



Summation Device

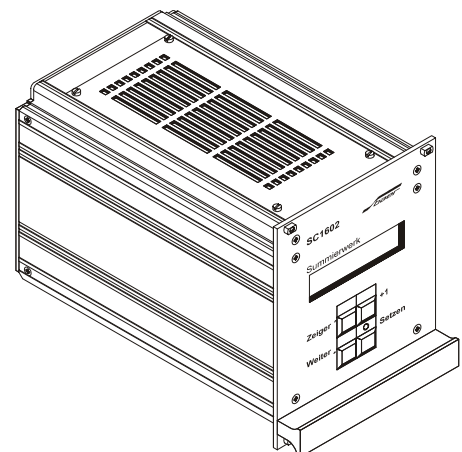
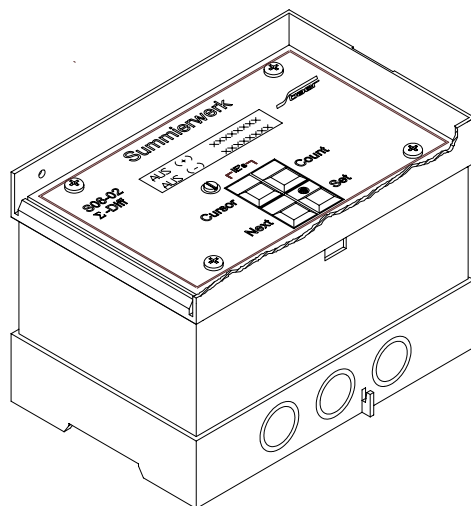
S06-02

SC 2059

SC 1602

User Manual

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1 Brief description

The summation device SC 1602, S06-02 or SC 2059 has 6 (16: SC 1602) pulse inputs and 2 summation outputs. The input and output valences and counter values, and the assignment of positive / negative sums or sum differences can be set, through the menu, by means of 4 keys.

The parameters and counter values may be retrieved by means of a 2 × 16-character LCD.

The standard display shows the actually sum registers (e.g. kWh): AUS (+) positive sum, AUS (-) negative sum.

By hitting the keys "COUNT" and "CUR-SOR" at the same time, the control counter value for every entry will be displayed (you can see the energy register for all inputs).

In the case of frequent changes of the direction of energy flow (e.g. between export and import), the hysteresis / slack (Leerweg) can be used to activate the function "Differential total calculation" (for energy registers and pulse outputs). Here pulses will only be added to the positive or negative energy registers once they have exceeded a minimum amount of energy after a change of energy flow direction. The function of the hysteresis is one of an intermediate storage register. Each pulse in positive direction will increase the value of that register, whereas each pulse in negative direction will decrease its value. Pulses only appear at the output of the hysteresis register once its programmable maximum content is exceeded in either direction. An integrated energy direction pointer ensures correct output to either "positive" or "negative" target registers. The purpose of the hysteresis register is to prevent unnecessary totaling of pulses in the "positive" and "negative" registers, when the flow of energy in both directions is almost in balance. A meaningful guideline for the content of the hysteresis is double the sum of the absolute value of all weighted inputs of the related total register.

If you set the hysteresis to 0 (zero) the summation device calculate two different sums.

Note: IE: pulse input
 IA: pulse output
 Register: LCD-Disply
 Leerweg: hysteresis

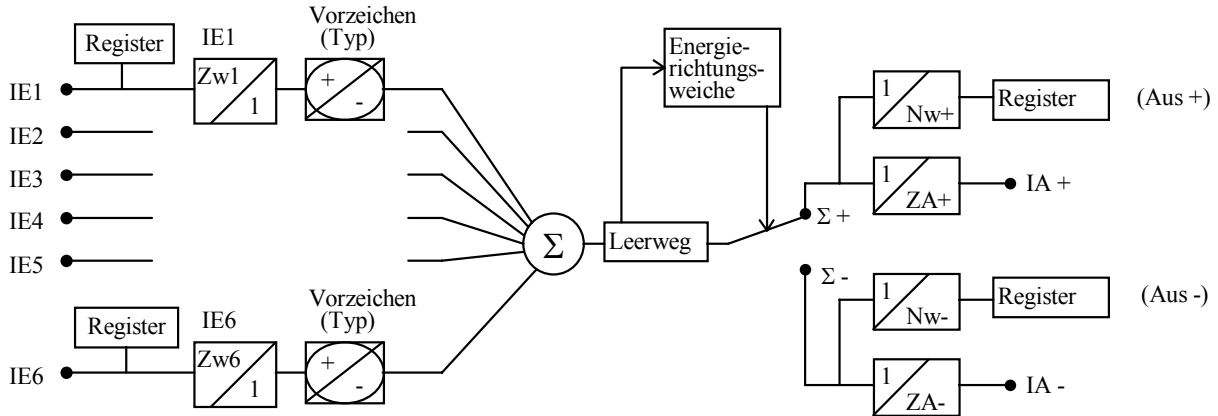


Figure 1, Block diagram 1: one sum for differential total calculation

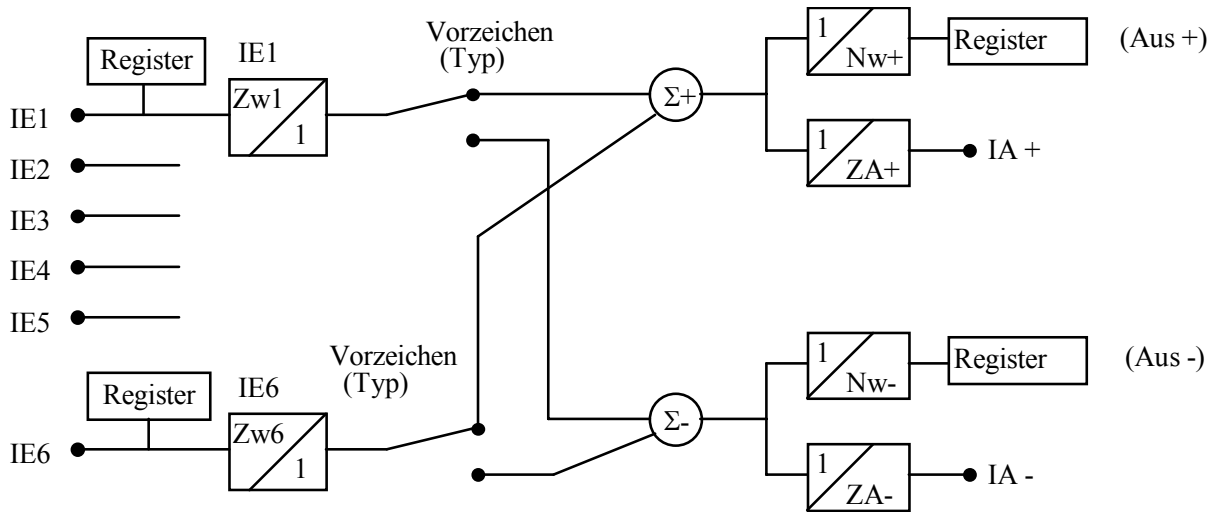


Figure 2, Block diagram 2: two different sums (Leerweg/Hyseteresis=0)

Note: Denominators Nw+, Nw-, ZA+ and ZA- must be different from 0 (zero)!

2 Housing S06-02

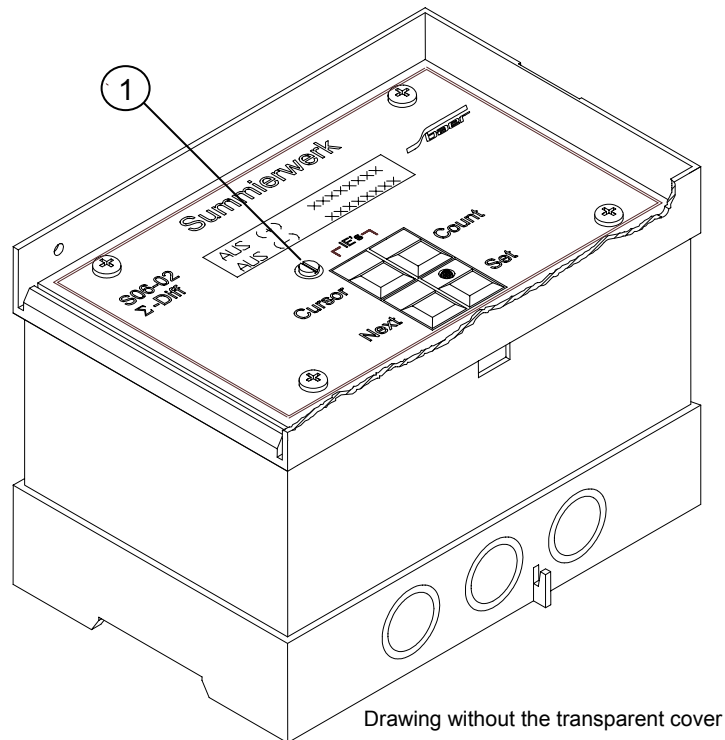


Figure3, Housing S06-02

2.1 Preparation S06-02

Remove the device socket by loosening the screw ①.

Wire the device socket, in current less state, following the connection scheme.

Then put the S06-02 on the device socket and tighten the screw ①.

2.2 Features S06-02

After power on you see the version number and following the standard display (LCD):

A U S (+)	X X X X
A U S (-)	X X X X

In case of power fail all parameters will be saved in NOVRAM.

3 Housing SC 2059 / SC 1602

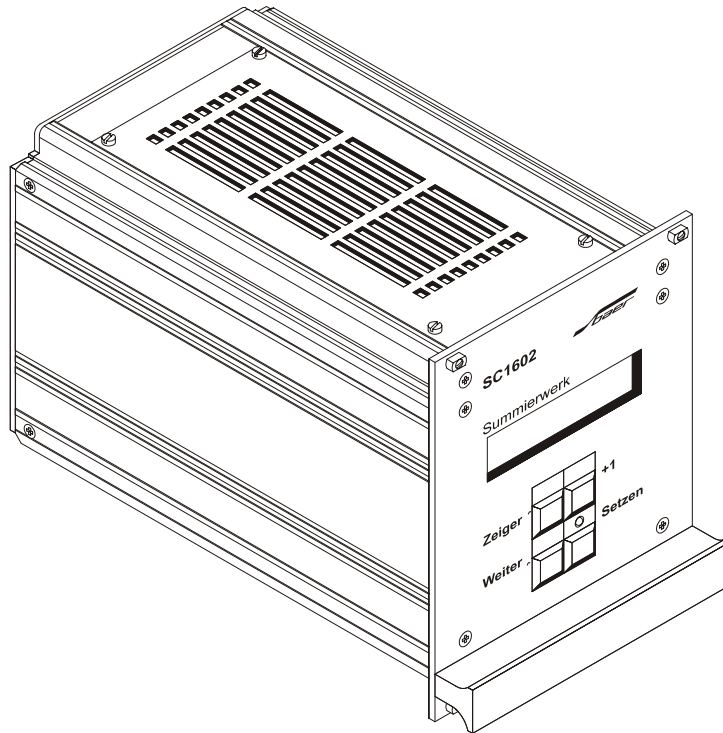


Figure 4, Housing SC 2059 / SC 1602

3.1 Preparation SC 2059 / SC 1602

Make the electrical connections as shown in the enclosed terminal connection diagram. Now switch on the power supply. Parameterize the device.

Note! The casing of SC 2059 / SC1602 should become protective earth (PE).

3.2 Features SC 2059 / SC 1602

After power on you see the version number and following the standard display (LCD):

A U S (+)	X X X X
A U S (-)	X X X X

AUS(+): positive sum

AUS(-): negative sum

In case of power fail all parameters will be saved in NOVRAM.

4 Calculation formula

In order to calculate the pulse translations, use the following formulas:

Zwx	=	Numerator value
Kw	=	Counter constant
Nw	=	Common denominator
Rx	=	Pulse valence of the counter

4.1 Pulse inputs:

$$\frac{\text{Numerator 1}}{\text{Denominator}} = \frac{Zw 1}{Nw} = \frac{1}{R1 \times Kw1} \Rightarrow Zw1 = \dots$$

$$\frac{\text{Numerator 2}}{\text{Denominator}} = \frac{Zw 2}{Nw} = \frac{1}{R2 \times Kw2} \Rightarrow Zw2 = \dots$$

$$\frac{\text{Numerator 3}}{\text{Denominator}} = \frac{Zw 3}{Nw} = \frac{1}{R3 \times Kw3} \Rightarrow Zw3 = \dots$$

$$\frac{\text{Numerator 4}}{\text{Denominator}} = \frac{Zw 4}{Nw} = \frac{1}{R4 \times Kw4} \Rightarrow Zw4 = \dots$$

$$\frac{\text{Numerator 5}}{\text{Denominator}} = \frac{Zw 5}{Nw} = \frac{1}{R5 \times Kw5} \Rightarrow Zw5 = \dots$$

$$\frac{\text{Numerator 6}}{\text{Denominator}} = \frac{Zw 6}{Nw} = \frac{1}{R6 \times Kw6} \Rightarrow Zw6 = \dots$$

...

$$\frac{\text{Numerator 16}}{\text{Denominator}} = \frac{Zw 16}{Nw} = \frac{1}{R16 \times Kw16} \Rightarrow Zw16 = \dots \text{ (SC 1602 only)}$$

Requirement: all denominators must be identically!

Common denominator Nw =

4.2 Pulse outputs:

Pulse constant Ra = ... Pulses per work unit (e.g. Pulses/kWh)

Value (Output positive):

$$(ZA +) = \frac{Nw +}{(RA+) \times (Kw A +)} \Rightarrow (ZA +) = \dots$$

Value (Output negative):

$$(ZA -) = \frac{Nw -}{(RA-) \times (Kw A -)} \Rightarrow (ZA -) = \dots$$

Calculation for sum difference (positive and negative sum):

The calculation of each pulse input takes place in the way showed above. Every input counter must get the corresponding type (+, - or 0).

$$\text{Hysteresis} = 2(Zw1 + Zw2 + Zw3 + Zw4 + Zw5 + Zw6 + \dots + Zw16) \Rightarrow \text{Hysteresis (LEERWEG)} = \dots$$

For two different sums \Rightarrow Hysteresis (LEERWEG) = 0

Sum + (pos.) corresponds Sum 1

Sum - (neg.) corresponds Sum 2

4.3 Example

4.3.1. Example 1:

Two pulse inputs (Input1 and Input2) and one pulse output:

Output1 (positive output) = Input1 + Input2

⇒ Input1: Type+

Input2: Type+

R1 = 96 Pulses/kWh

R2 = 48 Pulses/kWh

Kw1 = Kw2 = 1

1) Pulse input:

$$\frac{Zw1}{Nw} = \frac{1}{R1 \times Kw1} = \frac{1}{96 \times 1} = \frac{1}{96} \Rightarrow Zw1 = 1(\text{Type } +)$$

$$\frac{Zw2}{Nw} = \frac{1}{R2 \times Kw2} = \frac{1}{48 \times 1} = \frac{1}{48} = \frac{2}{96} \Rightarrow Zw2 = 2(\text{Type } +)$$

Common denominator Nw = 96

2) Pulse output:

Pulse constant output positive: (Ra +) = 48 Pulses/kWh

$$(ZA+) = \frac{(Nw+)}{(RA+) \times KwA+} = \frac{96}{48 \times 1} = 2 \Rightarrow (ZA+) = 2$$

If the terms of the sum are only positive, the numerator for negative output must be set,

for example: (ZA-) = (ZA+)

Because positive sum only:

⇒ Hysteresis (LEERWEG) = 0

4.3.2. Example 2:

Inputs 1, 2, 3 and 4 will be calculated corresponding to the formula given above. They must be all positive. Inputs 5 and 6 can also be summed up together, but only in the negative domain.

Two pulse outputs for sum (+) and sum (-):

$$R1 = 5 \text{ Pulses/kWh}$$

$$R2 = 10 \text{ Pulses/kWh}$$

$$R3 = 2 \text{ Pulses/kWh}$$

$$R4 = 10 \text{ Pulses/kWh}$$

$$R5 = 5 \text{ Pulses/kWh}$$

$$R6 = 10 \text{ Pulses/kWh}$$

$$Kw1 = Kw2 = Kw3 = Kw4 = Kw5 = Kw6 = 1$$

$$\frac{Zw1}{Nw} = \frac{1}{5} = \frac{2}{10} \Rightarrow Zw1 = 2 \text{ Type +}$$

$$\frac{Zw2}{Nw} = \frac{1}{10} \Rightarrow Zw2 = 1 \text{ Type +}$$

$$\frac{Zw3}{Nw} = \frac{1}{2} = \frac{5}{10} \Rightarrow Zw3 = 1 \text{ Type +}$$

$$\frac{Zw4}{Nw} = \frac{1}{10} \Rightarrow Zw4 = 1 \text{ Type +}$$

$$\frac{Zw5}{Nw} = \frac{1}{5} = \frac{2}{10} \Rightarrow Zw5 = 2 \text{ Type -}$$

$$\frac{Zw6}{Nw} = \frac{1}{10} \Rightarrow Zw6 = 1 \text{ Type -}$$

Common denominator: $Nw = 10$

$$(Nw+) = (Nw-) = 10$$

Note: Set for every input type + or -.

Pulse constant output positive and negative:

$$(RA+) = (RA-) = 0,1 \text{ Pulses/kWh}$$

Output positive

$$ZA + = \frac{(Nw +)}{(RA -) \times (Kw +)} = \frac{10}{0,1 \times 1} = 100 \Rightarrow (ZA +) = 100$$

Output negative

$$ZA - = \frac{(Nw +)}{(RA -) \times (Kw +)} = \frac{10}{0,1 \times 1} = 100 \Rightarrow (ZA -) = 100$$

Note: Both outputs must have the same valve.

$$\text{Hysteresis} = 2 \times (2+1+5+1+2+1) = 24 \Rightarrow \text{Hysteresis (LEERWEG)} = 24$$

4.3.3. Example 3:

Pulses from two meters will be added.

Pulse output: $R_a = 80$ Pulses/kWh

Unit for display value: kWh

Meter 1: $R_1 = 300$ Pulses/kWh

Meter 2: $R_2 = 400$ Pulses/kWh

Pulse output: $R_A = 80$ Pulses/kWh

Because positive sum only:

⇒ Hysteresis (LEERWEG) = 0

1) Find the lowest common denominator (Lcd) for both meter:

$$Z_{A+} = \text{Lcd}(300, 400) = 1200$$

2) Denominator for kWh in display: Multiplication Z_{A+} and R_a :

$$N_{w+} = 1200 \times 80 = 96000$$

3) Calculation for numerator: $Z_{wX} = N_{w+}/R_x$:

$$Z_{w1} = \frac{N_{w+}}{R_1} = \frac{96000}{300} = 320 \qquad Z_{w2} = \frac{N_{w+}}{R_2} = \frac{96000}{400} = 240$$

Following:

$$\begin{array}{l} \frac{Z_{w1}}{N_{w+}} = \frac{320}{96000} \\ \frac{Z_{w2}}{N_{w+}} = \frac{240}{96000} \end{array} \qquad \begin{array}{l} \frac{Z_{w1}}{Z_{A+}} = \frac{320}{1200} \\ \frac{Z_{w2}}{Z_{A+}} = \frac{240}{1200} \end{array}$$

Cancel:

$$\frac{Z_{w1}}{N_{w+}} = \frac{8}{2400}$$

$$\frac{Z_{w2}}{N_{w+}} = \frac{9}{2400}$$

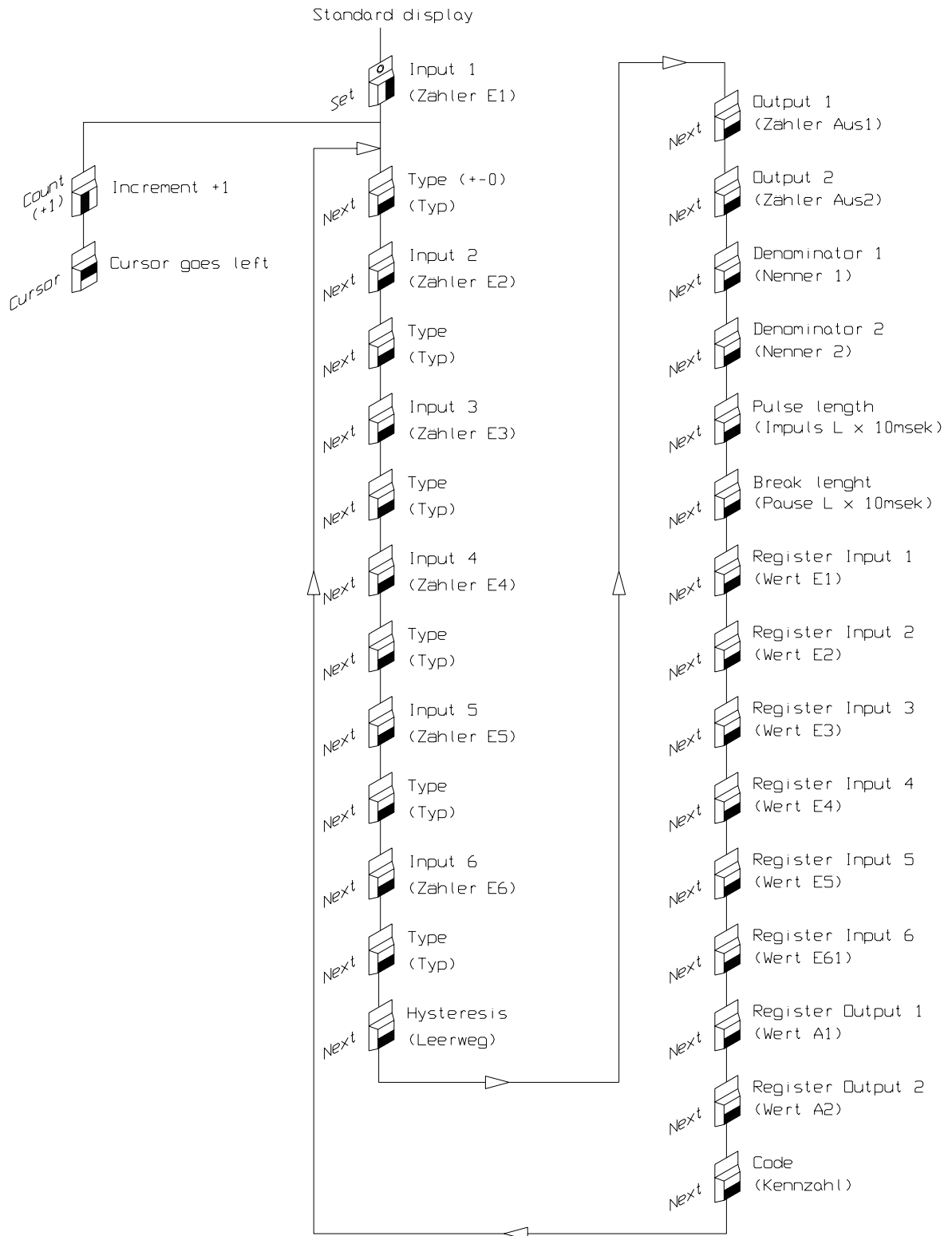
$$\frac{Z_{w1}}{Z_{A+}} = \frac{8}{30}$$

$$\frac{Z_{w2}}{Z_{A+}} = \frac{9}{30}$$

Result: $Z_{w1} = 8$; $Z_{w2} = 9$; $Z_{A+} = 30$; $N_{w+} = 2400$

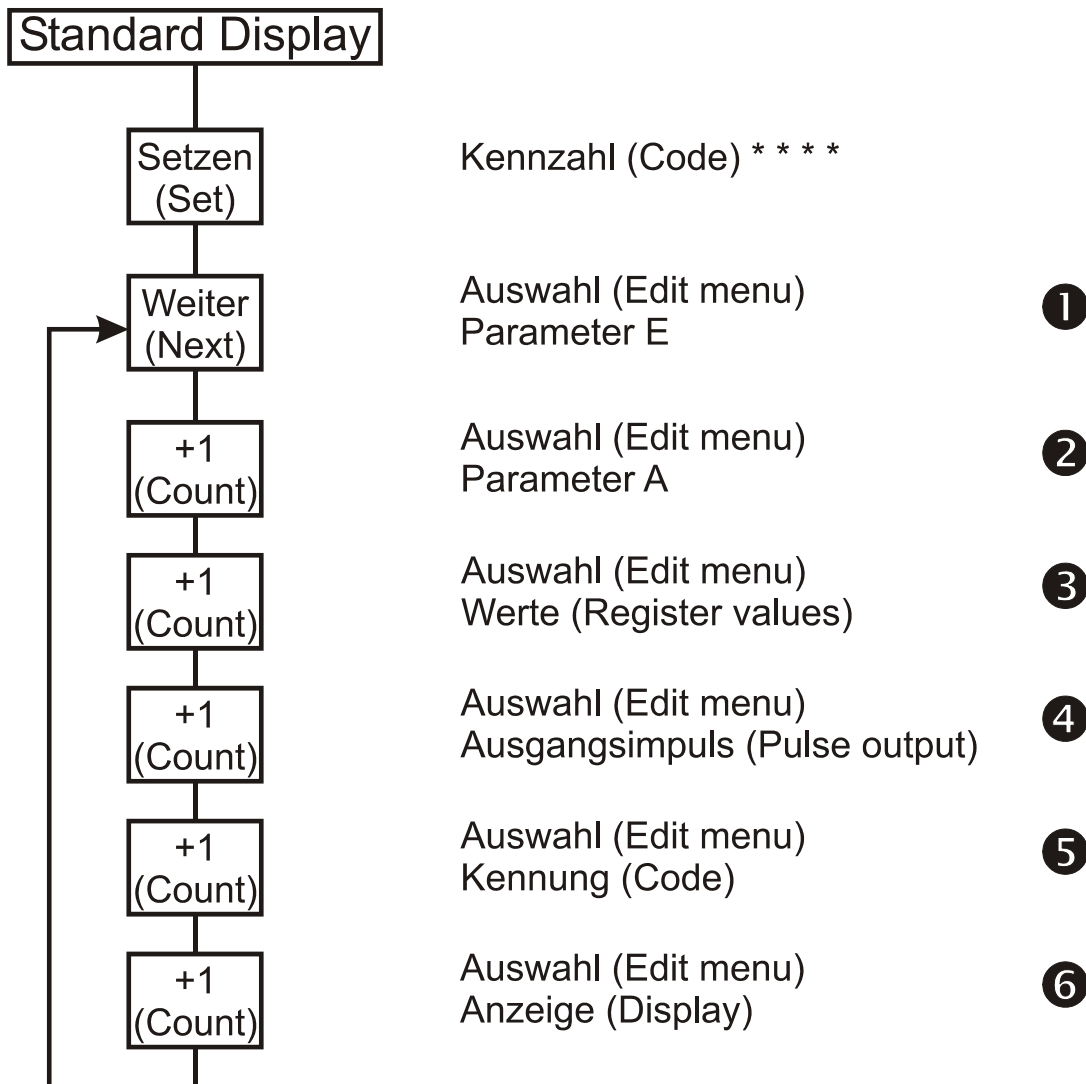
5 Flow chart

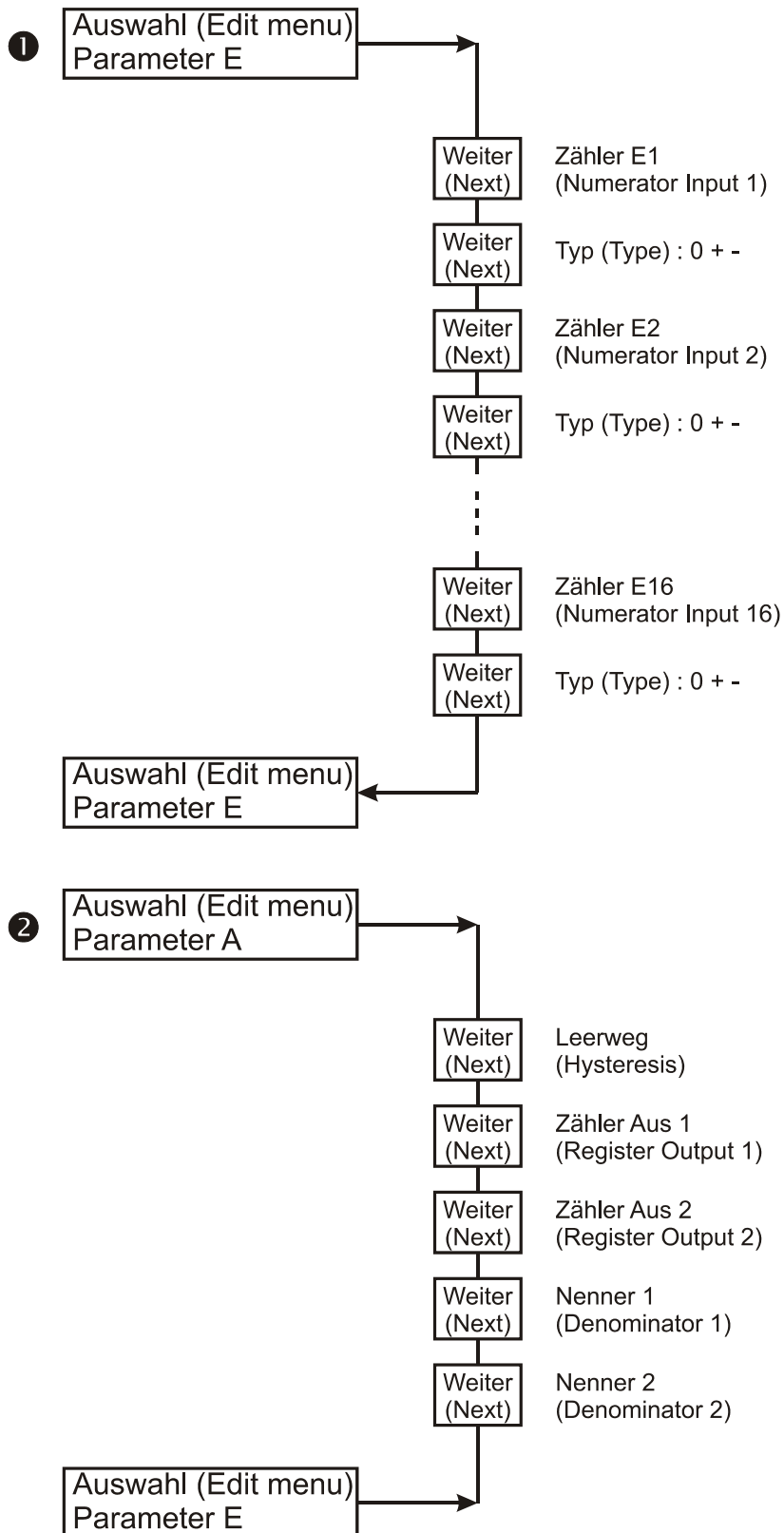
5.1 SC 2059 and S06-02

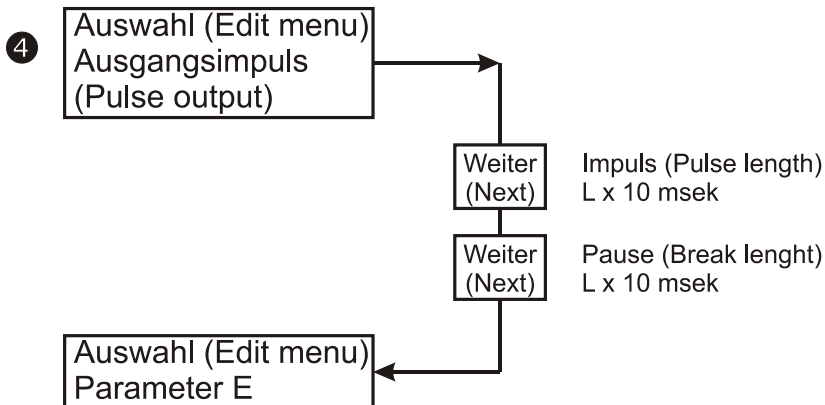
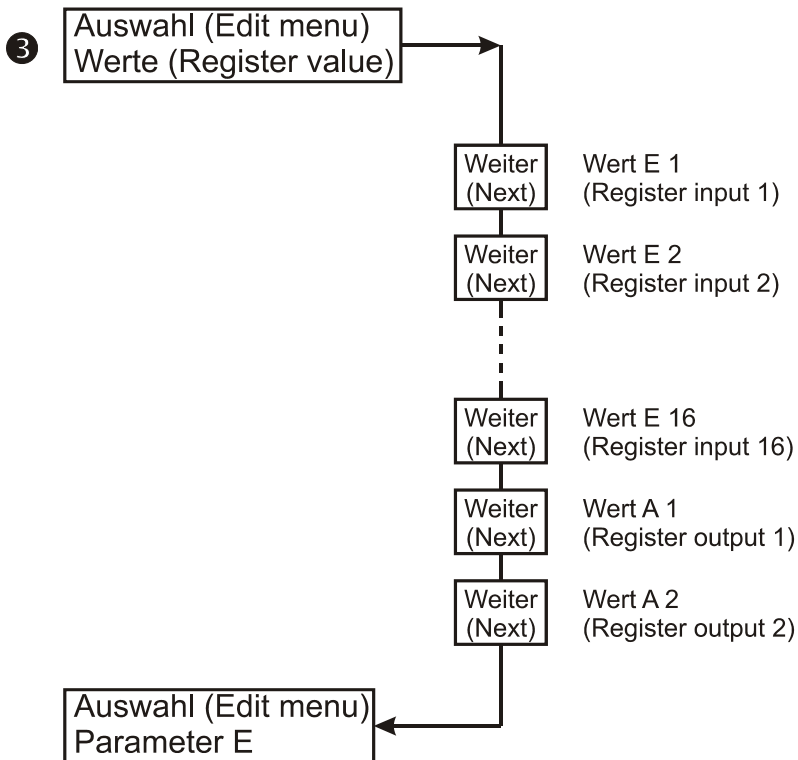


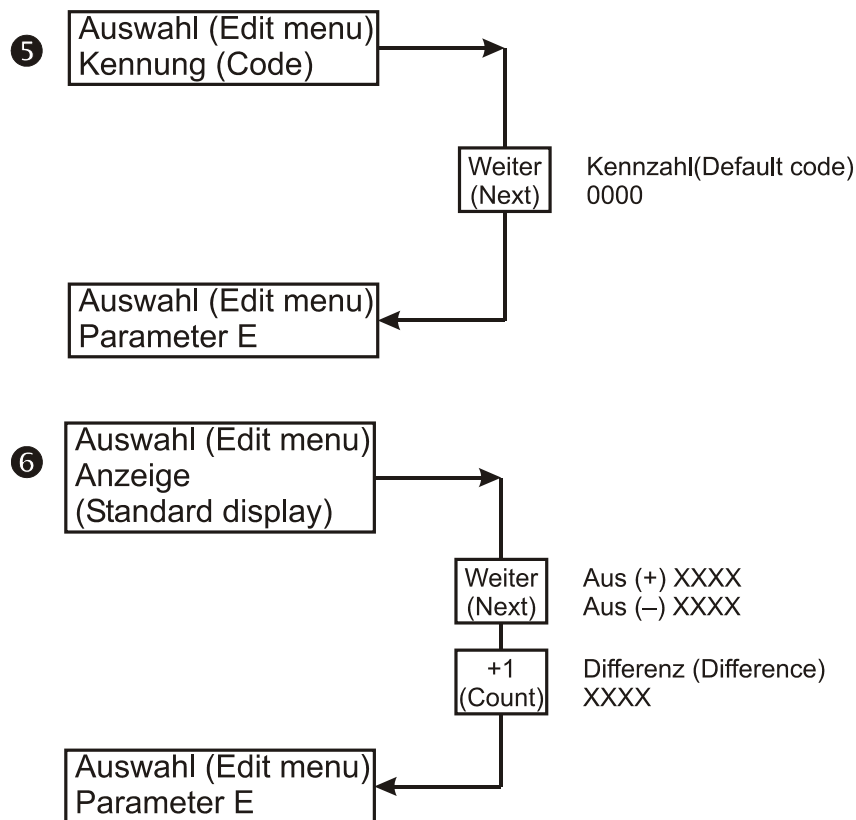
5.2 SC 1602

SC 1602 has up to 16 pulse inputs.









6 Setting of parameters

Alternative label:

```
CURSOR := ZEIGER
NEXT    := WEITER
COUNT := +1
SET     := SETZEN
```

Standard display:

```
AUS (+) xxxxxxxx
AUS (-) xxxxxxxx
```

Hit the "SET" key. The following information appears:

```
Kennzahl
****
```

The red LED in the "SET"-key will shine.

Note: **default code (Kennzahl): without code.**

Hit the "NEXT" key. The following information appears:

```
Zähler E1:
000001
```

The Cursor will blink at the first position of entry 1 (input 1). If you hit the key "COUNT", the blinking valve will be one position greater.

If you hit the key "CURSOR" the cursor will move one position to the left. With "COUNT" you can change the next valve.

If you hit the key "NEXT", the following in-formation will be displayed:

```
Typ      E1:
+
```

If you hit the key "COUNT" the entry can be made a positive (output 1) or a negative (output 2) term of sum.

After you hit "NEXT", the following information will be displayed:

```
Zähler E2:
000001
```

You may continue in the same way you did with entry 1.

After you have set the term of sum for entry 6 (or 16 for SC 1602), and then hit the key "NEXT", the following information will be displayed:

```
Leerweg :  
000000
```

By hitting the keys "COUNT" and "CURSOR", you can set the hysteresis (Leerweg) using the following formula:

Hysteresis = Sum of all the counters \times 2

This is valid **only** for the sum difference. If you hit the key "NEXT" the following information will be displayed:

```
Zähler Aus 1:  
00001
```

By hitting the keys "COUNT" and "CURSOR" you may set the pulse valve of output 1.

If you hit the key "NEXT", the impulse valve for output 2 will be displayed:

```
Zähler Aus 2:  
00001
```

By hitting the keys "COUNT" and "CURSOR", you may set the pulse valve for output 2 (negative sum). If you hit the key "NEXT", the impulse valve for denominator 1 will be displayed:

```
Nenner 1  
00001
```

You can set the impulse valve of denominator 1 by hitting the keys "COUNT" and "CURSOR". If you hit the key "NEXT", the impulse valve for denominator 2 will be displayed:

```
Nenner 2  
00001
```

By hitting the keys "COUNT" and "CURSOR" you can set the pulse value for denominator 2.

Note! Denominator 1 > 0 and denominator 2 > 0!

If you hit the key "NEXT", the duration of the pulse period will be displayed:

```
Impuls L * 10msek
09
```

In our example, the duration of the pulse period is 90 milliseconds.

By hitting the keys "COUNT" and "CURSOR" you may set the duration of the pulse. If you hit the key "NEXT", the duration of the break will be displayed. (in milliseconds):

```
Pause L * 10msek
11
```

In our example the break is 110 milliseconds.

By hitting the keys "COUNT" and "CURSOR" you may set the duration of the break. If you hit the key "NEXT", the control counter value for entry 1 (input 1) will be displayed:

```
Wert E1
00000001
```

By hitting the keys "COUNT" and "CURSOR" you may set the control counter value for entry 1.

If you hit the key "NEXT", the control counter value for entry 2 (input 2) will be displayed.

```
Wert E2
00000001
```

By hitting the keys "COUNT" and "CURSOR" you may set the control counter value for entry 2.

You may continue in the same way with the other control counter values for entries and outputs.

After you set the value for output 2, the setting of parameters is done. If you now hit the key "NEXT", the menu for parameter setting will be restarted.

If you hit the key "SET", the red LED will get dark and you get again the standard display

7 Pulse inputs

If you hit the keys "CURSOR" and "COUNT" at the same time, the control counter value for every entry (input) will be displayed.

EIN	1	xxxxxxxxx
EIN	2	xxxxxxxxx

By hitting the key "COUNT" the remaining counters (3 and 4, 5 and 6 ...) will be displayed, as often as you like it

If you hit the key "CURSOR", this cycle will be cancelled and you get again the standard display.

AUS	(+)	xxxxxxxxx
AUS	(-)	xxxxxxxxx

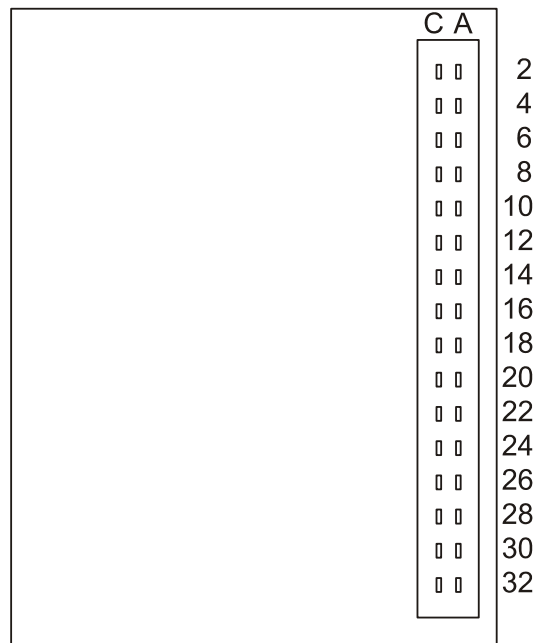
S06-02

Terminal	Description
1	Supply voltage: N (Neutral)
2	Supply voltage: L1 (Phase, 115V or 230V)
3	Protective Earth (PE)
9	Pulse output 1+ (Sum pos): (IAW passive)
10	Pulse output 1- (Sum pos)
12	Pulse output 2+ (Sum neg): (IAW passive)
13	Pulse output 2- (Sum neg)
14	Pulse input 1+
15	Pulse input 1-
16	Pulse input 2+
17	Pulse input 2-
18	Pulse input 3+
19	Pulse input 3-
20	Pulse input 4+
21	Pulse input 4-
22	Pulse input 5+
23	Pulse input 5-
24	Pulse input 6+
25	Pulse input 6-

8.2 SC 2059

The summation device SC 2059 is 19" insert case (width 21PU, high 3HU).

Note! The casing of SC 2059 should become protective earth (PE).



Die Versorgungsspannung kann geräteintern über einen Schiebeschalter von 115VAC auf 230VAC umgeschaltet werden.

SC 2059

Terminal		Description
A4	In 1+	Pulse input 1
C4	In 1-	
A6	In 2+	Pulse input 2
C6	In 2-	
A8	In 3+	Pulse input 3
C8	In 3-	
A10	In 4+	Pulse input 4
C10	In 4-	
A12	In 5+	Pulse input 5
C12	In 5-	
A14	In 6+	Pulse input 6
C14	In 6-	
A20	Out positive +	Pulse output 1 (Sum positive)
C20	Out positive -	
A22	Out negative +	Pulse output 2 (Sum negative)
C22	Out negative -	
A30	L1 (Phase)	Supply voltage 115V or 230V
C30	L1 (Phase)	Supply voltage 115V or 230V
A32	N (Neutral)	Supply voltage 115V or 230V
C32	N (Neutral)	Supply voltage 115V or 230V

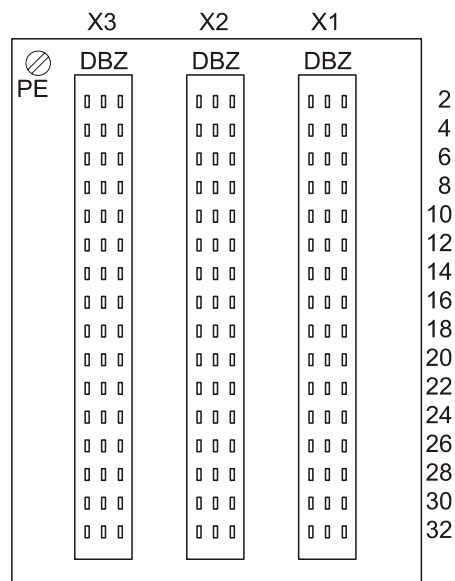
8.3 SC 1602

The summation device SC 1602 is 19" insert case (width 21PU, high 3HU).

Terminals: three cards with 48 pins according to DIN 41612 type F:

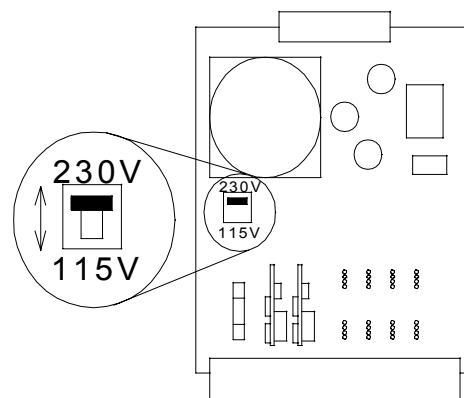
- X1 power supply and pulse outputs
- X2 pulse inputs 9 to 16
- X3 pulse inputs 1 to 8 and the CPU.

Note! The casing of SC 2059 should become protective earth (PE).



The supply voltage can be changed from 115VAC to 230VAC inside the device (on the terminal card X1) by means of a sliding switch.

! The supply voltage must only be changed when the device is without power!



SC 1602: terminal X1

	D	B	Z	Description
2				
4	+12V	+24V	0V	see below
6				
8				
10				
12				
14				
16				
18	Sum1 +		Sum1 -	Pulse output 1 (Sum positive)
20	+Out		-Out	Supply for outputs, see below
22	Sum2 +		Sum2 -	Pulse output 2 (Sum negative)
24				
26				
28	L1			Supply voltage (Phase)
30	N			Supply voltage (Neutral)
32	PE	PE	PE	Protective Earth (must be connected!)

- 0V (Z4): Ground wire for inputs and internal logic
- +12V (D4): +12V **Output**: must be connected with another terminals!
- +24V (B4): +24V **Input** for alternative supply voltage (+24VDC). PE must be connected!
- +Out/-Out
(D20/Z20): for IAD only.

SC 1602: terminal X2 (optional)

	D	B	Z	Description
2	In 9+		In 9-	Pulse input 9
4	+12V		0V	See below
6	In 10+		In 10-	Pulse input 10
8				
10	In 11+		In 11-	Pulse input 11
12				
14	In 12+		In 12-	Pulse input 12
16				
18	In 13+		In 13-	Pulse input 13
20				
22	In 14+		In 14-	Pulse input 14
24				
26	In 15+		In 15-	Pulse input 15
28				
30	In 16+		In 16-	Pulse input 16
32				

0V (Z4): Ground wire for inputs
 +12V (D4): +12V supply (alternative)

SC 1602: terminal X3

	D	B	Z	Description
2	In 1+		In 1-	Pulse input 1
4	+12V		0V	See below
6	In 2+		In 2-	Pulse input 2
8				
10	In 3+		In 3-	Pulse input 3
12				
14	In 4+		In 4-	Pulse input 4
16				
18	In 5+		In 5-	Pulse input 5
20				
22	In 6+		In 6-	Pulse input 6
24				
26	In 7+		In 7-	Pulse input 7
28				
30	In 8+		In 8-	Pulse input 8
32				

0V (Z4): Ground wire for inputs
 +12V (D4): +12V supply (alternative)

9 FAQ

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Important: Keep ready:

- Serial number
- Type
- Software version
- Last update
- Order number

10 List of parameters

		Default	Parameter
Input 1:	Numerator Zw1	1	
	Type (+/-)	+	
	Register	0	
Input 2:	Numerator Zw2	1	
	Type (+/-)	-	
	Register	0	
Input 3:	Numerator Zw3	1	
	Type (+/-)	+	
	Register	0	
Input 4:	Numerator Zw4	1	
	Type (+/-)	-	
	Register	0	
Input 5:	Numerator Zw5	1	
	Type (+/-)	+	
	Register	0	
Input 6:	Numerator Zw6	1	
	Type (+/-)	-	
	Register	0	
Input 7: *	Numerator Zw7	1	
	Type (+/-)	+	
	Register	0	
Input 8: *	Numerator Zw8	1	
	Type (+/-)	-	
	Register	0	
Input 9: *	Numerator Zw9	1	
	Type (+/-)	+	
	Register	0	
Input 10: *	Numerator Zw10	1	
	Type (+/-)	-	
	Register	0	
Input 11: *	Numerator Zw11	1	
	Type (+/-)	+	
	Register	0	
Input 12: *	Numerator Zw12	1	
	Type (+/-)	-	

	Register		0	
Input 13: *	Numerator Zw13		1	
	Type (+/-)		+	
	Register		0	
Input 14: *	Numerator Zw14		1	
	Type (+/-)		-	
	Register		0	
Input 15: *	Numerator Zw15		1	
	Type (+/-)		+	
	Register		0	
Input 16: *	Numerator Zw16		1	
	Type (+/-)		-	
	Register		0	
Hysteresis (Leerweg)			0	
Output 1 (+):	Denominator Aus 1+ ZA+		1	
	Register		0	
Output 2 (-):	Denominator Aus 2- ZA-		1	
	Register		0	
Common denominator 1 (Display) Nw+			1	
Common denominator 2 (Display) Nw-			1	
Pulse length			90 ms	
Break length			110 ms	

*: only SC 1602