Brief description

Panel mounting instrument ES230 with dimensions 144x144x46mm resp. ES230s with dimensions 96 x 96 x 46 mm. Four-quadrant measurement for power system and consumption analysis in single and multi-phase AC systems. Three large LED displays with four digits plus sign. The converter data are included for direct display and further processing. Configurable display settings for user specific presentation, integrated energy meters, impulse counters, and limit value indication. Comprehensive average value and max./min. value functions. Harmonic analysis and THD measurement. Determination of the neutral wire current. Asymmetry factor and neutral point voltage shift. Two switched outputs for the control of impulse counters, or for signalling limit alarms.

Technical data

(for more detailed information please see datasheet, download under www.dranetz-bmi.com)

Measuring inputs

Nominal frequency:	50, 60 Hz
Nominal input voltage:	Phase-phase: 500 V Phase - N: 290 V
Nominal input current:	5 A or 1 A

Continuous thermal rating of inputs

10 A at 346 V in single-phase AC system 10 A at 600 V in three-phase system

Short-time thermal rating of inputs

Input variable	Number of inputs	Duration of overloads	Interval between two overloads
577 V LN	10	1 s	10 s
100 A	10	1 s	100 s
100 A	5	3 s	5 min

Measuring ranges

U, I, S:	≤120% of nominal value
P, Q:	≤± 120% of nominal value
F:	45 to 65 Hz
cosφ:	± 1

Display

The measurement display is 4 digit (frequency) and right justified. Energy values are displayed with 8 digits.

Zero value suppression

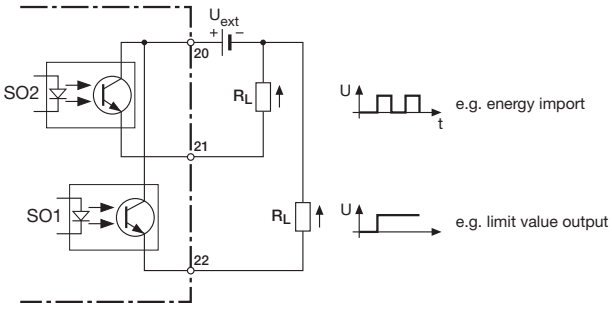
PF resp cosφ:	Display ---, if Sx < 0.2% Snenn
Currents:	Display 0, if Ix < 0.1% Inenn
unb. U:	Display 0, if Ø U < 5% Unenn

Pulse/Limit value outputs

Depending on the function selected, the two digital outputs can be used either as pulse outputs for actual and reactive energy or as limit signals.

The outputs are passive, and are galvanically isolated from all the other circuits by opto-couplers. They are suitable to drive tariff devices (S0-standard DIN 43 864), or 24 V relais.

U_{ext}	≤40 V DC	(OFF: leakage current ≤0.1 mA)
I_L	≤150 mA	(ON: terminal voltage ≤1.2 V)



Limit value outputs

The measured values can be freely allocated.

Pulse outputs

Active and reactive energy pulses can be generated for the control of electronic and electromechanical counters.

Power supply*

DC-, AC power pack 45 to 400 Hz
85 to 253 V AC/DC or
20 to 70 V AC/DC

Power consumption: < 3 VA (without extension module)

* For power supplies > 125 V the auxiliary circuit should include an external fuse.

Reference conditions

acc. to IEC 688 resp EN 60 688

Sine 50 - 60 Hz, 15 - 30°, application group II

Measurement accuracy (related to nominal value)

Current, voltage	± 0.2%
Power	± 0.5%
Power factor	± 0.5%
Energy	± 0.5%
Frequency	± 0.02 Hz (abs.)

Environmental conditions

Operating temperature:	-10 to +55 °C
Storage temperature:	-25 to +70 °C
Humidity relative:	≤75%
Altitude:	2000 m max.

Indoor use statement

Safety

Protection class:	II (voltage inputs with protection impedances)
Measuring category:	III
Pollution degree:	2
Measurement voltage:	300 V
Test voltage:	Between current inputs, power supply, digital outputs, terminals of the plugged-in module: 3700 V / 50 Hz / 1 min. On voltage inputs: 4.25 kV 1.2/50 µs
Module connections:	The pin rail at the back is connected to the voltage inputs via a protection impedance. Only the permitted modules can be plugged-in!
Enclosure protection:	Front IP 66, terminals IP 20

Commissioning

The multifunctional power monitor is made operational by switching on the power supply. The following appears sequentially on the display:

1. Segment tests: all the segments of the displays and all the LEDs are lit for 2 s.

2. Version of the software: e.g. ES230 1.04
3. The 3 line voltages at switching on.

Loss of the power supply

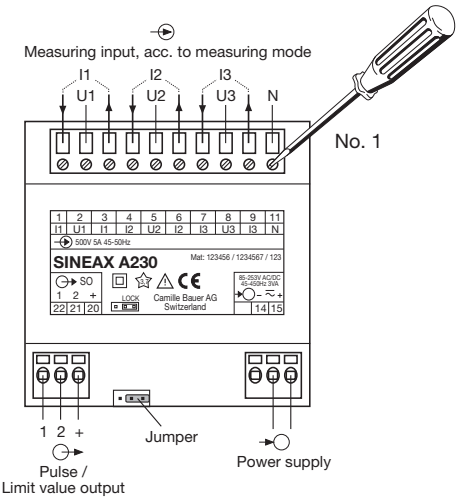
All the values configured remain during a loss of the power supply.
On reconnecting the power supply, the last mode selected is displayed.

Note of maintenance

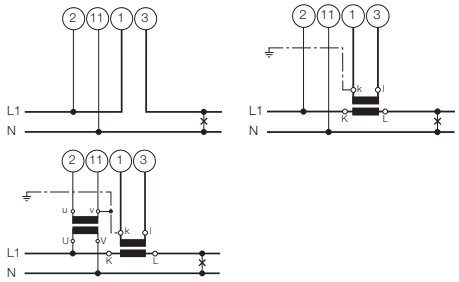
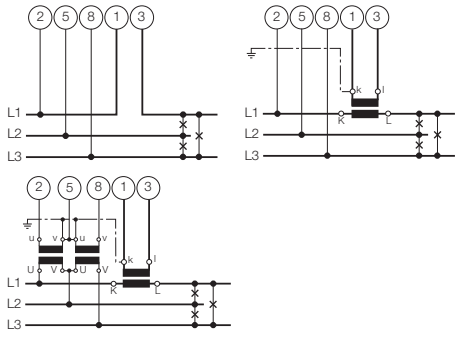
No maintenance is required.

Electrical connections

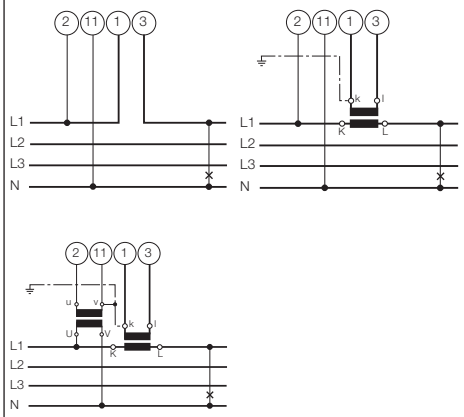
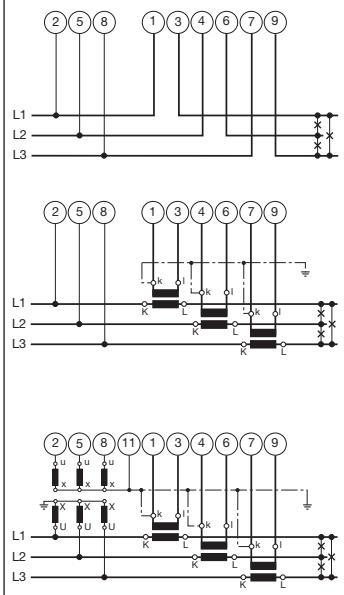
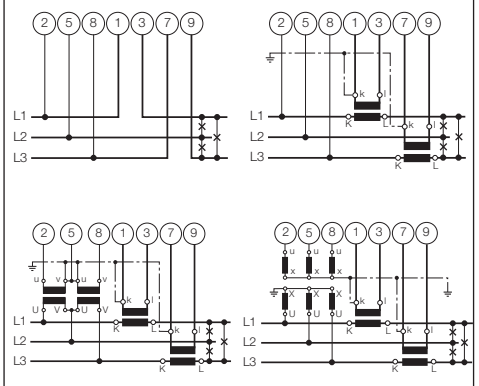
(the electrical connections are identical for the Encore ES230 and ES230s).



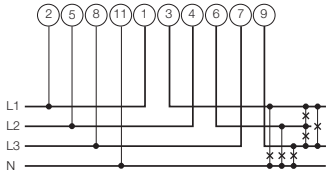
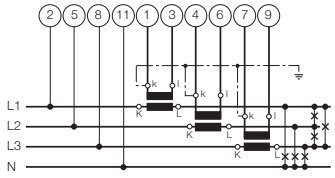
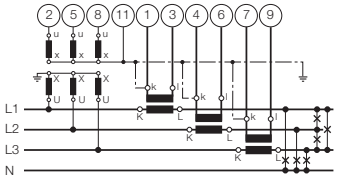
Connecting modes

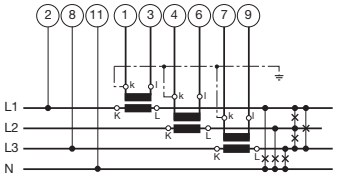
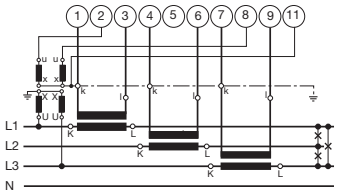
System/ application	Terminals
Single phase AC system 	
3-wire 3-phase **symmetric load** I: L1 	 Connect the voltage according to the following table for current measurement in L2 or L3:

Current transf.	Terminals		2	5	8
L2	1	3	L2	L3	L1
L3	1	3	L3	L1	L2

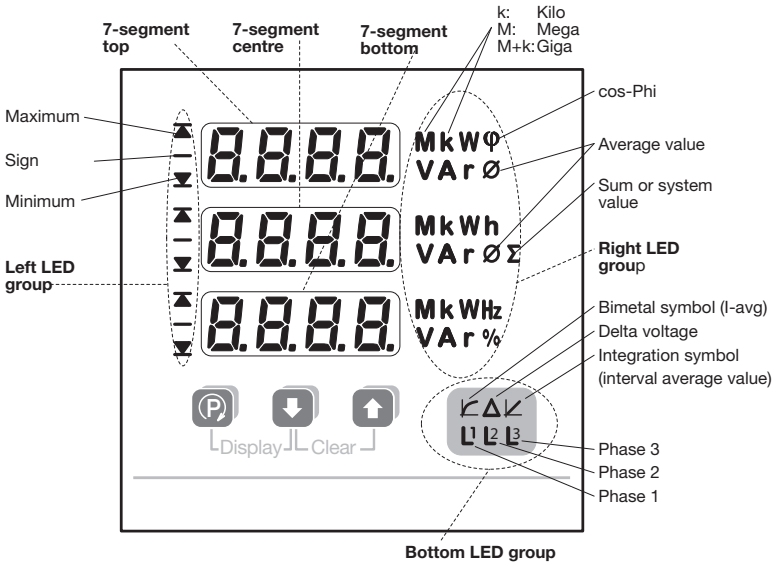
System/ application	Terminals
4-wire 3-phase **symmetric load** I: L1 	 Connect the voltage according to the following table for current measurement in L2 or L3:
3-wire 3-phase **asymmetric load** 	 3 single-pole insulated voltage transformers in high-voltage system
3-wire 3-phase **asymmetric load**, Aron 	

Current transf.	Terminals		2	11
L2	1	3	L2	N
L3	1	3	L3	N

System/ application	Terminals
4-wire 3-phase **asymmetric load** 	   3 single-pole insulated voltage transformers in high-voltage system

System/ application	Terminals
4-wire 3-phase **asymmetric load**, Open-Y 	 Low-voltage system  2 single-pole insulated voltage transformers in high-voltage system

Measured value display



Abbreviations and symbols

oL	Overload, out of range indicator	ind	Inductive
U.nE	Neutral point voltage shift (U neutral-earth)	CAP	Capacitive
unb.U	Voltage asymmetry factor (unbalance U)	.H	Energy high tariff
in	Neutral current	.L	Energy low tariff
SYSt.	System power	thd.U	THD-U
x.xx i φ	Power factor incoming inductive	thd.i	THD-I
x.xx c φ	Power factor incoming capacitive	trnd	Interval power: Trend
- x.xx i φ	Power factor outgoing inductive	t-0…t-4	Interval power: last to fifth last interval
- x.xx c φ	Power factor outgoing capacitive	H2.U…H15.U	2nd - 15th harmonic U
inc	Incoming	H2.i…H15.i	2nd - 15th harmonic I
out	Outgoing		

Available measurement data (at connection mode 4-wire asymmetric load)	LED group left (t c b)	Example 7-segm. display top	Example 7-segm. display centre	Example 7-segm. display bottom	LED group right	LED group bottom
Phase voltages: U1, U2, U3		230.2	231.1	229.9	V	L1 L2 L3
Maximum values: U1-max, U2-max, U3-max	▲ ▲ ▲	235.1	236.4	231.2	V	L1 L2 L3
Minimum values: U1-min, U2-min, U3-min	▼ ▼ ▼	227.8	226.6	225.7	V	L1 L2 L3
Delta voltages: U12, U23, U31		400.0	402.5	398.4	V	≤
Maximum values: U12-max, U23-max, U31-max	▲ ▲ ▲	405.2	406.4	403.3	V	≤
Minimum values: U12-min, U23-min, U31-min	▼ ▼ ▼	395.5	397.4	396.8	V	
Neutral point voltage shift: UNE and UNE-max	▲	U.nE	2.3	8.6	V	
Voltage asymmetry factor (unbalanced U)	▲	unb.U	1.4	6.2	%	
Phase currents: I1,I2, I3		11.54	10.98	10.23	A	L1 L2 L3
Maximum values: I1-max, I2-max, I3-max	▲ ▲ ▲	12.65	11.86	11.07	A	L1 L2 L3
Average values: I1avg, I2avg, I3avg (bimetal-15minutes)		7.23	6.86	6.46	A	⌐ L1 L2 L3
Max. average values: I1avg-max, I2avg-max, I3avg-max (slave pointer -15 minutes)	▲ ▲ ▲	7.98	7.48	6.98	A	⌐ L1 L2 L3
Neutral current: IN and IN-max	▲	in	1.13	2.75	A	
Active power: P1, P2, P3	a)	2240	2032	1491	W	L1 L2 L3
Maximum values: P1-max, P2-max, P3-max	▲ ▲ ▲ a)	2554	2825	2482	W	L1 L2 L3
Active power system: P and P-max	▲ a)	SYSt.	5.76	7.86	kW	
Reactive power: Q1, Q2, Q3	b)	1078	393	721	VAr	L1 L2 L3
Maximum values: Q1-max, Q2-max, Q3-max	▲ ▲ ▲ b)	1704	561	1027	VAr	L1 L2 L3
Reactive power system: Q and Q-max	▲ b)	SYSt.	2.19	3.29	kVAr	
Apparent powers: S1, S2, S3		2281	2157	2089	VA	L1 L2 L3
Maximum values: S1-max, S2-max, S3-max	▲ ▲ ▲	3066	2874	2682	VA	L1 L2 L3
Apparent power system: S and S-max	▲	SYSt.	6.64	8.11	kVA	
Power factors: PF1, PF2, PF3	a)	0.82c	0.97c	0.92c	φ	L1 L2 L3
PF-system, PF-min-inductive-incoming, PF-min-capacitive-incoming	a) ▼ ▼	0.90c	– – – i	0.72c	φ	
PF-system, PF-min-inductive-outgoing, PF-min-capacitive-outgoing	a) – – ▼ ▼	0.90c	– – – i	– – – c	φ	
Frequency: F-max, F-actual, F-min	▲ ▼	50.14	50.03	49.78	Hz	
Active power incoming EP high tariff		4589	2356	inc.H	kWh ≤	
Active power incoming EP low tariff c)		1234	5678	inc.L	kWh ≤	
Active power outgoing EP high tariff		4589	2356	out.H	kWh ≤	
Active power outgoing EP low tariff c)		1234	5678	out.L	kWh ≤	
Reactive power inductive EQ high tariff d)		9876	5432	ind.H	kVarh ≤	
Reactive power inductive EQ low tariff c) d)		1234	9876	ind.L	kVarh ≤	
Reactive power capacitive EQ high tariff d)		76	5432	CAP.H	kVarh ≤	
Reactive power capacitive EQ low tariff c) d)		234	9876	CAP.L	kVarh ≤	
Reactive power incoming EQ high tariff e)		9876	5432	inc.H	kVarh ≤	
Reactive power incoming EQ low tariff c) e)		1234	9876	inc.L	kVarh ≤	
Reactive power outgoing EQ high tariff e)		76	5432	out.H	kVarh ≤	
Reactive power outgoing EQ low tariff c) e)		234	9876	out.L	kVarh ≤	
P-system, Q-system, S-system		5.76	2.19	6.64	kW kVAr kVA	
Average U1-U2-U3, average I1-I2-I3, P-system		230.4	10.92	5.76	VØ AØ kW	
PF-system, P-system, Q-system		0.90c	5.76	2.19	φ kW kVAr	
P-system, S-system, frequency		5.76	6.64	50.03	kW kVA Hz	
P1, Q1, S1		2240	1078	2485	W VAr VA	L1
P2, Q2, S2		2032	393	2070	W VAr VA	L2
P3, Q3, S3		1491	721	2089	W VAr VA	L3
U1, I1, P1		230.2	11.54	2240	V A W	L1
U2, I2, P2		231.1	10.98	2032	V A W	L2
U3, I3, P3		229.9	10.23	1491	V A W	L3

Continuation see next page!

Available measurement data (at connection mode 4-wire asymmetric load)			LED group left (t c b)	Example 7-segm. display top	Example 7-segm. display centre	Example 7-segm. display bottom	LED group right	LED group bottom
THD-U1, THD-U1-max			▲	thd.U	2.5	8.0	%	L1
THD-U2, THD-U2-max			▲	thd.U	2.6	8.3	%	L2
THD-U3, THD-U3-max			▲	thd.U	2.4	3.9	%	L3
THD-I1, THD-I1-max			▲	thd.I	2.4	10.8	%	L1
THD-I2, THD-I2-max			▲	thd.I	2.5	9.5	%	L2
THD-I3, THD-I3-max			▲	thd.I	2.4	4.6	%	L3
Interval active power:	Trend-incoming			P.inc	5.23	trnd	kW ≤	⌐
Interval active power:	Maximum-incoming Minimum-incoming		▲ ▼	P.inc	6.02	1.56	kW ≤	⌐
Interval active power:	last interval (t-0) incoming to fifth last interval (t-4) incoming			P.inc P.inc	3.91 5.52	t–0 to t–4	kW ≤ kW ≤	⌐ ⌐
Interval active power:	Trend-outgoing			P.out	0.00	trnd	kW ≤	⌐
Interval active power:	Maximum-outgoing Minimum-outgoing		▲ ▼	P.out	0.00	0.00	kW ≤	⌐
Interval active power:	last interval (t-0) outgoing to fifth last interval (t-4) outgoing			P.out P.out	0.00 0.00	t–0 to t–4	kW ≤ kW ≤	⌐ ⌐
Interval react. power:	Trend-inductive	d)		Q.ind	0.00	trnd	kVAr ≤	⌐
Interval react. power:	Maximum-inductive Minimum-inductive	d)	▲ ▼	Q.ind	0.00	0.00	kVAr ≤	⌐
Interval react. power:	last interval (t-0) inductive to fifth last interval (t-4) inductive	d)		Q.ind Q.ind	0.00 0.00	t–0 to t–4	kVAr ≤ kVAr ≤	⌐ ⌐
Interval react. power:	Trend-capacitive	d)		Q.cap	2.17	trnd	kVAr ≤	⌐
Interval react. power:	Maximum-cap.,Minimum-cap.	d)	▲ ▼	Q.cap	2.53	0.78	kVAr ≤	⌐
Interval react. power:	last interval (t-0) capacitive to fifth last interval (t-4) capacitive	d)		Q.cap Q.cap	1.41 1.14	t–0 to t–4	kVAr ≤ kVAr ≤	⌐ ⌐
Interval react. power:	Trend-incoming	e)		Q.inc	2.17	trnd	kVAr ≤	⌐
Interval react. power:	Maximum-incoming Minimum-incoming	e)	▲ ▼	Q.inc	2.53	0.78	kVAr ≤	⌐
Interval react. power:	last interval (t-0) incoming to fifth last interval (t-4) incoming	e)		Q.inc Q.inc	1.41 1.14	t–0 to t–4	kVAr ≤ kVAr ≤	⌐ ⌐
Interval react. power:	Trend-outgoing	e)		Q.out	0.00	trnd	kVAr ≤	⌐
Interval react. power:	Maximum-outgoing Minimum-outgoing	e)	▲ ▼	Q.out	0.00	0.00	kVAr ≤	⌐
Interval react. power:	last interval (t-0) outgoing to fifth last interval (t-4) outgoing	e)		Q.out Q.out	0.00 0.00	t–0 to t–4	kVAr ≤ kVAr ≤	⌐ ⌐
Interval appar. power:	Trend			S	5.23	trnd	kVA ≤	⌐
Interval appar. power:	Maximum, Minimum		▲ ▼	S	6.02	1.56	kVA ≤	⌐
Interval appar. power:	last interval (t-0) to fifth last interval (t-4)			S S	3.91 5.52	t–0 to t–4	kVA ≤ kVA ≤	⌐ ⌐
2nd harmonic U1:	H2-U1,	H2-U1-max	▲	H2.U	0.1	1.2	%	L1
15th harmonic U1:	to H15-U1,	H15-U1-max	▲	to H15.U	0.5	1.8	%	L1
2nd harmonic U2:	H2-U2,	H2-U2-max	▲	H2.U	0.1	0.4	%	L2
15th harmonic U2:	to H15-U2,	H15-U2-max	▲	to H15.U	0.7	2.0	%	L2
2nd harmonic U3:	H2-U3,	H2-U3-max	▲	H2.U	0.2	1.5	%	L2
15th harmonic U3:	to H15-U3,	H15-U3-max	▲	to H15.U	1.5	2.8	%	L2

Continuation see next page!

Available measurement data (at connection mode 4-wire asymmetric load)			LED group left (t c b)	Example 7-segm. display top	Example 7-segm. display centre	Example 7-segm. display bottom	LED group right	LED group bottom
2nd harmonic I1:	H2-I1,	H2-I1-max	▲	H2.I	0.4	2.2	%	L1
to				to				
15th harmonic I1:	H15-I1,	H15-I1-max	▲	H15.I	0.9	4.8	%	L1
2nd harmonic I2:	H2-I2,	H2-I2-max	▲	H2.I	0.3	1.8	%	L2
to				to				
15th harmonic I2:	H15-I2,	H15-I2-max	▲	H15.I	0.8	5.2	%	L2
2nd harmonic I3:	H2-I3,	H2-I3-max	▲	H2.I	0.5	3.2	%	L2
to				to				
15th harmonic I3:	H15-I3,	H15-I3-max	▲	H15.I	1.1	5.8	%	L2

a) incoming: no sign Outgoing: sign –

b) incoming inductive, outgoing capacitive: no sign
incoming capacitive, outgoing inductive: sign –

c) Tariff switching via digital input or controlled via the bus only (optional extension module required)

d) only active if the Q definition is set to "ind/cap" (display configuration **7** : Q.tot)

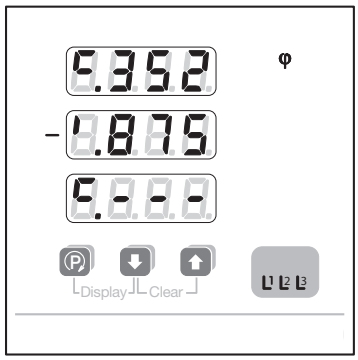
e) only active if the Q definition is set to "inc/out" (display configuration **7** : Q.tot)

Determination of measured quantities

The calculation of the measurements is made in accordance with DIN 40 110, with the exception of the reactive power. This is calculated by the Encore ES230/ES230s as a signed value. Transducers and displays can possibly display different values for the reactive power in the same power system. The reason is the different calculation methods.

Trend values display the predicted value for the current interval.

Example: Power factor 4 quadrant display



PF-L1, PF-L2, PF-L3 actual
(Matrix table 4-wire asymmetric load: field a-6)

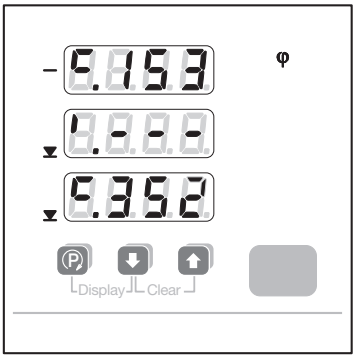
Actual power factors per phase:

top: PF L1 = incoming / capacitive / 0.352

centre: PF L2 = outgoing / inductive / 0.875

bottom: PF L3 = cannot be measured

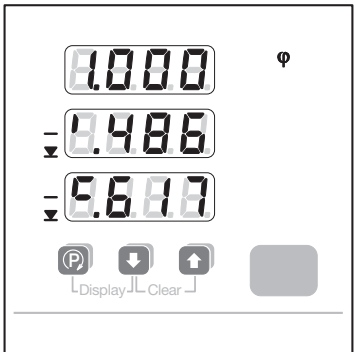
(---: apparent power < 1% of nominal input power
→ PF cannot be measured



PF-system-actual and PF-min-incoming
(Matrix table 4-wire asymmetric load: field b-6)

top: PF system actual = outgoing / capacitive / 0.153
(---: apparent power < 1% of nominal input power
→ PF cannot be measured

centre: PF minimum incoming inductive = no measuring value
bottom: PF minimum incoming capacitive = 0.352
(minimum: lowest value of PF1, PF2 or PF3)
(---: no measured value in the quadrants concerned)



PF-system-actual and PF-min-outgoing
(Matrix table 4-wire asymmetric load: field c-6)

top: PF system actual = incoming / ––– / 1.000
(---: apparent power < 1% of nominal input power
→ PF cannot be measured

centre: PF minimum outgoing inductive = 0.486
bottom: PF minimum outgoing capacitive = 0.617
(Minimum: lowest value of PF1, PF2 or PF3)
(---: no measured value in the quadrants concerned)

Display modes

All the display values in accordance with the matrix tables can be displayed (factory setting).

Only the pre-configured display values are displayed. The factory pre-configured values are shown in the matrix tables with a gray-background.

Automatically changing display. The display time, and the values to be displayed are pre-configurable.

The factory pre-configured values are shown in the matrix tables with a bold outline. The factory setting for the display time is 4 seconds.

Preferred display

You may select a preferred display which is displayed automatically after a certain time without user interaction. So the normal appearance of the device is always the same. There are two different possibilities to define a preferred display.

Preferred display in Loop mode

In Loop mode a display can be set which should be displayed normally all the time. In addition, any other value can be selected as for the full mode. After the reset time period (2 - 32 s), the display automatically returns to the preferred display.

Configuration

The Loop mode is blocked with the mode lock 17. The reset time is configured with the display interval configuration 18. Set the required window to "on" in the display configuration under No. 20 (Menu Disp). Set all the other display elements to "off".

Preferred display in User-Modus

Only the User mode is active. Out of the displayable displays a preferred display can be selected, which is automatically displayed after a predefined time without user interaction. All other display contents may be directly displayed using the keys. The delay until the preferred display is shown is 4 min. for version 4.00 resp. 10 min. starting from version 4.01 of the basic device.

Configuration

The User mode is blocked with the mode lock 17. Use the keys to show the display which should serve as the preferred display and set it as the prefereed display by pressing the keys (P) and ↑ at the same time. The same procedure may be used to switch-off the preferred display. The displays which should be displayable in the User mode may be set to "on" in the menu Menu Disp under No. 21. All other elements hould be set to "off".

Duration of the display

It may be difficult to read the measured values when they change quickly. Therefore the write interval can be increased in the menu "Display settings".

Operation

Changing the display mode

By simultaneously pressing the buttons (P) and ↓ (display) for a longer time, the display mode changes and then remains in the last mode displayed when the buttons are released (factory setting: FULL). If the mode cannot be changed, the mode lock is switched on.

Locking — In the display configuration menu (Menu Disp), changing the display modes can be blocked with the mode lock 16 .

Navigation

X axis (a, b, c, ...) — For each pressing of the (P) button, the displayed value changes in accordance with the preconfiguration and matrix table one window towards the right and loops back to the beginning.

Y axis (1, 2, 3, ...) — For each pressing of the ↑ or ↓ buttons, the displayed value changes in accordance with the preconfiguration and matrix table one window upwards as far as the top window or respectively one window downwards as far as the bottom window.

Brightness (13 levels)

brighter — Press the key ↑ for a longer time.

darker — Press the key ↓ for a longer time.

Deletion of the max./min. values and meters

Simultaneous longer pressing of the ↑ and ↓ buttons (clear) deletes the max. respectively min. values of the measured value displayed and the associated values. The energy meters are reset in the same way.

Locking — The reset function for the energy meters can be locked by setting the jumper at the rear of the instrument to the position LOCK.

Display window

▲ = Maximum, ▼ = Minimum

Matrix table 4L, asymmetric load

Q measured values are in italics: depending on the Q definition **7**, either the values for incoming/outgoing or the values for inductive/capacitive are displayed.

	a	b	c	d	e	f	g	h
1	U1 U2 U3	U1▲ U2▲ U3▲	U1▼ U2▼ U3▼	U12 U23 U31	U12▲ U23▲ U31▲	U12▼ U23▼ U31▼	UNE UNE▲	unb. U unb. U▲
2	I1 I2 I3	I1▲ I2▲ I3▲	I1avg I2avg I3avg	I1avg▲ I2avg▲ I3avg▲	IN IN▲			
3	P1 P2 P3	P1▲ P2▲ P3▲	 P P▲					
4	Q1 Q2 Q3	Q1▲ Q2▲ Q3▲	 Q Q▲					
5	S1 S2 S3	S1▲ S2▲ S3▲	 S S▲					
6	PF1 PF2 PF3	PF PF▼-inc-ind PF▼-inc-cap	PF PF▼-out-ind PF▼-out-cap					
7	F▲ F F▼							
8	..... EP_inc HT	..... EP_inc LT	..... EP_out HT	..... EP_out LT				
9	..... EQ inc/ind HT	..... EQ inc/ind LT	..... EQ out/cap HT	..... EQ out/cap LT				
10	P Q S	U Ø I Ø P	PF P Q	P S F				
11	P1 Q1 S1	P2 Q2 S2	P3 Q3 S2	U1 I1 P1	U2 I2 P2	U3 I3 P3		
12	thd.U1 thd.U1▲	thd.U2 thd.U2▲	thd.U3 thd.U3▲					
13	thd.I1 thd.I1▲	thd.I2 thd.I2▲	thd.I3 thd.I3▲					
14	P.inc-int-Trend	P.inc-int-▲ P.inc-int-▼	P.inc-int t-0	P.inc-int t-1	P.inc-int t-2	P.inc-int t-3	P.inc-int t-4	
15	P.out-int-Trend	P.out-int-▲ P.out-int-▼	P.out-int t-0	P.out-int t-1	P.out-int t-2	P.out-int t-3	P.out-int t-4	
16	Q.inc/ind-int-Trend	Q.inc/ind-int-▲ Q.inc/ind-int-▼	Q.inc/ind-int t-0	Q.inc/ind-int t-1	Q.inc/ind-int t-2	Q.inc/ind-int t-3	Q.inc/ind-int t-4	
17	Q.out/cap-int-Trend	Q.out/cap-int-▲ Q.out/cap-int-▼	Q.out/cap-int t-0	Q.out/cap-int t-1	Q.out/cap-int t-2	Q.out/cap-int t-3	Q.out/cap-int t-4	
18	S.int-Trend	S.int-▲ S.int-▼	S.int t-0	S.int t-1	S.int t-2	S.int t-3	S.int t-4	

Matrix table 3L, asymmetric load

▲ = Maximum, ▼ = Minimum

Q measured values are in italics: depending on the Q definition **7**, either the values for incoming/outgoing or the values for inductive/capacitive are displayed.

	a	b	c	d	e	f	g
1	U12 U23 U31	U12 ▲ U23 ▲ U31 ▲	U12 ▼ U23 ▼ U31 ▼				
2	I1 I2 I3	I1 ▲ I2 ▲ I3 ▲	I1avg I2avg I3avg	I1avg ▲ I2avg ▲ I3avg ▲			
3	P P ▲						
4	Q Q ▲						
5	S S ▲						
6	PF PF ▼ -inc-ind PF ▼ -inc-cap	PF PF ▼ -out-ind PF ▼ -out-cap					
7	F ▲ F F ▼						
8	..... EP_inc HT	..... EP_inc LT	..... EP_out HT	..... EP_out LT			
9	..... EQ inc/ind HT	..... EQ inc/ind LT	..... EQ out/cap HT	..... EQ out/cap LT			
10	P Q S	U Ø I Ø P	PF P Q	P S F			
11	thd.U12 thd.U12 ▲	thd.U23 thd.U23 ▲	thd.U31 thd.U31 ▲				
12	thd.I1 thd.I1 ▲	thd.I2 thd.I2 ▲	thd.I3 thd.I3 ▲				
13	P.inc-int-Trend	P.inc-int- ▲ P.inc-int- ▼	P.inc-int t-0	P.inc-int t-1	P.inc-int t-2	P.inc-int t-3	P.inc-int t-4
14	P.out-int-Trend	P.out-int- ▲ P.out-int- ▼	P.out-int t-0	P.out-int t-1	P.out-int t-2	P.out-int t-3	P.out-int t-4
15	Q.inc/ind-int-Trend	Q.inc/ind-int- ▲ Q.inc/ind-int- ▼	Q.inc/ind-int t-0	Q.inc/ind-int t-1	Q.inc/ind-int t-2	Q.inc/ind-int t-3	Q.inc/ind-int t-4
16	Q.out/cap-int-Trend	Q.out/cap-int- ▲ Q.out/cap-int- ▼	Q.out/cap-int t-0	Q.out/cap-int t-1	Q.out/cap-int t-2	Q.out/cap-int t-3	Q.out/cap-int t-4
17	S.int-Trend	S.int- ▲ S.int- ▼	S.int t-0	S.int t-1	S.int t-2	S.int t-3	S.int t-4

Matrix table single phase, 3L and 4L symmetric load

▲ = Maximum, ▼ = Minimum

Q measured values are in italics: depending on the Q definition **7**, either the values for incoming/outgoing or the values for inductive/capacitive are displayed.

	a	b	c	d	e	f	g
1	U ▲ U U ▼						
2	I I ▲	Iavg Iavg ▲					
3	P P ▲						
4	Q Q ▲						
5	S S ▲						
6	PF PF ▼ -inc-ind PF ▼ -inc-cap	PF PF ▼ -out-ind PF ▼ -out-cap					
7	F ▲ F F ▼						
8	..... EP_inc HT	..... EP_inc LT	..... EP_out HT	..... EP_out LT			
9	..... EQ inc/ind HT	..... EQ inc/ind LT	..... EQ out/cap HT	..... EQ out/cap LT			
10	P Q S	U I P	PF P Q	P S F			
11	thd.U thd.U ▲						
12	thd.I thd.I ▲						
13	P.inc-int-Trend	P.inc-int- ▲ P.inc-int- ▼	P.inc-int t-0	P.inc-int t-1	P.inc-int t-2	P.inc-int t-3	P.inc-int t-4
14	P.out-int-Trend	P.out-int- ▲ P.out-int- ▼	P.out-int t-0	P.out-int t-1	P.out-int t-2	P.out-int t-3	P.out-int t-4
15	Q.inc/ind-int-Trend	Q.inc/ind-int- ▲ Q.inc/ind-int- ▼	Q.inc/ind-int t-0	Q.inc/ind-int t-1	Q.inc/ind-int t-2	Q.inc/ind-int t-3	Q.inc/ind-int t-4
16	Q.out/cap-int-Trend	Q.out/cap-int- ▲ Q.out/cap-int- ▼	Q.out/cap-int t-0	Q.out/cap-int t-1	Q.out/cap-int t-2	Q.out/cap-int t-3	Q.out/cap-int t-4
17	S.int-Trend	S.int- ▲ S.int- ▼	S.int t-0	S.int t-1	S.int t-2	S.int t-3	S.int t-4

	a	b	c	d	e	f	g	h	i	j	k	l	m	n
18	H2.U H2▲.U	H3.U H3▲.U	H4.U H4▲.U	H5.U H5▲.U	H6.U H6▲.U	H7.U H7▲.U	H8.U H8▲.U	H9.U H9▲.U	H10.U H10▲.U	H11.U H11▲.U	H12.U H12▲.U	H13.U H13▲.U	H14.U H14▲.U	H15.U H15▲.U
19	H2.I H2▲.I	H3.I H3▲.I	H4.I H4▲.I	H5.I H5▲.I	H6.I H6▲.I	H7.I H7▲.I	H8.I H8▲.I	H9.I H9▲.I	H10.I H10▲.I	H11.I H11▲.I	H12.I H12▲.I	H13.I H13▲.I	H14.I H14▲.I	H15.I H15▲.I

Programming (Programming diagram on page 18)

All parameter may be displayed at any time. For modifications the jumper on the backside of the device must be removed (not on position LOCK).

(1) Change from the display level to the menu level by pressing the Ⓟ button for a longer time.

(2) Select the required menu item by pressing the Ⓟ button for a shorter time.

(3) Use ▼ to enter the level where the desired parameter is displayed.

(4) Pressing Ⓟ shortly will force the selectable element to flash.

(5) The flashing content may be modified using the keys ▼ or ▲.

(6) To acknowledge, shortly press the Ⓟ button.

(7) If the next 7-segment display, the decimal point, or a unit flashes: continue at (5).

(8) If additional parameters are to be modified at the same menu item, change to the required parameter with the ▼ or ▲ buttons and continue at (4).

(9) If modifications are to be made in other menu columns, return to the menu level with the ▲ button, and continue at (2).

(10) Return to the display level by pressing the Ⓟ button for a longer time.

The navigation steps for the selection of display elements under "Menu Disp" differ from the above description between points (4) and (8) (see configuration diagram Nos. 20 and 22).

Hints

All settings will remain non-volatile stored even in case of power-fail.

First you have to set the system configuration, the transformer ratios and the Q definition because further measurand selections, alarm limit settings etc. will depend on them.

As an alternative to the configuration of the various options with the display buttons, they can be configured comfortably with the A200plus software (with the extension module EMMOD 201 and EMMOD 203). The data can be stored on the PC and used later.

Locking the configuration

Place the jumper in the LOCK position.

The configuration of all parameters is disabled.

Factory Default

Jumper:	not in the LOCK position
Connecting mode:	4-wire asymmetric load
Transformer ratio:	1:1
Q definition:	inductive / capacitive
Limit value / S01:	Off
Limit value / S02:	Off
Synchronizing interval:	15 min.
Display mode:	FULL, duration of the display 0.0 s
Brightness:	middle value

Overview of the parameters

The following table gives all the parameters together with their adjustable ranges or the possible selections. The numbers with a black background (xx) give a reference to the corresponding positions in the navigation diagram on page 18.

No.	Topmost display	Undermost display	Meaning	Hints
1	SYSTEM TYPE		System configuration	
		4L n.b	4-line system, unbalanced load, Open-Y	(4 lines unbalanced, Open-Y)
		4L n	4-line system, unbalanced load	(4 lines unbalanced)
		3L n.A	3-line system, unbalanced load, Aron	(3 lines unbalanced, Aron)
		3L n	3-line system, unbalanced load	(3 lines unbalanced
		4L b	4-line system, balanced load	(4 lines balanced)
		3L b	3-line system, balanced load	(3 lines balanced)
		1L	Single-line system	(1 line)
2	cos PHI	MAth	Load type for energy recovery: Mathematical	4 quadrant display, ind-cap-ind-cap
		ELEC	Load type for energy recovery: Electrical	4 quadrant display, ind-ind-cap-cap
3	VOLT PRIM	5.000 V 100 V to 999 kV	Primary voltage of an external transformer on the voltage input (line-to-line voltage)	First you enter any 3-digit number followed by the appropriate power unit selection in steps of factor 10.
4	VOLT SEC	5.000 V 100 V to 999 V	Secondary voltage of an external transformer on the voltage input (line-to-line voltage)	
5	CURR PRIM	5.000 A 1.00 A to 999 kA	Primary current of an external transformer on the current input	
6	CURR SEC	5.000 A	Secondary current of an external transformer on the current input	

No.	Topmost display	Undermost display	Meaning	Hints
7			Q definition for meters, pulse outputs and power average values	(Q-totalizers)
			Q-incoming Q-outgoing	(incoming) (outgoing)
			Q-inductive Q-capacitive	(inductive) (capacitive)
8			Operating mode of both digital outputs “out.1” and “out.2”	(Mode)
			Output switched-off	Simulation via interface module is still possible
			Energy pulse output	The output generates energy pulses depending on the rate set under 14 . The meter measurands to output may be selected under 13 .
			Alarm output	If the alarm limit 10 is exceeded the output will be active (current flows). If the measurand is below limit 11 the output will be passive. The source of the monitored is selected under 9 .

No.	Topmost display	Undermost display	Meaning	Hints		
9			Alarm supervision source	This selection is presented only if operating mode 8 is set to ALM previously.		
				Line type		
				'1L' '3Lb' '4Lb'	'3Lu' '3Lu.A'	'4Lu' '4Lu.0'
		 resp.	Q interval (Reactive power interval) (cap./outg. to Q-definition 7) Trend	●	●	●
			P interval (Active power interval) outgoing (Outgoing) Trend	●	●	●
			S interval (Apparent power interval) Trend	●	●	●
		 resp.	Q interval (Reactive power interval) (ind./inc. to Q-definition 7) Trend	●	●	●
			P interval (Active power interval) incoming (Incoming) Trend	●	●	●
		 resp.	Q interval (Reactive power interval) (cap./outg. to Q-definition 7)	●	●	●
			P interval (Active power interval) outgoing (Outgoing)	●	●	●
			unbalance U (Voltage asymmetry factor)			●
			U neutral-earth voltage (Neutral point shift)			●
			THD current	●		
			THD voltage	●		
			Frequency	●	●	●

No.	Topmost display	Undermost display	Meaning	Hints		
9	A.SrC		Alarm supervision source (continuation)	Line type		
				'1L' '3Lb' '4Lb'	'3Lu' '3Lu.A'	'4Lu' '4Lu.0'
		In	I neutral (Neutral current)			●
		S.Int	S interval (Apparent power interval)	●	●	●
		Q.Int ind. inc.	Q interval (Reactive power interval) resp. (ind./inc. to Q-definition 7)	●	●	●
		P.Int inc.	P interval (Active power interval) incoming (incoming)	●	●	●
		PF	Power factor (cos-phi)	●	●	
		S	Apparent power	●	●	
		Q	Reactive power	●	●	
		P	Active power	●	●	
		U	Voltage	●		
		U.L-n	U Line-Neutral (Phase voltage)			
		U.L-L	U Line-Line (Line to line voltage)			
		I.Avg	I Average (Phase current bimetal)	●		
		I	Phase current	●		
				: 'A.on' = OR-operation of line-measurands 'A.off' = AND-operation of line-measurands		
10	out.1 /.2 A.on	0.0 V	Alarm unit for ON-state	The maximum values of the alarm limits depend on the possible measuring range (fixed by hardware), converted into possible primary values given by the selected system configuration and transformation ratios..		
11	out.1 /.2 A.oFF	0.0 V	Alarm unit for OFF-state			
12	out.1 /.2 A.dEL	0.0	Switch-in and Dropout delay of the alarm	Range: 0.3 … 999.9 s		

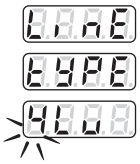
Examples

Example 1: Programming the system configuration (3-line, unbalanced load)

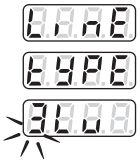
1. Press (P) > 2 s

2. Press ↓ (present setting is displayed)

3. Press (P) (alterable parameter flashes)



4. Press ↓ / ↑ to select desired setting



5. Press (P) (takes over new setting).
Display stops flashing

6. Press (P) > 2 s to return to display level

Example 2: Programming voltage transformer ratio and synchronization interval

1. Press (P) > 2 s

2. Press (P) (transformer ratio menu)

3. Press ↓ (present setting of primary voltage)

4. Press (P) (leftmost digit flashes)

5. Press ↓ / ↑ until desired number appears

6. Press (P) (middle digit flashes)

7. Press ↓ / ↑ until desired number appears

8. Press (P) (rightmost digit flashes)

9. Press ↓ / ↑ until desired number appears

10. Press (P) (decimal point flashes)

11. Press ↓ / ↑ until the decimal point is on the desired position and the kilo/Mega display is correct

12. Press (P) (takes over new value).
The display stops flashing

13. Press ↓ (present setting of secondary voltage)

14. Programming procedure same as for primary voltage (1 to 12)

15. Press ▲ until the topmost display


as shown

16. Press P four times


17. Press ▼ (present setting of synchronization interval in minutes)


18. Press P (left digit flashes)

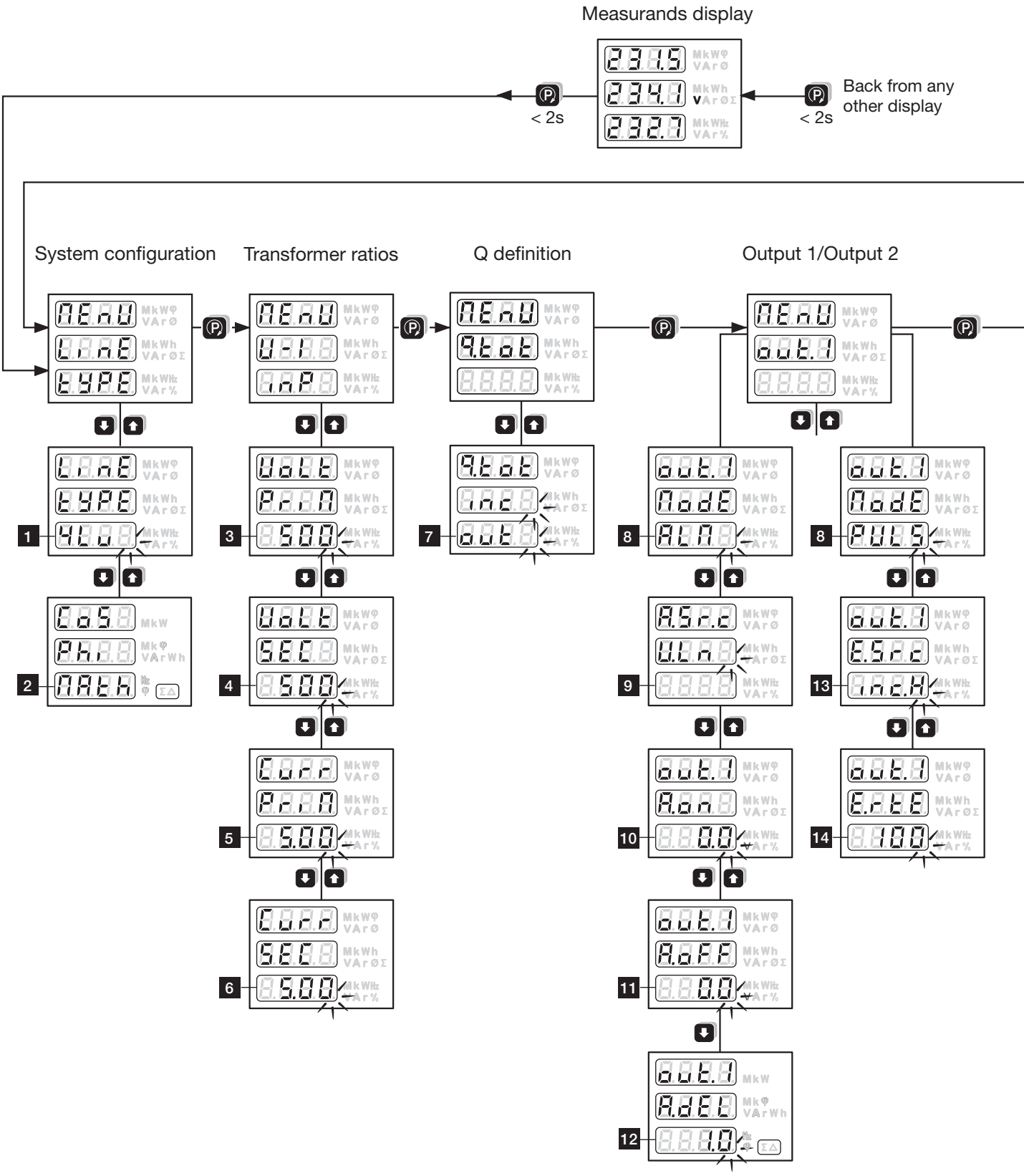

19. Press ▼ / ▲ until desired number appears

20. Press P (right digit flashes)

21. Press ▼ / ▲ until desired number appears

22. Press P (takes over new value).
The display stops flashing

23. Press P > 2 s (return to display level)

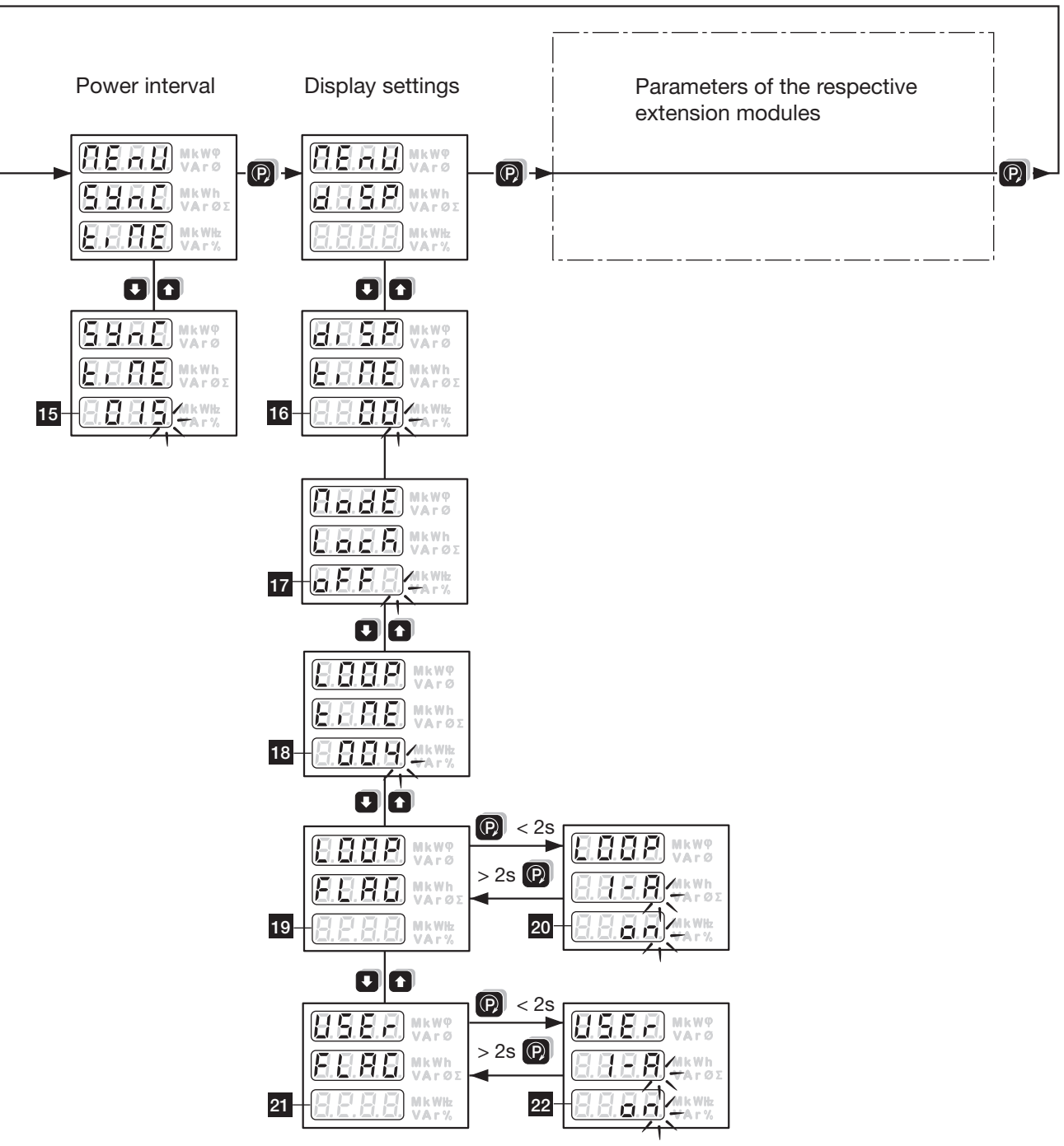


configurable element

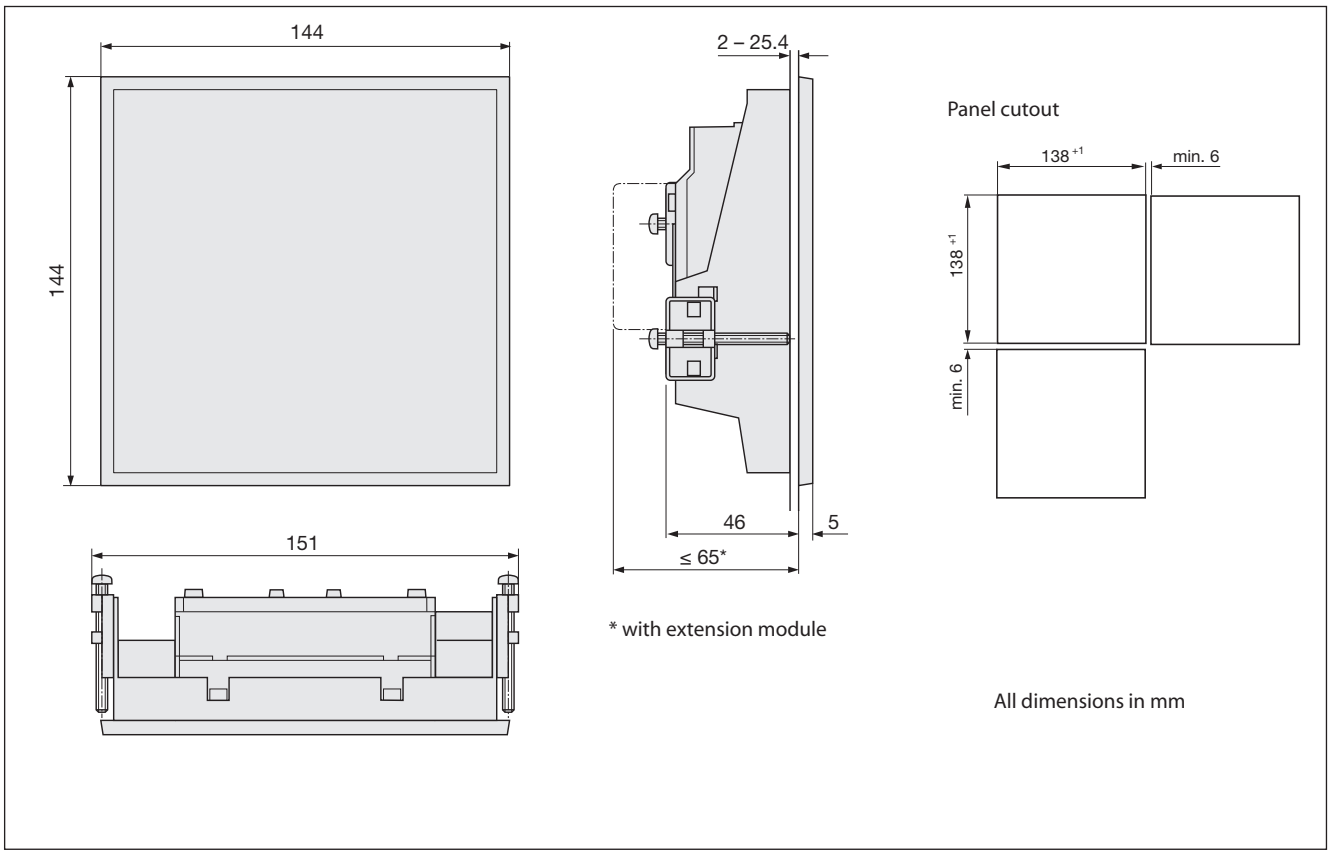
Display level

Menu level

Parameter level



Dimensional drawing Encore ES230



Dimensional drawing Encore ES230s