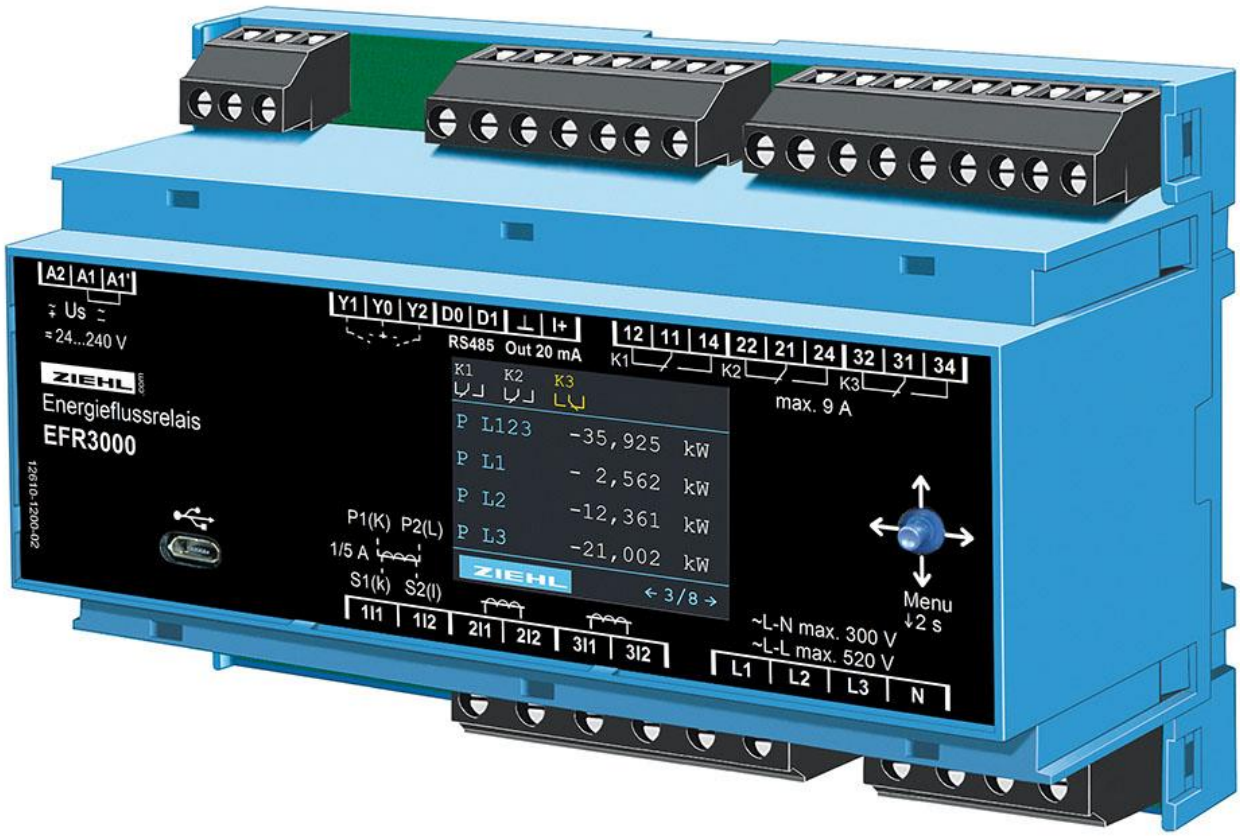
Operating Manual EFR3000

updated: 2017-09-19/Ba/Fz
from firmware: 0-01

Energy flow relay
- Optimization of the internal consumption of self-generated energy
- Energy flow direction relay for battery storage systems (zero export / import device < 0.5s)
- Limitation of the infeed power
- 0/4 - 20 mA output with linear control function or as a scalable instrument transformer
- SG ready optimized

- Configuration also via web interface with transmission through USB memory stick
http://www.public.ziehl.com/efr3000/



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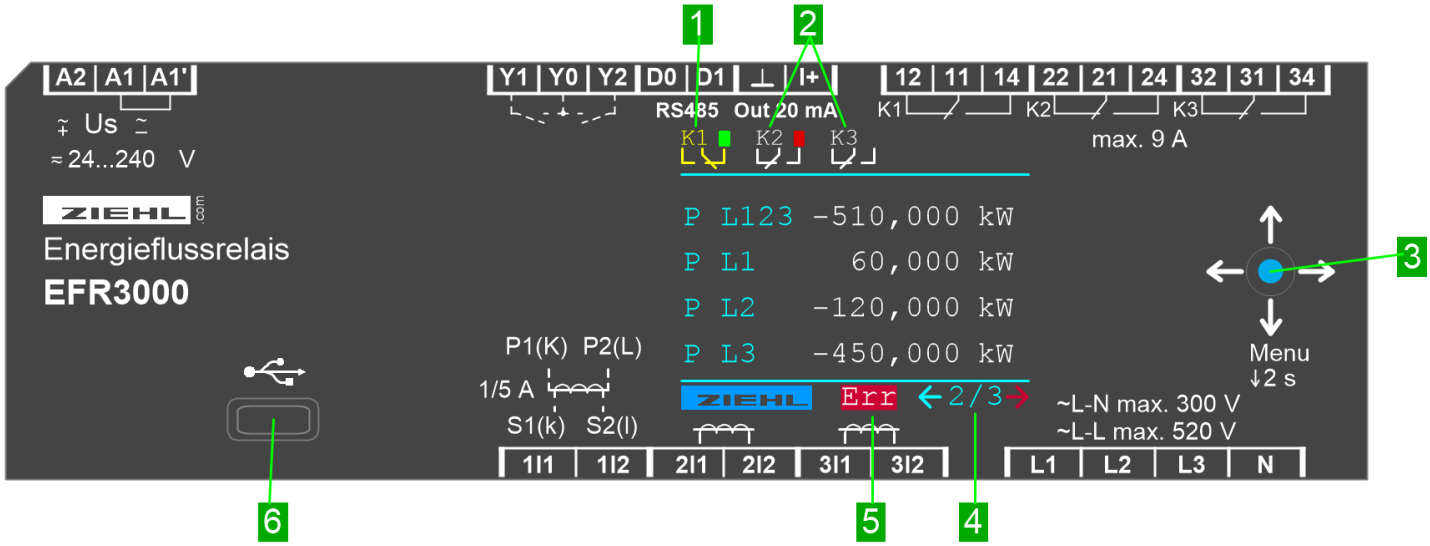
1 Display and controls



1 Relay K1 actuated (11 – 14),
Green time bar = load change is detected

2 Relays K2 & K3 de-energised (21 – 22; 31 – 32),
Red time bar = delayed on/off operational or load not detected

3 Joystick button (special functions are displayed in the Err space)

4 Current display page / number of display pages / short-cuts for menu item

5 Error present, for display with help text navigate to the right (red arrow)

6 Connection for Micro USB memory stick, for firmware update, backup and exchange of configuration

2 Factory setting Pr1…4

* factory setting			**Pr1**	**Pr2**	**Pr3**	**Pr4***	
Menu	**Parameter / Unit**		largest only 1-stufig	largest combination 3-stufig	largest combination 7-stufig	fixed sequence K1-K2-K3	**Users Data**
Current transformer	Primary	A	60	60	60	60	A
	Secondary	A	1	1	1	1	A
Relay	power at K1	kW	1,00	1,00	1,00	1,00	kW
	power at K2		2,00	2,00	2,00	2,00	kW
	power at K3		3,00	3,00	3,00	3,00	kW
	phase K1	Ph.	L1	L1	L1	L1	Ph
	phase K2		L2	L2	L2	L2	Ph
	phase K2		L3	L3	L3	L3	Ph
	load on K1		11-14	11-14	11-14	11-14	
	load on K2		21-24	21-24	21-24	21-24	
	load on K3		31-34	31-34	31-34	31-34	
	auto Reset K1		-	-	-	-	
	auto Reset K2		-	-	-	-	
	auto Reset K3		-	-	-	-	
Times	delay on K1	time	00:05:00	00:05:00	00:05:00	00:05:00	hh : mm : ss
	delay on K2		00:04:30	00:04:30		00:04:30	hh : mm : ss
	delay on K3		00:04:00	00:04:00		00:04:00	hh : mm : ss
	min on K1		00:05:00	00:05:00	00:05:00	00:05:00	hh : mm : ss
	min on K2		00:05:00	00:05:00		00:05:00	hh : mm : ss
	min on K3		00:05:00	00:05:00		00:05:00	hh : mm : ss
	delay off K1		00:03:00	00:03:00	00:03:00	00:03:00	hh : mm : ss
	delay off K2		00:03:30	00:03:30		00:03:30	hh : mm : ss
	delay off K3		00:04:00	00:04:00		00:04:00	hh : mm : ss
	load step K1		00:01:00	00:01:00	-	00:01:00	hh : mm : ss
	load step K2		00:01:00	00:01:00	-	00:01:00	hh : mm : ss
	load step K3		00:01:00	00:01:00	-	00:01:00	hh : mm : ss
Limits	power K1 on	kW	-1,20	-1,20	-	-1,20	kW
	power K1 off		-0,10	-0,10	-	-0,10	kW
	power K2 on		-2,20	-2,20	-	-2,20	kW
	power K2 off		-0,10	-0,10	-	-0,10	kW
	power K3 on		-3,20	-3,20	-	-3,20	kW
	power K3 off		-0,10	-0,10	-	-0,10	kW
	limit off		-	-	-0,50	-	kW
Digital inputs	Y0-Y1		Off	Off	Off	Off	
	Y0-Y2		Off	Off	Off	Off	
Analog output	function		kW-L123	kW-L123	kW-L123	kW-L123	
	mode		0-20 mA	0-20 mA	0-20 mA	0-20 mA	
	Zero	kW	10,00	10,00	10,00	10,00	kW
	full scale		-10,00	-10,00	-10,00	-10,00	kW
	target value		-0,10	-0,10	-0,10	-0,10	kW
	max. power		1,00	1,00	1,00	1,00	kW
	regulation speed	%	90	90	90	90	%
	regul. interval	s	0,5	0,5	0,5	0,5	s
	regul. tolerance	%	25	25	25	25	%
Interface	adress		1	1	1	1	
	baud rate	kBd	9,6 kBd	9,6 kBd	9,6 kBd	9,6 kBd	kBd
	parity		Even	Even	Even	Even	
	stop bit		1	1	1	1	
Program & Code	program no.		1	2	3	4	
	default setting		No	No	No	No	
	code lock		Off	Off	Off	Off	

* factory setting			Pr1	Pr2	Pr3	Pr4*	
Menu	**Parameter / Unit**		largest only 1-stufig	largest combination 3-stufig	largest combination 7-stufig	fixed sequence K1-K2-K3	**Users Data**
Options	language		English	English	English	English	
	brightness	%	50	50	50	50	%
	dimming time	time	00:05:00	00:05:00	00:05:00	00:05:00	hh : mm : ss
	display interval	s	0,5	0,5	0,5	0,5	s
Info	firmware Version		0-00	0-00	0-00	0-00	
	serial number		-	-	-	-	

3 Factory setting Pr5+6 (zero export / import device)

* factory setting zero export device			Pr5	Pr6			
Menu	**Parameter / Unit**		zero exp. sum	zero exp. 1 of 3*			**Users Data**
Current transformer	primary	A	60	60			A
	secondary	A	1	1			A
Relay	phase K1		-	L123			
	phase K2		-	L123			
	phase K3		-	L123			
	auto Reset K1		Off	Off			
	auto Reset K2		Off	Off			
	auto Reset K3		Off	Off			
Times	delay off K1	time	00:00,10	00:00,10			mm : ss
	delay off K2		00:00,10	00:00,10			mm : ss
	delay off K3		00:00,10	00:00,10			mm : ss
	delay on K1		00:00:10	00:00:10			hh : mm : ss
	delay on K2		00:00:10	00:00:10			hh : mm : ss
	delay on K3		00:00:10	00:00:10			hh : mm : ss
Limits	power K1 on	kW	0,50	0,50			kW
	power K1 off		0,10	0,10			kW
	power K2 on		-0,50	-0,50			kW
	power K2 off		-0,10	-0,10			kW
	power K3 on		0,70	0,70			kW
	power K3 off		0,30	0,30			kW
Analog output	function		kW-L123	kW-L123			
	mode		0-20 mA	0-20 mA			
	Zero	kW	10,00	10,00			kW
	full scale		-10,00	-10,00			kW
	target value		-0,10	-0,10			kW
	max. power		1,00	1,00			kW
	regulation speed	%	90	90			%
	regul. interval	s	0,5	0,5			s
	regul. tolerance	%	25	25			%
Interface	adress		1	1			
	baud rate	kBd	9,6 kBd	9,6 kBd			kBd
	parity		Even	Even			
	stop bit		1	1			
Program & Code	program Nr		5	6			
	default setting		No	No			
	code lock		Off	Off			

			Pr5	Pr6			
Menu	**Parameter / Unit**		zero exp. sum	zero exp. 1 of 3*			**Users Data**
Options	language		Deutsch	Deutsch			
	brightness	%	50	50			%
	dimming time	time	00:05:00	00:05:00			hh : mm : ss
	display interval	s	0,5	0,5			s
Info	firmware Version		0-00	0-00			
	serial number		-	-			

4 Application and brief description

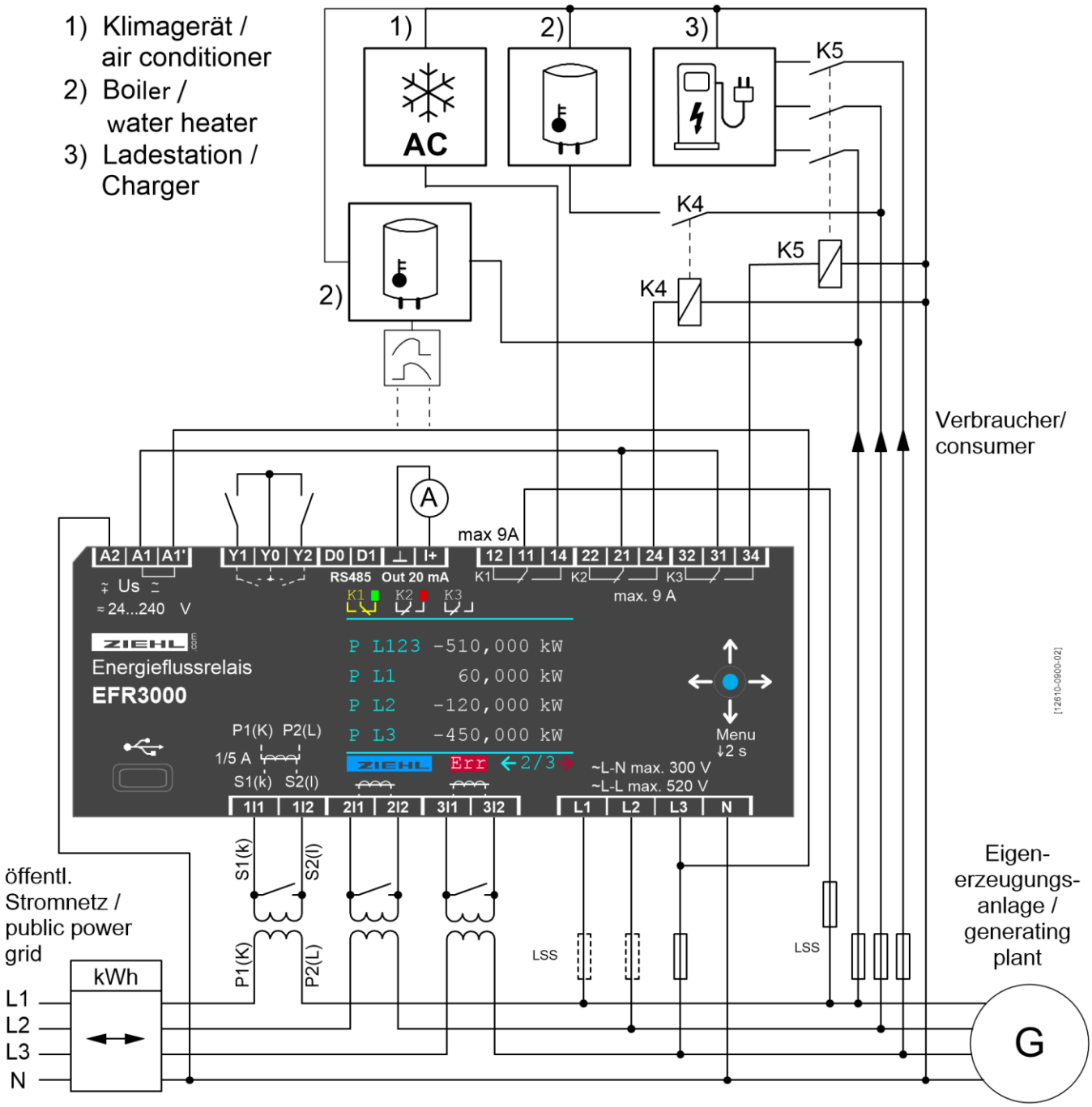
EFR3000 energy flow relays monitor the current flow between the consumer and the power supply (electric utility companies/energy suppliers). If an own generating plant generates more power than is currently being consumed then it is often more cost effective to consume the excess electricity itself. This is always the case if the feed-in remuneration is significantly below the price paid to the power utility for the purchase of the electricity; in Germany that generally applies to newly installed or newer plants.
Is there enough intrinsic power left, the EFR3000 switches in up to three consumers and ensures that the current is consumed in-house. Potential consumers are, for example, air conditioning systems, hot water production or battery charging devices along with washing machines, dryers, etc...
The EFR3000 is also advantageous where the own production is relatively constant, e.g. water power smoothing out fluctuations in consumption which prevents infeeds.

5 Summary of the functions

- Measurement of active power 1-phase or 3-phase (up to 1000 kW)
- Colour LCD display and intuitive operation with joystick
- 3 inputs for commercially available current transformers, programmable transmission ratio
- 3 output relays, switching capacity per 2 kW, higher loads can be connected via contactors
- 2 digital inputs Y1/Y2 for control functions
- RS485 interface (Modbus RTU) and Micro-USB port for configuration and updates
- Analogue output for power and energy flow direction 0/4 ... 20 mA (L1, L2, L3, or L123, scalable) or for continuous regulation of a consumer
- Energy flow direction sensor, shut-down < 0.5s in impermissible non-conforming infeed
- Universal supply voltage AC/DC 24-240 V
- Panel mounted distributor housing 140 mm wide (8 TE)

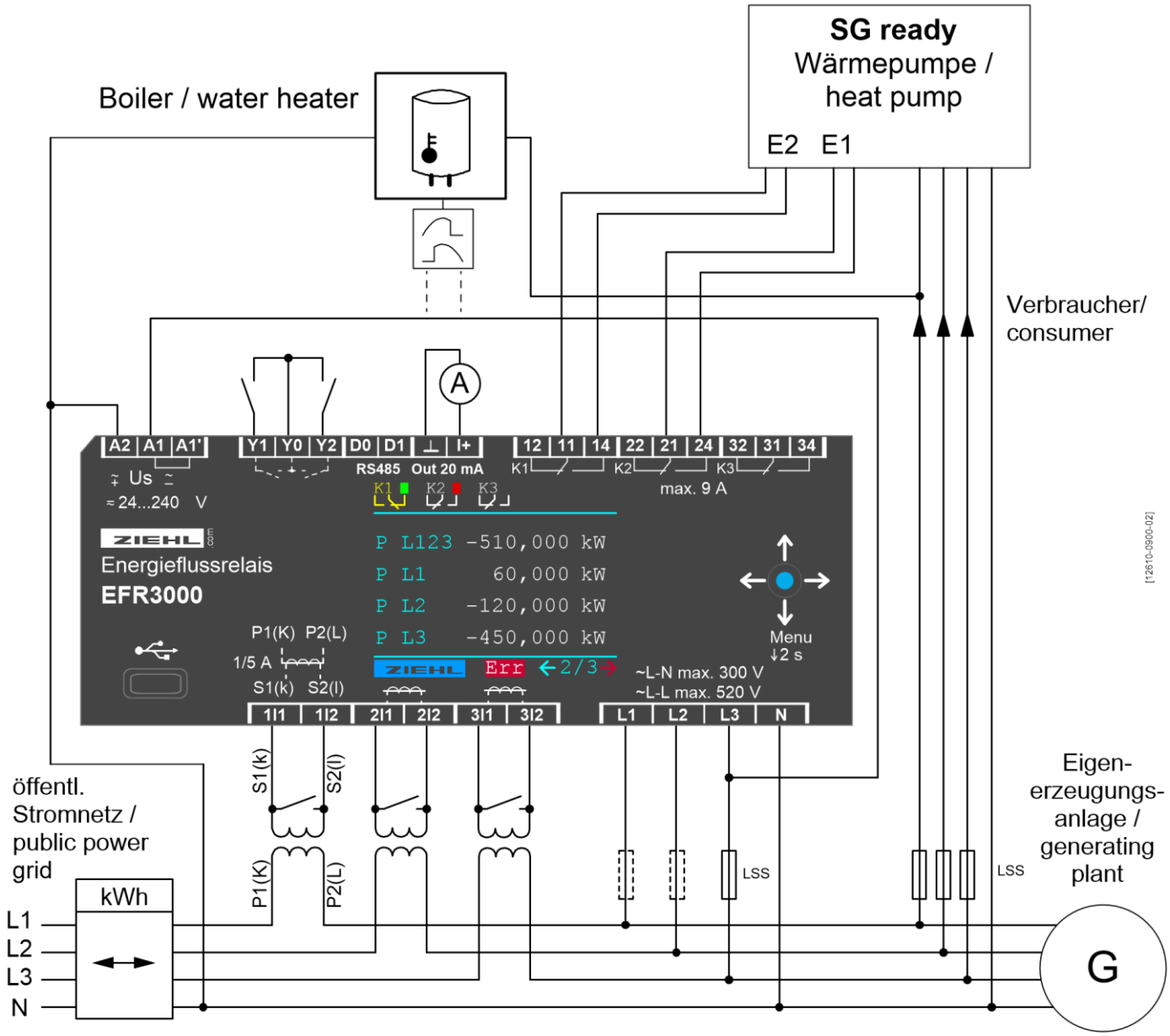
6 Connection diagrams

6.1 1x directly, 1x coupling relay 1 phase load, 1x coupling relay 3-phase load and controlled load to analogue output

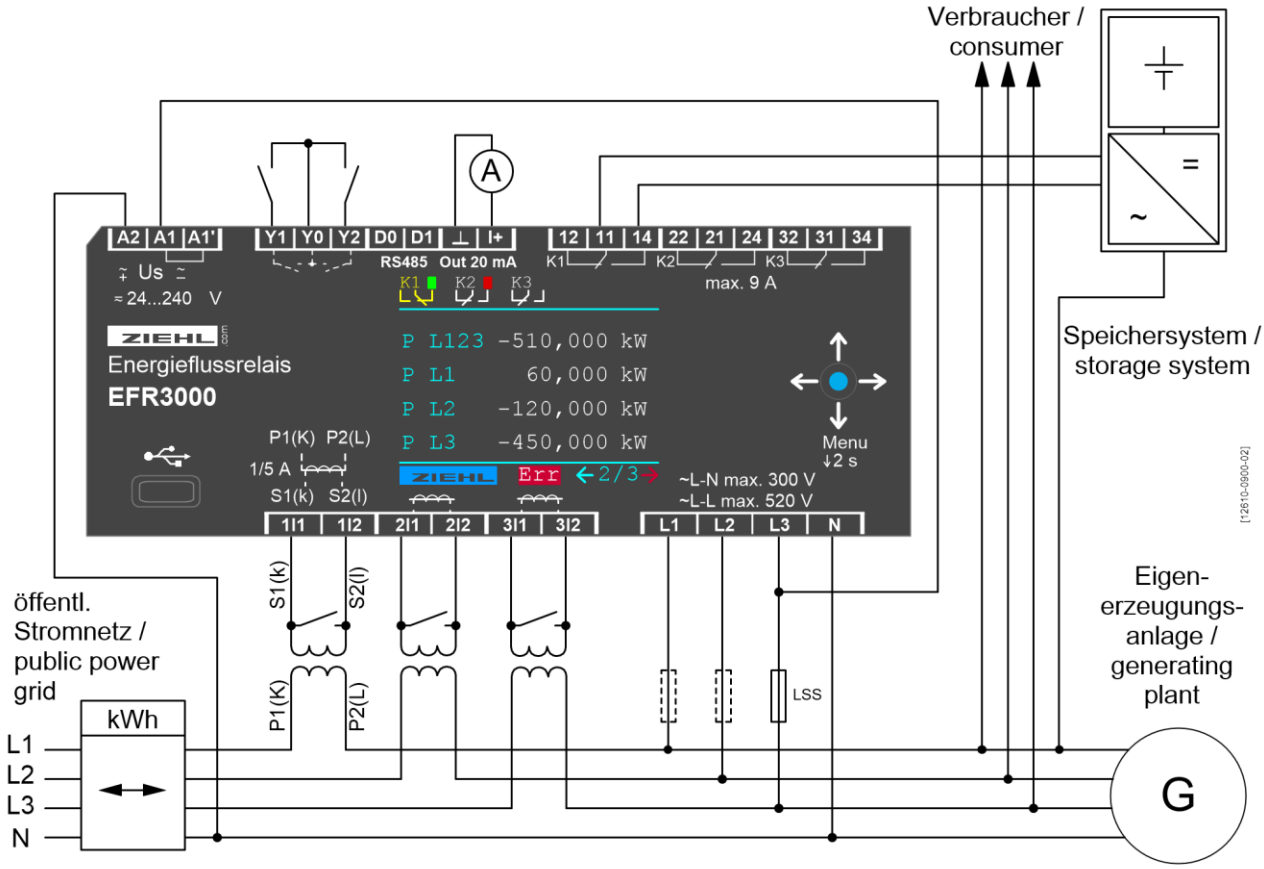


Info:
Loads/consumers of up to maximum 2kW (9 A) can also be switched without coupling relay.

6.2 SG ready heat pump (operating condition 3 + 4, Pr4) and controlled load on analogue output

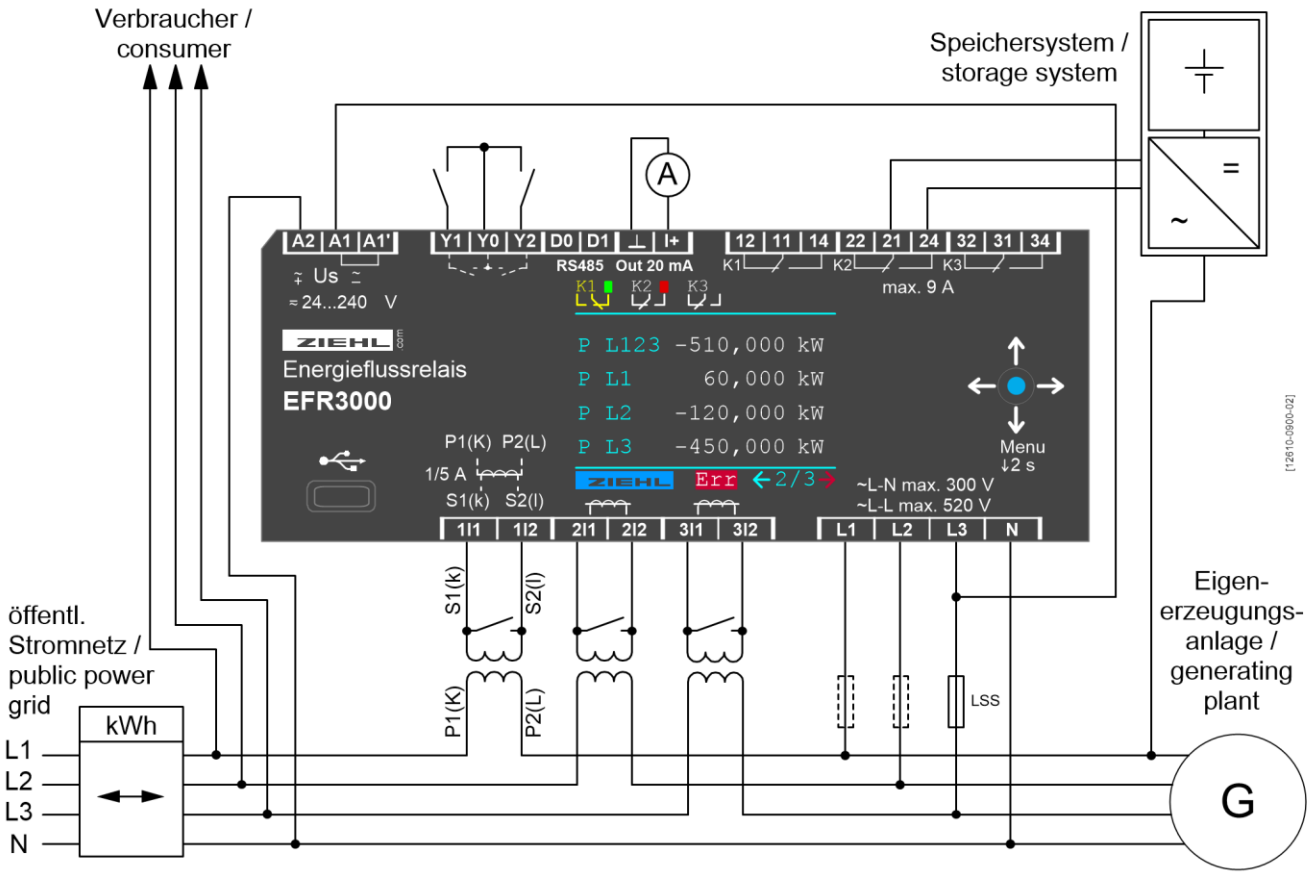


6.3 Energy flow direction relay (zero export device) without delivery into the public grid



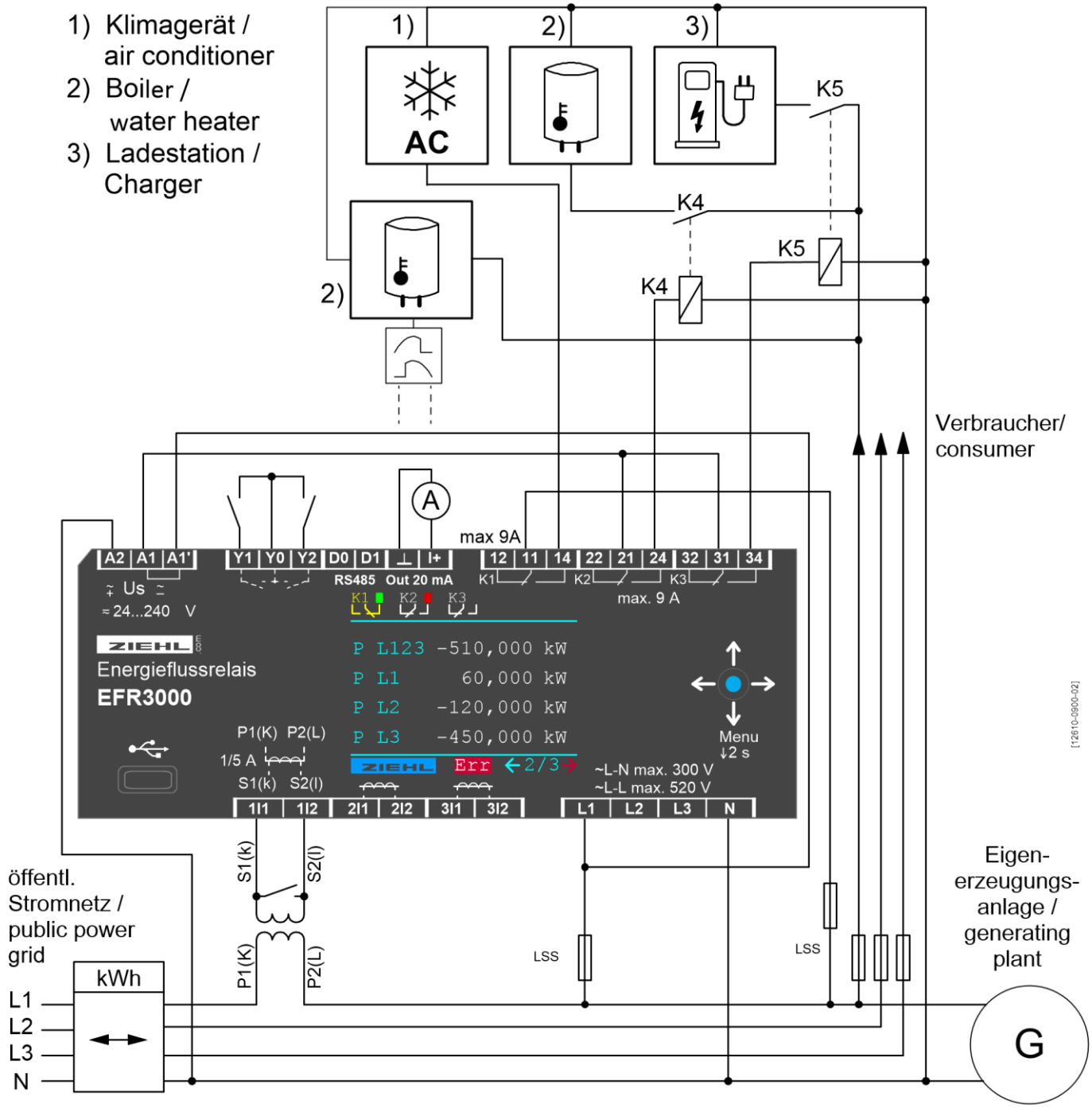
Info:
Setting MIN monitoring: Power Kx off < Power Kx on

6.4 Energy flow direction relay (zero import device) without delivery from the public grid



Info:
Setting MAX monitoring: Power Kx off > Power Kx on

6.5 1 phase connection to L1 (!)



Info:
Loads/consumers of up to maximum 2kW (9 A) can also be switched without coupling relay.
Do not connect any cables to unassigned measuring inputs!

7 Important notes

When using phase-angle controllers / trailing-edge controllers comply with the specifications of the grid operator.

External current transformers:

- **External current transformers are required to measure currents.**
- **The secondary lines S1 (K) and S2 (L) must not be grounded.**
- **The secondary circuits of the current transformers must never be operated open (dangerous electrical voltage)**

For switching 3-phase rotating (motor-driven) loads, protection must be used.

8 Installation/assembly

The device can be fastened:

- Panel mounted distributor installation on 35 mm mounting rails as per DIN EN 60715
- With M4 screws for wall installation. (additional bar not included in the scope of delivery)

Connect per connection diagram or type plate.

9 Detailed description

The EFR measures the flow of energy in all 3 phases. If there is enough intrinsic power left, the EFR3000 switches in up to three consumers and ensures that the current is consumed in-house. Potential consumers are, for example, air conditioning systems, hot water production or battery charging devices along with washing machines, dryers, etc... This is relatively easy if a PV system is feeding-in at a regular rate under clear skies and consumers with constant power consumption such as heat pumps or heating elements are connected. Consumers are particularly suitable that consume a lot of energy and which can be connected often, e.g. hot water generation. It is more complicated if the infeed varies due to clouds in front of the sun and consumers do not continuously consume power such as washing machines, dryers, irons or cookers. With the analogue output a consumer can be continuously regulated and thus the internal consumption can be further optimized. When using phase-angle controllers, the requirements of the network operators need to be observed.
The EFR3000 makes it possible to optimize the internal consumption even under difficult conditions.

To accomplish that, the following parameters can be set:

- Power consumption of the connected consumer
- Operating points, the energy flow at which the consumers are switched on
- Switch-on delay of the consumers, Short reduction of consumption (also through clocked consumers) or peaks in the infeed do not immediately lead to switching in additional consumers
- Minimum start up time, Heat pumps must not be continuously turned on and off, washing machines should be able to conclude a washing cycle.
- Turn-off delay, Short consumption peaks or reduction at the infeed do not immediately lead to a consumer being switched off.
- Reset point, the energy flow at which the consumers are switched off again. In practice, this value usually lies slightly on the "power delivery" side.
- Hide inputs to consumers if they are not available, e.g. hot water boiler has reached the maximum temperature.

The power is always evaluated and displayed as seen from power meter:
Delivery from energy supplier is positive, the power fed into the grid reduces the electricity invoice and is therefore negative (- prefix).

9.1 Description of the connections

Connection	Description
A1, A1‘ and A2	Supply voltage DC/AC 24 – 240 V 0/50/60 Hz
Y0	Supply voltage for digital inputs, approx. 18V DC
Y1 and Y2	Digital inputs, K1...3 external on or off
D0 and D1	RS485 interface
Gnd and I+	Analogue output 0/4...20 mA for adjustable loads or as instrument transformer
12,11,14; 22,21,24; 32,31,34	Relays K1, K2 and K3 (max. 9A direct)
L1, L2, L3 and N	Voltage measurement, phase L1, L2, L3 and neutral conductor
1l1(k), 1l2(l); 2l1(k), 2l2(l); 3l1(k), 3l2(l)	Current measurement, phase L1, L2 and L3 (only through current transformers 1 / 5 A), k = secondary power plant, l = secondary load

9.2 Functional characteristics

<table>
<tr><td>Negative measured value for performance</td><td>+ : Reference
- : Supply (excess)</td></tr>
<tr><td>Consideration of connected loads/consumers</td><td>Depending on the selected program, connected loads / consumers are taken into account to identify internal connect / disconnect limits</td></tr>
<tr><td>Influence of delay times</td><td>Depending on the program, determines not only the limit of the connection sequence but also the set delay times
(larger load should have shorter time and therefore has priority)</td></tr>
<tr><td>Implement minimum run times
(Min on)</td><td>Minimum run times of, e.g. heat pumps, washing machines, etc. can be implemented through the minimum startup time (Times -> Min on Kx); once a load/consumer is switched on, shut-down is earliest after the set time</td></tr>
<tr><td>Implement minimum switch-off time
(delay on)</td><td>Minimum off time of, for example, heat pumps, etc. can be implemented through the delay ON time (Times -> delay on), this time runs out before the On consumer is switched on, the minimum switch off time of the consumer can be set, the delay ON time can also be set shorter</td></tr>
<tr><td>SG ready</td><td>In Program 4, the EFR3000 also supports
SG ready devices / heat pumps:
<table>
<tr><th>Operating status</th><th>Signal K2 : K1</th><th>Description</th></tr>
<tr><td>3</td><td>0 : 1</td><td>Switch-on recommendation for enhanced operation</td></tr>
<tr><td>4</td><td>1 : 1</td><td>Definitive switch-on command</td></tr>
</table></td></tr>
<tr><td>Min / Max values</td><td>All the min and max values are stored zero voltage retentive; press the 2s button ↑ to delete the currently displayed min and max values</td></tr>
<tr><td>zero export / import device, relay function</td><td>In PR5+6 the relay position cannot be adjusted; the closed-circuit current principle always applies here i.e. the limit value is not exceeded/undercut = relay actuated (x1-x4)</td></tr>
<tr><td>zero export / import device, monitor function</td><td>In PR5+6 the set limit values determine the monitoring function of the associated relay:
Power Kx off > Power Kx on = MAX monitoring (exceed)
Power Kx off < Power Kx on = MIN monitoring (undercut)</td></tr>
</table>

9.3 Program 1 (the largest of up to 3 consumers is switched on)

Precondition:

- Own generating unit, e.g. photovoltaic, CHP, wind rotor, water turbine,
- 1…3 switchable consumers, same / different power, e.g. heating element, heat pump, rechargeable batteries, electric car, electric heating, air conditioning, ...
- Max. 1 controllable consumer with linear phase angle or trailing-edge control 0/4 to 20 mA (0-10V), e.g. heating element
- 1 and / or 3-phase consumers

Goal:

- The highest possible internal consumption by switching-in the largest-possible consumer / load
- Taking into account the analogue consumed power it is possible to switch on a relay if the relay is switched on and the controlled consumer is reduced (relays have priority)

Measurement:

- The EFR3000 monitors the accumulated flow of energy at the grid connection point (between the public power grid and the consumers / generators

Feature:

- Consumers that are already switch on and the analogue controlled consumers are taken into account (which is why the typical power consumption of the consumers has to be set)

Connection:

- If the grid-infeed increase, the delivery falls under the limit-ON value which is set for the load or consumer, than the delay-ON time, set for the load, starts to count.
  If the limit value remains undercut for the entire time, the consumer is switched on and the set minimum-on time begins
- If the grid-infeed carry on to increase, the delivery continue to fall below the next largest consumer switch on, after the expiration of the set delay-ON time and minimum start-up time, the smaller consumer will be switch off and the larger one switch on.
- All consumers are switch on in the same way
- Thereby if sufficient power is available the largest possible consumer is switch on first it should be given the shortest delay-ON time (smallest = longest)

Disconnection:

- If the grid-infeed decreases and the delivery rise above the limit OFF value which is set for the load or consumer, than the delay-OFF time, set for the load, starts to count.
  If the limit value remains undercut for the entire time, the consumer is switch off after the minimum-on time has expired
- When switching back to the next lower level, the delay ON time does not run down again which efficiently uses the excess energy

Application examples:

- 3 heating elements with different power, only one of them is allowed to be switch on at one time.
- Electric heating with 3 heating levels, only one of them is allowed to be switch on at the same time.

9.4 Program 2 (up to 3 consumers are switched on in succession)

Precondition:

- Own generating unit, e.g. photovoltaic, CHP, wind rotor, water turbine,
- 1 up to 3 switchable consumers, same or different power, e.g. heating element, heat pump, rechargeable batteries, electric car, electric heating, air conditioning, ...
- Max. 1 controllable consumer with linear phase-angle or trailing-edge control 0/4 to 20 mA (0-10V)
- 1 and / or 3-phase consumers

Goal:

- Highest possible internal consumption by gradually switching on the consumers or loads, at the same time. The previously switched on consumers are still switched on.
- If it is possible to switch on a relay in consideration of analogue consumed power, the relay would turn on and the analogue controlled consumer is going to switch off. (priority in relays)

Measurement:

- The EFR3000 monitors the amount flow of energy at the grid connection point (between the public power grid and the consumers / generators)

Feature:

- Analogue regulated consumers are taken into account
- Previously switch on consumers are not taken into account, the actually measured value P L123 is evaluated

Connection:

- If the grid-infeed increases and the delivery falls under the limit ON value, which is set for the consumer, than the delay-ON time, set for the load, starts to count. If the limit value remains undercut for the entire time, the consumer switch on and the set minimum-on time begin.
- If the grid-infeed carry on to increase, the delivery continue to fall below the setting limit the next largest consumer switch on after the expiration of the set delay-ON time.
- All consumers are switch on in the same way
- The sequence is determined by the set limit values and by the set delay ON times

Disconnection:

- If the infeed decreases / the delivery increases over the limit OFF value set for the load / consumer, the set delay OFF time starts; if the limit value remains exceeded for the entire time, the consumer is switched off after the expiration of the minimum start-up time
- All consumers are switched off the same way
- So that the smallest consumer is switched off first it should be given the shortest delay OFF time (largest = longest)

Example:

- Electric heating with 3 heat levels, all 3 can be operated at the same time but the sequence (low, medium, high) must be correct

9.5 Program 3 (largest load combination of 7-stages)

Precondition:

- Own generating unit, e.g. photovoltaic, CHP, wind rotor, water turbine,…
- 3 switchable consumers (otherwise Pr 2), different powers, e.g. heating element, electric heating, ...
- Is ideal for switching heating levels
- Max. 1 controllable consumer with linear phase angle or trailing-edge control 0/4 to 20 mA (0-10V)
- 1 and / or 3-phase consumers

Goal:

- The highest possible internal consumption by switching in the largest-possible load combination
- Taking into account the analogue consumed power it is possible to switch on a relay if the relay is switched on and the controlled consumer is reduced (relays have priority)

Measurement:

- The EFR3000 monitors the accumulated flow of energy at the grid connection point (between the public power grid and the consumers / generators)

Feature:

- Analogue regulated consumers are taken into account
- Consumers that are already switched on are taken into account (which is why the typical power consumption of the consumer has to be set)

Connection:

- All 7 levels have a common SWITCH-OFF value and the same delay ON + OFF and minimum on time
- If the infeed increases / the delivery falls under the set SWITCH-OFF value + load size of the stages, the set delay ON time starts; if the limit value remains undercut for the entire time, the first consumer is switched on and the set minimum startup time begins
- If the infeed increases / the delivery continues to fall so that the next largest combination could be switched on, after the expiration of the set minimum startup time + delay ON time the smaller combination will be switch off and the larger one switch on
- All combinations are switched on the same way

Disconnection:

- If the infeed decreases / the delivery increases over the set SWITCH-OFF value, the set delay OFF time starts; if the SWITCH-OFF value remains exceeded for the entire time, the combination is switched off after the expiration of the minimum startup time
- When switching back to the next lower level, the delay ON time does not run down again which efficiently uses the excess energy

Example:

3 heating elements with the same/different power; all 3 can be operated simultaneously

9.6 Program 4 (fixed starting sequence K1-K2-K3, SG ready)

Precondition:

- Own generating unit, e.g. photovoltaic, CHP, wind rotor, water turbine,
- 1…3 switchable consumers, same / different power e.g. heating element, heat pump (also SG ready), rechargeable batteries, electric car, electric heating, air conditioning, ...
- Max. 1 controllable consumer with linear phase angle or trailing-edge control 0/4 to 20 mA (0-10V), e.g. heating element
- 1 and / or 3-phase consumers

Goal:

- Highest possible internal consumption by gradually switching in the consumers / loads in the fixed starting sequence K1 – K2 – K3, at the same time the previously switched on consumers / loads stay switched on
- The load at K2 is switched on earliest if K1 is switched on,
  the load to K3 is switched on earliest if K2 is switched on
- It is ensured that Consumer K1 is always first switched on, for example, generates hot water
- Taking into account the analogue consumed power it is possible to switch on a relay if the relay is switched on and the controlled consumer is reduced (relays have priority)

Measurement:

- The EFR3000 monitors the accumulated flow of energy at the grid connection point
  (between the public power grid and the consumers / generators)

Feature:

- Analogue regulated consumers are taken into account
- Previously switched-in consumers are not taken into account, the actually measured value P L123 is evaluated

Connection:

- If the infeed increases / the delivery falls under the limit ON value set for the load / consumer on K1, the set delay ON time starts; if the limit value remains undercut for the entire time, the consumer on K1 is switched on and the set minimum startup time begins
- If the infeed increases / the delivery continues to fall so that the consumer on K2 could also be switched on, after the expiration of the set delay ON time it is also switched on
- If the infeed increases / the delivery continues to fall so that the consumer on K3 could also be switched on, after the expiration of the set delay ON time it is also switched on

Disconnection:

- If the infeed decreases / the delivery increases over the limit OFF value set for the load / consumer, the set delay OFF time starts; if the limit value remains exceeded for the entire time, the consumer is switched off after the expiration of the minimum startup time
- All consumers are switched off the same way
- Shut-down does <u>not</u> take place in a fixed sequence

Example:

- Analogue output: Phase angle control with heating element;
  K1: Heating element for service water heating; K2 Air-conditioner; K3: Heat pump,
  K1 has priority before K2, K2 has priority before K3

9.7 Program 5 (zero export / import added together, prevent/ limit infeed)

Precondition:

- Own generating unit, e.g. photovoltaic, CHP, wind rotor, water turbine, …
- Regulatory requirements from the grid-provider for limitation or prevention of energy flow accumulated over all 3 phases.

Goals:

- Prevent grid-infeed of mixed- or non-self-generated energy.
- Charging of batteries only in case of excess power and discharge during delivery only.
- Prevent or limit feed in of energy
- If necessary switch on consumers before generating unit has to be limited or shut down.

Measurement:

- The EFR3000 monitors the accumulated flow of energy at the grid connection point (purchase or delivery to the public power grid)
- The EFR3000 monitors the flow of energy directly at batteries. (Prevent energy flow in inadmissible direction)

Feature:

- Measuring of actual power P L123 at point of measurement.
- The monitoring function is determined separately for each alarm/relay via the set limit values
  MAX monitoring: Power Kx off > Power Kx on;
  MIN monitoring: Power Kx off < Power Kx on;
- Fixed function of relay: alarm = relay off = contact x1-x4 open, contact x1-x2 closed.
- Storage of shut down (autoreset on = switched off), reset at device or with Y1.
- The three relay outputs (alarms) are working independently.
- Delay-OFF times can be set from 0 s (= reaction time <500 ms.)

Switch-off MAX monitoring:

- If power P L123 rises above the limit Kx off, delay off time starts. If power stays above limit for this time, Kx switches off.
  Reconnection: If power P L123 falls under the limit Kx on, the set delay on time starts. If the limit value remains undercut for the entire time, Kx switch on (after reset only when Autoreset = off)..

Switch-off MIN monitoring:

- If power P L123 drops below the limit Kx off, delay off time starts. If power stays below limit for this time, Kx switches off.
  Reconnection: If power P L123 rises above the limit Kx on, the set delay on time starts. If the limit value remains exceeded for the entire time, Kx switch on (after reset only when Autoreset = off).

Switch-off MIN monitoring:

Examples:

- Limitation of grid-infeed:
  Own-generating unit produces more power than permissible at the grid-connection point:
  EFR3000 switches on 1 or 2 consumers. If this is not sufficient generation is reduced or switched off.
- Zero-grid-infeed: It is not allowed to feed into the grid.
  EFR3000 switches on 1 or 2 consumers. If this is not sufficient generation is reduced or switched off.
- Storage without import:
  EFR3000 shut down the unit, in case of power flow in inadmissible direction (to battery).
- Storage without delivery to grid (zero export):
  EFR3000 shut down the unit, in case of power flow in inadmissible direction (to grid).
- Connection of adjustable consumer at the analogue output:
  The EFR3000 regulates energy flow to a programmable value. Shut down only when power of consumer reaches maximum and energy flow cannot be limited sufficiently.

9.8 Program 6 (zero export / import device phase-wise, prevent/ limit infeed)

Precondition:

- Own generating unit, e.g. photovoltaic, CHP, wind rotor, water turbine, …
- Regulatory requirements from the grid-provider for limitation or prevention of energy flow in any phase.

Goals:

- Prevent grid-infeed of mixed- or non-self-generated energy.
- Charging of batteries only in case of excess power and discharge during delivery only.
- Prevent or limit feed in of energy
- If necessary switch on consumers before generating unit has to be limited or shut down.

Measurement:

- The monitored phase can be selected independently for each alarm/relay. In setting L123 it is monitored if limit is reached in at least one phase (OR).
- The EFR3000 monitors the flow of energy at the grid connection point (purchase or delivery to the public power grid)
- The EFR3000 monitors the flow of energy directly at batteries. (Prevent energy flow in inadmissible direction)

Feature:

- Measuring of actual power P L1 or L2 or L3 or L123 as assigned to the alarms/relays.
- The monitoring function is determined separately for each alarm/relay via the set limit values
  MAX monitoring: Power Kx off > Power Kx on;
  MIN monitoring: Power Kx off < Power Kx on;
- Fixed function of relay: alarm = relay off = contact x1-x4 open, contact x1-x2 closed.
- Storage of shut down (autoreset on = switched off), reset at device or with Y1.
- The three relay outputs (alarms) are working independently.
- Delay-OFF times can be set from 0 s (= reaction time <500 ms.)

Switch-off MAX monitoring:

- If power in assigned phase rises above the limit Kx off, delay off time starts. If power stays above limit for this time, Kx switches off.
  Reconnection: If power in assigned phase falls under the limit Kx on, the set delay on time starts. If the limit value remains undercut for the entire time, Kx switch on (after reset only when Autoreset = off).

Switch-off MIN monitoring:

- If power in assigned phase drops below the limit Kx off, delay off time starts. If power stays below limit for this time, Kx switches off.
  Reconnection: If power in assigned phase rises above the limit Kx on, the set delay on time starts. If the limit value remains exceeded for the entire time, Kx switch on (after reset only when Autoreset = off).

Switch-off MIN monitoring:

Examples:

- Limitation of grid-infeed:
  Own-generating unit produces more power than permissible at the grid-connection point:
  EFR3000 switches on 1 or 2 consumers. If this is not sufficient generation is reduced or switched off.
- Zero-grid-infeed: It is not allowed to feed into the grid.
  EFR3000 switches on 1 or 2 consumers. If this is not sufficient generation is reduced or switched off.
- Storage without import:
  EFR3000 shut down the unit, in case of power flow in inadmissible direction (to battery).
- Storage without delivery to grid (zero export):
  EFR3000 shut down the unit, in case of power flow in inadmissible direction (to grid).

9.9 Analogue output function

The 0/4 to 20 mA current output can be optionally used as either an instrument transformer for power or as a control output.
A single phase or even the sum of all phases (added up together) is evaluated/controlled.

The current output can be 0/2- 10V output as needed. To accomplish that, a resistor
is connected parallel to the output (20 mA * 500 ohms = 10 V). The input resistance of the controller must be known.

Formula for dimensioning:
Parallel resistance = (Input resistance controller * 500) / (Input resistance controller - 500)

Requirements placed on the controller:
- The control must be linear since the regulated power is used to calculate the switching points
- The control must be made with phase control or trailing-edge control
  (wave packet control and multicycle control are not supported)

The configured set point value, e.g. +0.1 kW = 100 watts delivery is regulated
If consumers are connected to Relays K1…3, the power triggered by the controller is taken into consideration when switching in the relay. Consumers are switched on as soon as there is adequate power. At the same time, switch-on and switch-off points and times programmed for the relays are taken into account.
If the device detects a failure of the load controlled with the analogue output (deviation from the setpoint > control tolerance), the triggered power is not taken into account when switching in K1…3.

Example:
Load connected to controller = 1 kW (at 20 mA)
Controller set point = 0 kW (no delivery and no infeed)
Power connected to Relay K1 = 0.5 kW
Switch-on point K1 = -0.1 kW (= infeed 100 Watts)
As soon as the controller triggered power is so high that by connecting the load to K1 the switch-on point for K1 is reached, the consumer connected to K1 is switched on. This is the case at 0.6 kW (= 60% of the 1 kW = 12 mA at the output).
Subsequently, under the new load conditions the controller tries to control back to the setpoint.
This also applies to Relays K2 and K3.

9.10 Function of the digital inputs PR1…4

The EFR3000 has 2 digital inputs for potential-free normally open contacts. That permits selectively switching each output relay on or off at any time. Consumers can therefore be blocked or switched on with external control. Y2 overwrites Y1
Function examples:

- Heating element, shut-down by an external thermostat when the temperature is reached
- Heat pump, off periods through timer
- Priority control, washing machine remains on until it is finished
- Charge E-auto at fixed time
- Generate hot water on demand

9.11 Function of the digital inputs PR5…6

In program 5 and 6 the digital input Y1 takes on the function of an external reset. A locked trigger can be externally deleted again (button or switch). The function is similar to a reset by the device button. If Y1 remains permanently closed, a locked trigger can be immediately deleted again.
Digital input Y2 is not occupied with any function.

10 Commissioning

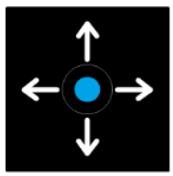
Convenient configuration is also possible through the following web interface with transmission through USB memory stick:

http://www.public.ziehl.com/efr3000/

10.1 Information on operating

2s: Reset
Increase value,
Scroll up,
Min/max values

Back,
move/scroll left



Confirm,
move/scroll right

Decrease value,
move/scroll down
2s: Menu

10.2 Switch on the unit / Language selection

During the initial start the unit displays the language selection. Once the language has been selected monitoring starts. The language can be changed at any time in the menu (Options -> language).

10.3 Program selection

The suitable program must be set on the EFR3000 in accordance with the application.
Setting procedure: Program&Code -> Program No

Pr	Description (switching sequence)	Analysis	RS485	Analogue output 0/4 to 20mA
1	Max 1 Load / Consumer ON (the largest of up to 3 consumers is switched on)	Accumulative power L123 + Total connected loads/consumers + Analogue controlled Load	Modbus	Control: Load L1 / L2 / L3 / L123 (3-phase) or Instrument transformer: kW-L1 / L2 / L3 / L123 (added-up)
2	Max 3 loads/consumers ON (largest load combination of 3-stages)			
3	Max 3 loads (otherwise Pr2) /consumers ON (largest load combination of 7-stages)			
4*	3 loads/consumers ON (K1-K2-K3 are switched on in a fixed sequence), SG ready			
5	Energy flow direction relay (zero export / import device) max 3 limit values (e.g. 2xadvance warning, 1 x shut-down)	Accumulative power L123		
6**	Energy flow direction relay (zero export / import device) max 3 limit values, separated by phase or all 3 phases simultaneously	Power L1 / L2 / L3 or L123 (=1 of 3)		

* Factory set
** Standard zero export / import device (L123)

Hint: When changing programs, all parameters of the selected program are reset to “default settings“ (see table „Default settings“). **Only change the parameters after you have selected the correct program.**

10.4 Description of the parameters

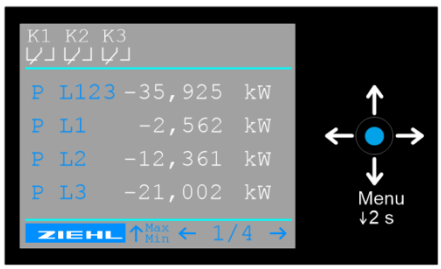
Menu	Parameters	Explanation	Adjustment range
Current transformer	Primary	Primary current of the current-transformer	1…1000 A
	Secondary	Secondary current of the current-transformer	1.0...5.0A
Relay	Output to K1/2/3	Max power consumption of the connected load, depending on the program the activated loads are offset against the measured value, After connecting a load the appropriate phase has to be changed by this amount (for 3-phase load by 1/3 each)	0.1…500.00 kW
	Phase K1/2/3	Phase(s) from which the load is supplied, after connecting a load, the value has to be changed on the related phase Pr6: Phase which is being evaluated, L123 all 3 phases are evaluated	L1 / L2 / L3 / L123
	Load ON K1/2/3	In which relay setting the load is switched on (Pr 5+6 11-12 = Alarm)	11-14 / 11-12
	Auto reset K1/2/3 (Pr5+6)	On: Relay switches back automatically Off: Relay only switches back after a manual reset (Y0-Y1 >100ms or close or press 2s button ↑)	on / off
Times	Delay on K1/2/3	The connect condition must be met uninterrupted for this time before it is switched on (Pr5+6 reconnection time)	10s…23h59m59s
	Min on K1/2/3	If a load is switched on, independent of the measured value it remains switched on until the expiration of this time is activated (minimum runtime)	10s…23h59m59s
	Delay off K1/2/3	The disconnect condition must be met uninterrupted for this time before it is switched off (Pr5+6 tripping time)	10s…23h59m59s (Pr5+6: 0s…59m59,99s)
	Last change K1/2/3	The period begins with the connection of a load, within this time a load change has to occur on the respective phase; otherwise a warning appears	10s…23h59m59s
Limits	Output K1/2/3 on	Pr1…4: If the measured value (+ Total switched on consumers) falls below this value then the delay ON time starts	-999.99…999.99 kW
	Performance K1/2/3 off	If the measured value rises over this value and the minimum switch-on time has expired, the delay OFF time starts	-999.99…999.99 kW
	Pr5+6: Power Kx off > Power Kx on = MAX monitoring (exceed) Power Kx off < Power Kx on = MIN monitoring (undercut)		
	Shut-down value (Pr3)	Reset point; if the measured value rises above this value, one stage is switched back	-999.99…999.99 kW
Digital inputs	Y0-Y1	When digital input Y1 is closed, each relay can be individually be switched on / off or all relays on / off	K1 on / K1 off / K2 on / K2 off / K3 on / K3 off / K1-3 on / K1-3 off
	Y0-Y2, Y2 overwrites Y1	When digital input Y2 is closed, each relay can be individually be switched on / off or all relays on / off	

Menu	Parameters	Explanation	Adjustment range
Analogue output	Function	Analogue output as an instrument transformer (kW-Lx) or as a control output (Load-Lx) for, e.g., linear phase angle control	off / kW-L123 / kW-L1 / kW-L2 / kW-L3 / Load-L123 / Load-L1 / Load-L2 / Load-L3
	Mode	0 or 4 mA … 20 mA	0-20 mA / 4-20 mA
	Zero point (instrument transformer)	Power in kW for zero point, Power in kW for full-scale **-**: Feed in (excess) **+**: Delivery (Zero point and full-scale may also have different signs)	-999.99…999.99 kW
	Full-scale (instrument transformer)		-999.99…999.99 kW
	Set point (Load / Control)	With sufficient load regulates the analogue output to this value	-999.99…999.99 kW
	Max. power (Load / Control)	Max. power consumption of the controlled load at 20mA	0.1…500.00 kW
	Control speed	Slow (20%)…fast (90%), Control response = (difference between the set point-actual value) * 20…90%	20…90 %
	Control interval	The set point value is readjusted in this interval; fast (0.5s)…slow (5.0s)	00.5…05.0 s
	Control tolerance	Difference set point actual > Control tolerance = Failure of the load is detected, e.g. due to a thermostat being switch-off; load on the analogue output is not taken into account by K1-3 when additional loads are switched on	5…50 %
Interface	Address	Address of the EFR3000	1…247
	Baud rate	Setting of the baud rate	4.8 / 9.6 / 19.2 / 57.6 / 115.2 kBd
	Parity	Setting of the parity	Even / odd / no
	Stop bit	Number of stop bits, 1 or 2	1 / 2
USB	EFR to USB	If the current settings are saved on a USB memory stick (.cfg), these settings can be transmitted to the EFR3000 at any time or even applied to a different EFR3000 regardless of the firmware version *	
	USB to EFR	If the settings are loaded from the USB memory stick (.cfg), the current settings will be overwritten and are not backed up	
	Firmware	Once the file has been selected (.hex), the firmware update starts, configuration is maintained after an update	
Program & Code	Program no.	Setting the program	1…3
	Default settings	Set the parameter to factory settings	yes / no
	Code lock	Switch code lock on/off, Factory preset code 504, for details please refer to 8.6 Code lock / Code reset	0…9999
Options	Language	Selects the language	German / English
	Brightness	The brightness to which the display is dimmed after the expiry of the dimming time	20…99 %
	Dimming time	Starts with the last press of a button; after expiration of the time the display is dimmed to the set brightness value	10s…01h00m00s
	Num. interval	Time interval in which the measured values are updated (to smooth the display)	00.1…02.0 s
Simulation	Relay	Simulate relay (On / Off)	
	Function	Complete functional simulation, analogue output and digital inputs	

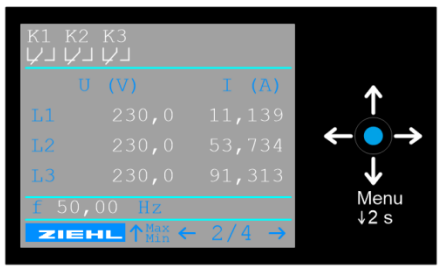
Menu	Parameters	Explanation	Adjustment range
Info	Firmware version	Display of the firmware version	00-0
	Serial number	Display of the serial number	0…999999
	Operating hours	Display of the operating hours (zero voltage retentive)	h
	Display error counter	Displays the number of errors that occurred (zero voltage retentive)	Err 1…9
	Clear error counter	Clears the error counter	Delete
	Display switch-on time	Displays the total switch-on time of the relay (is also indicated on display page 3.)	0…99999 min
	Clear switch-on time	Clears the entire switch-on time of the relay	Delete
	Warnings	Current pending warnings with help text	
	Comments	When configuring through the web interface (transmission through USB memory stick), a comment with a maximum of 208 characters can be stored and is displayed here	

* Possibility to store settings e.g. summer / winter

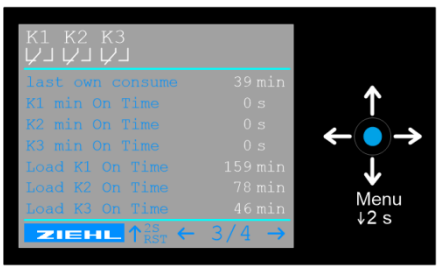
10.5 Description of the display pages (measured values)



1 / 4	
P L123	Power added together (sum of the 3 phases) in kW
P L1	Power L1 in kW
P L2	Power L2 in kW
P L3	Power L3 in kW



2 / 4	
U L1	Voltage L1 in V
U L1	Voltage L2 in V
U L2	Voltage L3 in V
I L1	Current L1 in A
I L2	Current L2 in A
I L3	Current L3 in A



3 / 4	
last own consume	Time without internal consumption (via EFR3000)
K1…3 Min On time	Counts down the minimum switch-on time
K1…3 delay On time	Counts down the delay ON time
K1…3 delay Off time	Counts down the delay OFF time
Load K1…3 On time	Total switch-on time of the load on relay K1…3 (zero voltage retentive)

4 / 4	
Firmware	Firmware version
Program No.	Current program
Digital inputs	Current state of the digital inputs
Analog output	Active current on the analogue output
Code lock	Current state of the code lock
RS485	Rx: Receive data Tx: Send data
Warnings	Current pending alarms (device still works, but maybe not optimally)

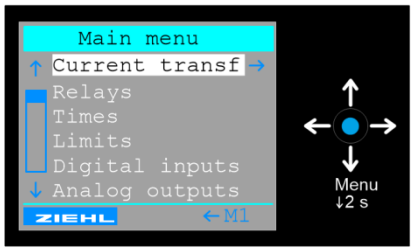
8.5.1 Explanation of the symbols

= Apply and save value / setting

= Back, value / parameter will not be saved

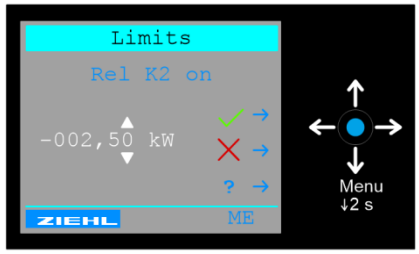
= Help text on the value / parameter

10.5.2 Display Examples



Display Menu

Display Time Setting



Display Limit value setting

10.6 Code lock / Code reset

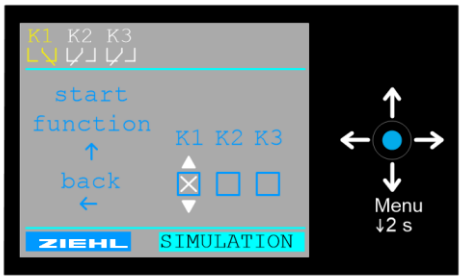
Program & Code -> code lock

You can protect all parameters by enabling the code lock. The factory setting is Code 504.
In the event of problems with the code lock (forgot the code) the lock can be switched off and the code reset to 504 when switching the power on by keeping the key pressed up (approx. 4s) until the message Code off is displayed.

10.7 Simulation

Simulation -> relays

Here you can set the output relay, regardless of the measured ON or OFF value.
That will actually turn the connected loads / consumers on or off!

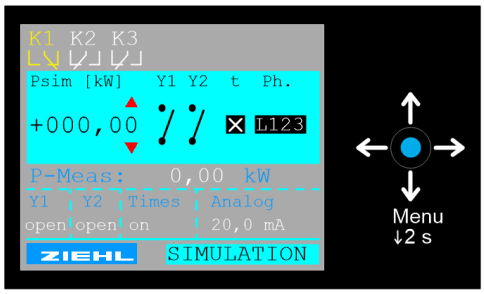


K1	☒ = Relay ON 11-14
K2	☒ = Relay ON 21-24
K3	☒ = Relay ON 31-34

Simulation -> function

In the simulation function a measurement value can be simulated even without connecting measuring inputs. All functions of the device operate as if this value is actually being measured. Suitable for the simulated measured value, the value of analogue output is also displayed.

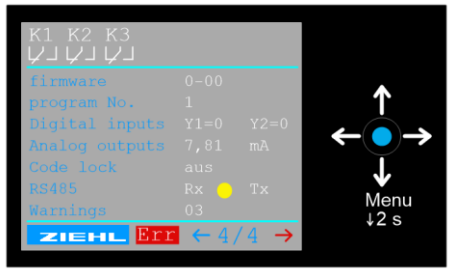
Psim [kW]	Simulated measured value
Y1, Y2	Simulation of digital inputs
t	☒ = Active time ☐ = Fixed time 1s
Ph	Phase being simulated
P-Meas	Measured value for evaluation (simulated value + switched on loads/consumers)
Y1, Y2	Digital inputs status
Times	Time status
Analog	Value at the analogue output



The set value is simulated until the simulation is excited by pressing the ← or → button several times. If no key is pressed for 15 minutes the simulation is also exited.

11 Troubleshooting and corrective measures

Error messages appear in the display footer displayed in red. (Err) As soon as a fault is resolved this message disappears automatically. I.e. error messages do not have to be acknowledged. If the key ➔ is pressed in Display page 4, a help text appears for each pending fault.



Fault	Cause	Corrective measure
Sign is not correct	Current transformer connected the wrong way around	**+**:Delivery **-**:infeed, rotate current transformer, Exchange S1(k) and S2(L) on the EFR3000 (switch off primary circuit first!)
Measured value changes when connecting a load in the wrong direction	Check the current transformer	
Device function is not plausible	False configuration	Get warnings (Info -> warnings); the EFR3000 recognizes any incorrect settings / functions and displays suggested solutions
Implausible measured values	Neutral conductor not connected	Connect the neutral conductor
The display is blank	Supply voltage not connected	Connect supply voltage in accordance with the page type plate at terminals A1 and A2
-EEE or EEE appears in the display	Measurement is above/below range	Measured voltage is too small or too large; comply with measurement range
Screen too dark	The display is dimmed after the set time (Options -> dimming time); the brightness is set too low (Options -> dimming time)	Increase brightness (Options -> brightness)
AD error	Internal AD converter error	Do a reset; interrupt supply voltage for >5s *
Calibration values	Calibration values are outside of tolerance	
Parameter value	Parameter value is outside of the permissible range	
The device cannot be configured	Code lock activated	In the event of problems with the code lock (forgot the code) the lock can be switched off and the code reset to 504 when switching the power on by keeping the key pressed upward (approx. 4s) until the message Code Off appears.

* Sent the unit to the factory for repair if the error is not resolved after reset

12 Tips and Tricks

Short periods of time (delay on/off, minimum switch-on time) allow the EFR3000 a faster response to changes and better optimization.
Attention: Some consumers have limited switching frequencies or processes (washing machine) and must not be interrupted.

The current output can also be used as 0/2- 10V output as needed. To do that, wire in a resistor parallel to the output. The input resistance of the controller must be known.
Formula for dimensioning:
Parallel resistance = (Input resistance * 500) / (Input resistance - 500)

13 Technical data

Supply voltage Us (A1, A2)	**DC/AC 24 – 240 V 0/50/60 Hz**
Tolerance	DC 20,4 - 297 V AC 20 - 264 V
power consumption	< 3 W < 9 VA
Output relay K1, K2, K3	**3 x 1 change over contact**
Switching voltage	max. AC 300 V; DC 300 V
min. voltage / current	12 V 10 mA
conventional thermal current Ith	max. 9 A
Switching power max. AC cos φ = 1	2000 VA
Switching power max. DC (ohm)	0,3 A 300 V / 0,4 A 120 V / 0,8 A 60 V / 9 A 28 V
Contact service life, electr. cos φ = 1	10^5 operating cycles 300 V / 9 A
Rated operational current	AC-15 Ie = 6 A Ue = 250 V
	DC-13 Ie = 2 A Ue = 24 V
	DC-13 Ie = 0,2 A Ue = 250 V
Test conditions	**EN 61010-1**
Rated impulse withstand voltage	4000 V
Overvoltage category	III
Pollution degree	2
Rated insulation Ui	300 V
Operating time	100 %
Wiring connection	
Supply voltage (Us)	A1, A1', A2
Measuring inputs (Mess)	1I1(k), 1I2(l), 2I1(k), 2I2(l), 3I1(k), 3I2(l), L1, L2, L3, N
Digital inputs (Dig)	Y0, Y1, Y2
Interface (RS485)	D0, D1
Analog Output (Analog)	GND (⊥), I+
Relay (Rel)	K1: 11, 12, 14 / K2: 21, 22, 24 / K3: 31, 32, 34
Isolation / Test voltage	Us → Mess, Dig, RS485, Analog, Rel DC 3820 V
	Mess → Dig, RS485, Analog, Rel DC 3820 V
	Rel → Dig, RS485, Analog DC 3820 V
	Rel (K1) → Rel (K2) → Rel (K3) DC 3820 V
Installation conditions	
Operating temperature	-20 °C ... +55 °C
Storage temperature	-20 °C …+70 °C
Altitude	< 2000 m above sea level
Climate resistance	5-85% rel. humidity, no condensation
Wiring temperature	-5 °C …+70 °C
Vibration resistance EN 60068-2-6	2 … 13,2 Hz ±1 mm 13,2 ... 100 Hz 1 g
	2…25 Hz ±1,6 mm 25 ... 150 Hz 5 g
EMC-Tests	**EN 61326-1**
EMC emission	EN 61326-1; CISPR 11 class B
EMC immunity	EN 61326-1 industrial environment
External Inputs	**ca. DC 18 V / 3,5 mA**
Digital Inputs Y0/Y1	function programmable
Digital Inputs Y0/Y2	function programmable
Measurement of voltage (L1 / L2 / L3 towards N)	

Voltage (Phase – N)	AC 35,0 … 330,0 V, 45 … 65 Hz	
Measuring principle	True RMS	
Max. error of measurement	±0,5% of fullscale , ± 1 Digit	
Input resistance Phase – N	> 600 kΩ	
Power consumption Phase – N	max. 0,15 VA	

Measurement of current (1I1(k) – 1I2(l), 2I1(k) – 2I2(l), 3I1(k) – 3I2(l))		
Nominal current	AC 1 A / 5 A	45 … 65 Hz
Measuring range	AC 0,002 … 6,000 A	45 … 65 Hz
Resolution	1 mA	
Measuring principle	True RMS	
Max. error of measurement	±0,5% of fullscale , ± 1 Digit	
Overload capacity		
continuously	8 A	
max. 1 s	25 A	
Inputs resistance	ca. 25 mΩ	
Power consumption	ca. 0,25 VA (1 A)	0,63 VA (5 A)
Connection of current measurement only with external current transformers:		
External current transformer Primary	1 … 1000 A	
External current transformer Secondary	1,0 … 5,0 A	

Measurement of active power	Multiply values by factor of current transformers
Range 1 A, per Phase / total	-300 … 300 W / -900 … 900 W
Range 5 A, per Phase / total	-3,96 … 3,96 kW / -9,99 … 9,99 kW
Range max., per Phase / total	-396 … 396 kW / -999 … 999 kW
Resolution	1 W
Max. error of measurement	±1% of fullscale ± 1 Digit
Reaction time zero export / import device	< 500ms + delay off

RS485 Interface (D0 – D1)	
Protocol	Modbus RTU
Baud rate	4800, 9600, 19200, 57600, 115200 Baud
Parity	no, odd, even
Stop bits	1 / 2
Max. cable length	approx. 1000m at 19200 Baud

Analog output (GND (⊥), I+)	DC 0/4 – 20 mA for active power ±999 kW, scalable
Max. error	±0,3 % of fullscale (ab 0,1 mA) + error of measurement active power
Temperature factor	< 0,015 % / K
Resolution	11,6 Bit < 6,1 µA
Load	≤ 500 Ω
error load	(250 Ω – load) / 250 Ω * 0,3 % of current
Regulation/ control	linear, phase control or phase alignment, with reinforced insulation / protective separation

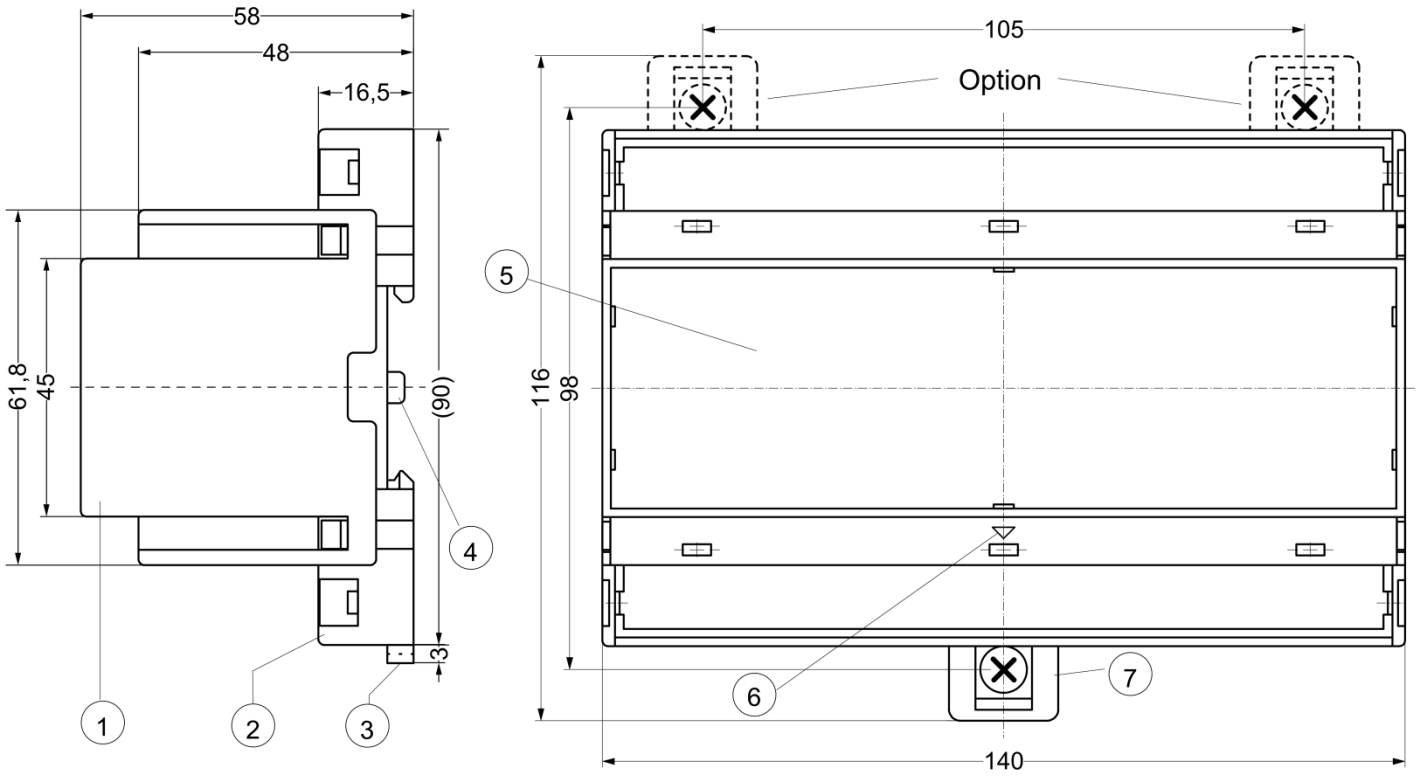
Housing	construction type V8, distribution board
Mounting depth	56 mm
Width	8 units
Dimensions (W x H x D)	140 x 90 x 58 mm
Terminals for measuring inputs:	
Wiring connection single strand	1 x 0,34 – 4,0 mm² / AWG 22 - 12
Finely stranded with wire end ferrule	1 x 0,34 – 2,5 mm² / AWG 22 - 12
Other terminals:	
Wiring connection single strand	1 x 0,34 - 2,5 mm² / AWG 22 - 12

Finely stranded with wire end ferrule	1 x 0,1 -1,5 mm² / AWG 27 - 14
Stripping length / specify torque	8 mm / 0,5 Nm
Protection class housing / terminals	IP 30 / IP20
Mounting	Snap-on fastening on 35 mm mounting rail acc. EN 60 715 or with M4 screwed attachment (additional bar not included in the scope of delivery)
Weight	ca. 300 g

We reserve the right to make technical changes

14 Mounting type V8

Dimensions in mm



1 Oberteil / cover
2 Unterteil / base
3 Riegel / bar for snap mounting
4 Plombenlasche / latch for sealing
5 Frontplatteneinsatz / front panel
6 Kennzeichen für unten / position downward
7 Riegel bei Wandbefestigung mit Schrauben. Riegelbohrung Ø 4,2 mm / for fixing to wall with screws, Ø 4,2 mm