



EV-94

OPERATING MANUAL



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1. INTRODUCTION

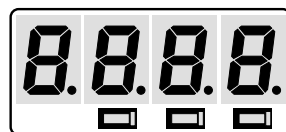
The EV-94 is a microprocessor controlled display, supervision and control unit for universal applications.

There are connections for four standard signals (0 to 20 mA, 4 to 20 mA, 0 to 1 Volt and 0 to 10 Volt), two temperature sensors (KTY87-205 and Pt1000), frequency measuring and counter functions.



In addition, two switching outputs are available, which can be configured as two-level controller, three-level controller, two-level controller with min./max. alarm, common or individual min./max. alarm.

Furthermore, the unit is equipped with a standard RS485 interface, thus allowing communication with a host computer. When leaving our factory the EV-94 has been subjected to various inspection tests and is completely calibrated.

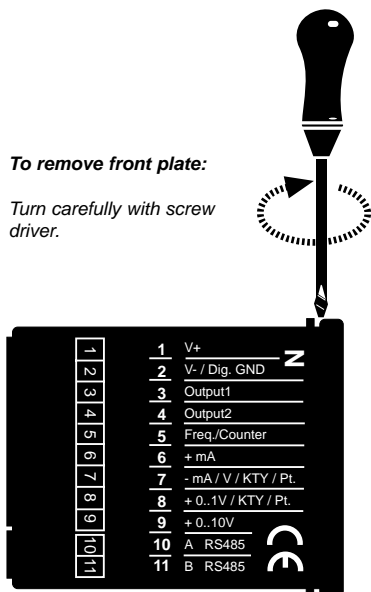


button 1 / button 2 / button 3

The instrument is ready for operation. Before it can actually be used, the EV-94 will have to be individually configured for customer's application.

To remove front plate:

Turn carefully with screw driver.



Please proceed as follows:

- Connect EV-94 completely (see chapter 2 "Electric connection").
- Remove red front plate (see sketch).
- Switch on supply voltage and wait for segment test to be completed.
- Adjust EV-94 to the input signal required proceeding as chapter 3 "Input Configuration".
- Set EV-94 outputs according to the directions given in chapter 4 "Output Configuration".
- Red front plate to be snapped back on.

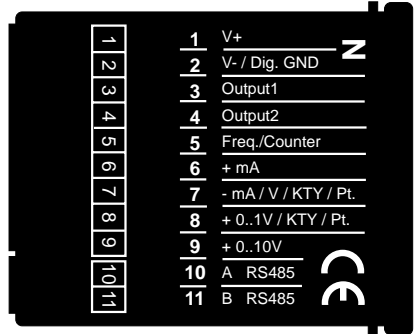
2. ELECTRIC CONNECTION

Electric connection and commissioning of the unit must be carried out by trained personnel.

Wrong connection may lead to the destruction of the EV-94 unit, in which case we cannot assume any warranty.

2.1. Terminal assignment

1	Supply voltage +Uv (9 to 28 V DC)
2	Supply voltage -Uv / Dig. GND
3	Switching output 1
4	Switching output 2
5	Frequency input / Counter input
6	Input mA
7	Input GND analog
8	Input 0 to 1 V
9	Input 0 to 10 V
10	A RS485 interface
11	B RS485 interface



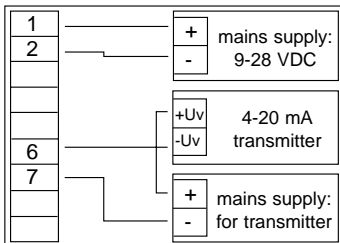
2.1. Connection data

	between connections	Operating values		Limit values		Notes
		min.	max.	min.	max.	
Supply voltage	1 and 2	9 V	28 V	0 V	30 V	Direct voltage
Switching outputs 1 and 2	3 and 2, 4 and 2		30 V 50 mA	0 V	30 V 50 mA	Direct voltage
Input mA	5 and 6	0 mA	20 mA	0 mA	40 mA	
Input 0-1 V	6 and 7	0 V	1 V	-0.5 V	5 V	
Input 0-10 V	6 and 8	0 V	10 V	-1 V	30 V	
Frequency- / counter input	2 and 4	< 0.8 V	> 2.4 V	-0.5 V	30 V 50 mA	Current has to be limited to 50 mA

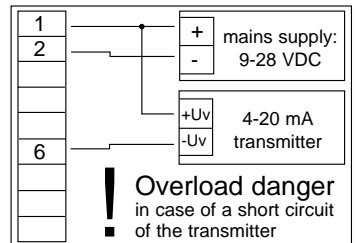
Before connection of the unit, please make sure that the permissible voltage and current values will not be exceeded.

2.3. Connection of input signal

2.3.1. Connection of a 4 to 20 mA measuring transducer in 2-wire technology

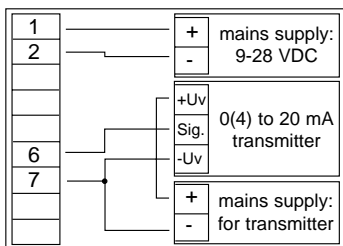


with individual transmitter supply

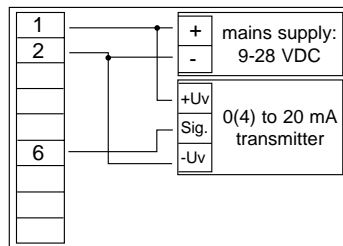


without individual transmitter supply

2.3.2. Connection of a 0(4) to 20 mA measuring transducer in 3-wire technology

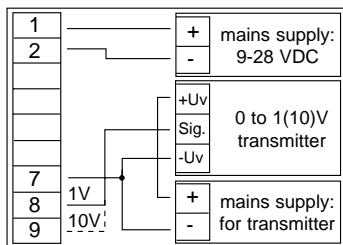


with individual transmitter supply

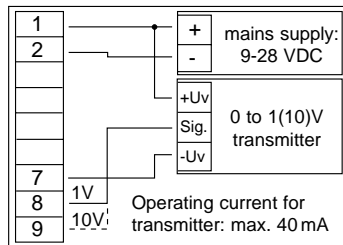


without individual transmitter supply

2.3.3. Connection of a 0 to 1(10) V measuring transducer in 3-wire technology

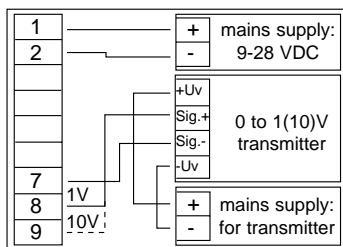


with individual transmitter supply

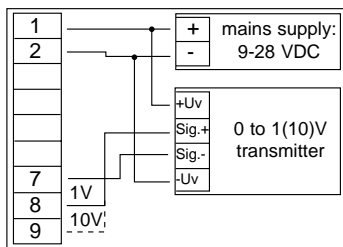


without individual transmitter supply

2.3.4. Connection of a 0 to 1(10) V measuring transducer in 4-wire technology

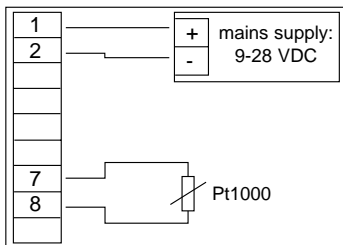


with individual transmitter supply

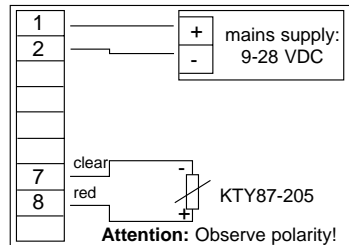


without individual transmitter supply

2.3.5. Connection of a Pt1000 or KTY87-205 temperature sensor

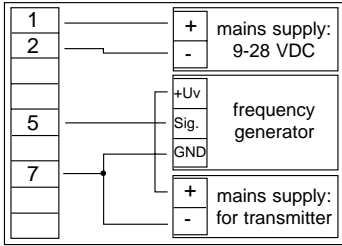


Pt1000 temperature sensor

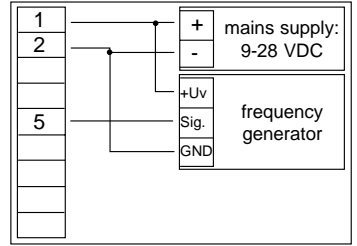


KTY87-205 temperature sensor

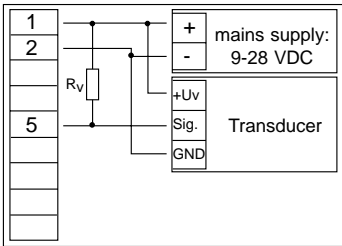
2.3.6. Connection of a frequency signal



with individual frequency generator supply

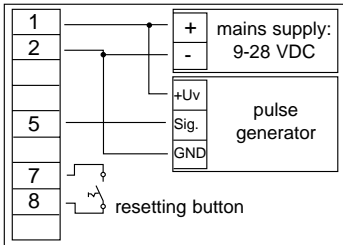


without individual frequency generator supply

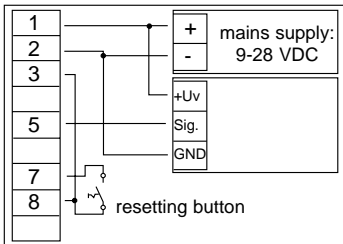


Connection of a transducer with transistor-output (open collector)

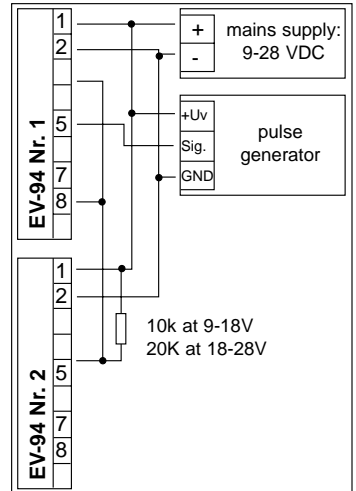
2.3.7. Connection of a counter signal



manual resetting with external button



automatic resetting via output 1, additionally manual resetting with external button



Cascading of EV-94

2.4. Connection of switching outputs

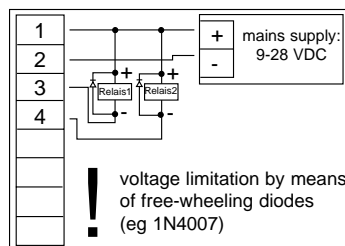
Both switching outputs of the EV-94 are designed as open collector transistor outputs. In the active mode the signal (switching output on) existing at the switching output will be switched reversely to the negative pole of the supply voltage (connection 2).

Please note: Especially when switching inductive loads (e.g. relays, coils etc.) protective arrangements to limit voltage peaks have to be taken.

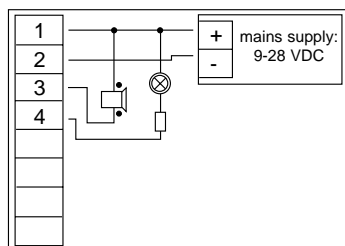
If an output is configured for alarm, it will be “on” as long as in idle state (no alarm). In case of an alarm condition being fulfilled, the output transistor will “open”.

Please note that the max. permissible voltage of 30 Volt and the max. switching current of 50 mA must not be exceeded (not even for a short time).

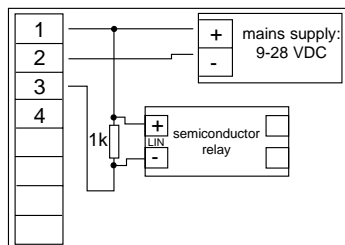
When switching large capacitive loads the making current will have to be limited to the permissible amperage by connecting a series resistor or a current limiter. The same applies to incandescent lamps, whose making current is also quite high due to their low cold resistance.



Connection of relay



Connection of audible piezo alarm and incandescent lamp

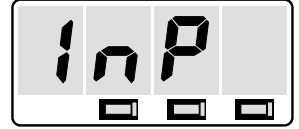


Connection of a semiconductor relay

3. INPUT CONFIGURATION

3.1. Selection of input signal

- Commission EV-94 and wait for segment test to be completed
- Press button 3 (eg using small screw driver)
INP ("INPUT") will be displayed
- Select input signal by pressing button 1 or button 2
(left-hand respectively centre button)



button 1 / button 2 / button 3

Display	Input signal	Also refer to chapter
0-20	0 to 20 mA	3.2
4-20	4 to 20 mA	3.2
0-01	0 to 1 Volt	3.2
0-10	0 to 10 Volt	3.2
tY87	KTY87-205	3.3
PLAt	Pt1000 - temperature sensor	3.3
FrEQ	frequency	3.4
Co.uP	upwards counter	3.5
Co.dn	downwards counter	3.5

- Acknowledge signal selected by pressing button 3. Display shows INP again.

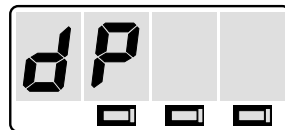
Depending on the input signal selected, additional inputs will be required. Please proceed as per the instructions given in

- chapter 3.2.** for **0 to 20mA, 4 to 20mA, 0 to 1Volt or 0 to 10Volt**
- chapter 3.3.** for **KTY87 or Pt1000**
- chapter 3.4.** for **frequency**
- chapter 3.5.** for **upwards or downwards counter**

3.2. Standard signals 0 to 20 mA, 4 to 20 mA, 0 to 1 Volt and 0 to 10 Volt

This chapter describes the EV-94 configuration for standard signals. The following instructions are based on the assumption that an input signal, ie 0 to 20 mA, 4 to 20 mA, 0 to 1 Volt or 0 to 10 Volt has been selected according to the directions given in chapter 3.1. The display shows INP.

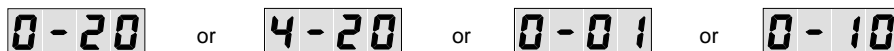
- Press button 3, display shows dP (decimal point).
- Select desired place for decimal point by pressing button 1 or button 2.



button 1 / button 2 / button 3

Display	Number of places after decimal point	Examples
	0	
	1	
	2	
	3	

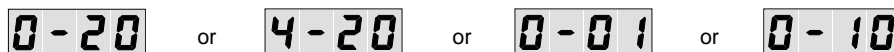
- Acknowledge position of decimal point by pressing button 3. Display shows dP again.
- After pressing button 3 again, the display will show the input signal set (0 to 20, 4 to 20, 0 to 1 or 0 to 10) with the left-hand figure flashing.



- Use buttons 1 and 2 to enter the value to be displayed for an input signal of 0 mA, 4 mA or respectively 0 Volt.

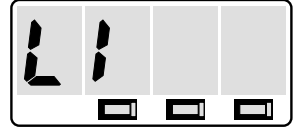
Rolling function: Buttons 1 and 2 are equipped with a rolling function for entering values. Short pressing of the buttons increases (button 1) respectively decreases (button 2) value by one digit. After pressing of the buttons (>1s) for an extended time the values start counting up- or downwards, with the counting speed being increased after 8 s.

- Acknowledge value displayed by pressing button 3. The display will show the input signal again.
- Switch over to next parameter by pressing button 3 once again. The display will continue showing the input signal selected with both right-hand figures flashing.



- Via buttons 1 and 2 you may now enter the value to be displayed on the EV-94 for either one of the following input signals: 20mA, 1 Volt or 10 Volt.
- Acknowledge value set by pressing button 3. The display will show the input signal again.

- Press button 3 once again. The display will show LI (Limit).
- Use buttons 1 and 2 to select desired measuring range limitation.

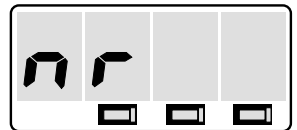


Display	Measuring range limitation	Application
0	The measuring range limits are approx. 10% over/under the standard signal set.	Standard setting
1	Measuring range is exactly limited to the desired standard signal.	In case signals above/below the standard signal range result in erroneous display/values: Example: rel. humidity > 100%

- Acknowledge selection by pressing button 3. The display will show LI again.
- Acknowledge selection by pressing button 3 once again. The display will show FILt (Filter).
- Select desired input filter 0, 1 or 2 with buttons 1 and 2.

Display	Filter state	Delay in display	Notes
0	off	----	
1	on	approx. 1.5 sec	If no valid measuring values can be found, an "average value" of the latest measuring series will be displayed.
2	on	approx. 1.5 sec	If no valid measuring values can be found the fault message FE5 will be displayed.

- Acknowledge by pressing button 3 once again. The display will show FILt again.
- Press button 3 once again. The display will show nr (Number).
- Use buttons 1 and 2 to enter the address numbers for accessing the EV-94 in a data communication network. For more detailed information please refer to chapter 5 "RS485-interface".



If you do not intend to use the RS485-interface, please disregard and skip both this point and the following one.

- Acknowledge your input by pressing button 3. The display will show nr again.

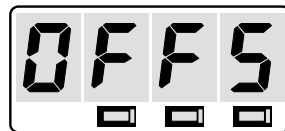
You have now completed setting up and adjusting of your EV-94 to your measuring transducer. Please proceed to the next step of commissioning, ie configuration of EV-94 outputs as described in chapter 4.

3.3. Temperature sensor KTY87-205 and Pt1000

This chapter describes the configuration of the EV-94 for direct connection of a temperature sensor type KTY87-205 or Pt1000. The following instructions are based on the assumption that you have selected input signal KTY87 or Pt1000 as described in chapter 3.1. The display should show INP.

- Press button 3, the display will show OFFS (Offset).
- Set offset value (zero offset) with button 1 and 2.

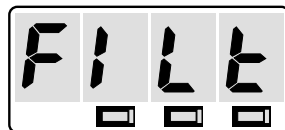
We recommend that the offset value be set to 0.0 respectively 0.



button 1 / button 2 / button 3

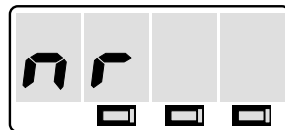
The offset value offers the possibility of correcting display faults resulting from very long and thin connecting lines respectively sensor tolerances. The value input here will be subtracted from the measuring result (offset of characteristic curve parallel to zero value).

- Acknowledge offset value by pressing button 3. The display will show OFFS again.
- Press button 3 once again. The display will show FILt (Filter).
- Use buttons 1 and 2 to select desired input filter 0, 1 or 2.



Display	Filter state	Delay in display	Notes
0	off	----	
1	on	approx. 1.5 sec	If no valid measuring values can be found, an "average value" of the latest measuring series will be displayed.
2	on	approx. 1.5 sec	If no valid measuring values can be found the fault message FE5 will be displayed.

- Acknowledge by pressing button 3 once again. The display will show FILt again.
- Press button 3 once again. The display will show nr (number).
- Use buttons 1 and 2 to enter the address numbers for accessing the GIA 10 in a datacommunication network.



For more detailed information please refer to chapter 5 "RS485-interface".

If you do not intend to use the RS485-interface, please disregard and skip both this point and the following one.

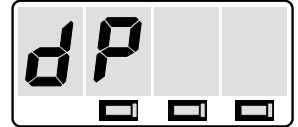
- Acknowledge your input by pressing button 3. The display will show nr again.

You have now completed adjusting of your EV-94 to the temperature sensor. Please proceed to the next step of commissioning, ie configuration of EV-94 outputs as described in chapter 4.

3.4. Frequency measuring

This chapter describes the configuration of the EV-94 when used for frequency measuring. The following instructions are based on the assumption that you have selected input signal “frequency” as described in chapter 3.1. The display should show INP.

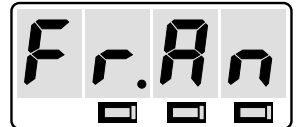
- Press button 3, the display will show dP (decimal point).
- Select position of decimal point as desired by pressing buttons 1 and 2.
- Acknowledge position of decimal point by pressing button 3. The display will show dP again.
- Press button 3, the display will show Fr.An., with Fr (frequency) flashing.
- Enter highest frequency value to be measured by pressing buttons 1 and 2.



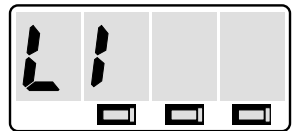
button 1 / button 2 / button 3

Rolling function: Buttons 1 and 2 are equipped with a rolling function for entering values. Short pressing of the buttons increases (button 1) respectively decreases (button 2) value by one digit. After pressing of the buttons (>1s) for an extended time the values start counting up- or downwards, with the counting speed being increased after 8 s.

- Acknowledge input with button 3. The display will show Fr.An. again.
- Press button 3 once again. The display continues showing Fr.An., with An (Anzeige = display) flashing.
- Use buttons 1 and 2 to enter value to be displayed on EV-94 for the highest possible frequency set before.

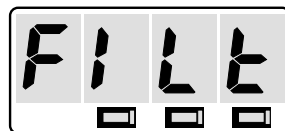


- Acknowledge value to be displayed by pressing button 3. The display will show Fr.An. again.
- Press button 3 once again. The display will show LI (Limit).
- Select desired limitation of measuring range by pressing buttons 1 and 2.



Display	Limitation of measuring range	Application
0	Frequencies up to 10kHz will be measured!	Standard setting
1	Frequencies exceeding the highest possible frequency set will result in erroneous displays.	In case signals exceed the highest frequency this will result in erroneous display values: Examples: rel. humidity > 100%

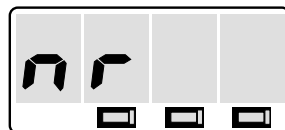
- Acknowledge selection by pressing button 3. The display will show LI again.
- Press button 3 once again, the display will show FILT (Filter).



- Select desired input filter 0, 1 or 2 by pressing buttons 1 and 2.

Display	Filter state	Delay in display	Notes
0	off	----	
1	on	approx. 1.5 sec	If no valid measuring values can be found, an "average value" of the latest measuring series will be displayed.
2	on	approx. 1.5 sec	If no valid measuring values can be found the fault message FE5 will be displayed.

- Acknowledge by pressing button 3 once again. The display will show FILT again.
- Press button 3 once again. The display will show nr.
- Use buttons 1 and 2 to enter the address numbers for accessing the EV-94 in a data communication network. For more detailed information please refer to chapter 5 "RS485-interface".



If you do not intend to use the RS485-interface, please disregard and skip both this point and the following one.

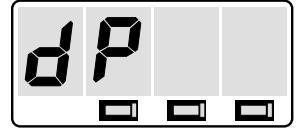
- Acknowledge your input by pressing button 3. The display will show nr again.

You have now completed adjusting of your EV-94 to the measuring transducer. Please proceed to the next step of commissioning, ie configuration of EV-94 outputs as described in chapter 4.

3.5. Upwards/downwards counter

This chapter describes the configuration of the EV-94 when used as counter. The following instructions are based on the assumption that you have selected input signal “upwards counter” (Co.up) or “downwards counter” (Co.dn) as described in chapter 3.1. The display should show INP.

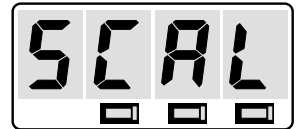
- Press button 3, the display will show dP (decimal point).
- Select position of decimal point as desired by pressing buttons 1 and 2.



button 1 / button 2 / button 3

Display	Number of decimal places	Example
	0	
	1	
	2	
	3	

- Acknowledge position of decimal point by pressing button 3. The display will show dP again.
- Press button 3, the display will show SCAL (scaler).
- Set desired scaler value (1 to 255) by pressing buttons 1 and 2.



Rolling function: Buttons 1 and 2 are equipped with a rolling function for entering values. Short pressing of the buttons increases (button 1) respectively decreases (button 2) value by one digit. After pressing of the buttons (>1s) for an extended time the values start counting up- or downwards, with the counting speed being increased after 8 s.

The pulses received at the input of the EV-94 will be divided by the scaler value before being evaluated by the EV-94.

The EV-94 is able to process a maximum number of 20 pulses directly. By entering a corresponding scaler value, pulse frequencies of up to 5100 pulses (= 20 pulse/s x 255) can be displayed.

The EV-94 counter ranges from 0 to 32767 pulses. By means of the scaler this range can be extended to up to 8355585 pulses (32767 x 255).

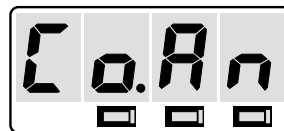
Coarse scaling of the EV-94 is also facilitated by the scaler value.

Example: A flow sensor emits 120 pulses per litre. By entering a scaler value of 120 one pulse per litre will be transferred to the EV-94 for evaluation.

If possible, we recommend setting a scaler value above 1, as this will render the EV-94 unit more insensitive to high frequency interference signals.

- Acknowledge scaler value by pressing button 3. The display will show SCAL again.

- Press button 3, the display will show "Co.An", with Co (counter) flashing.

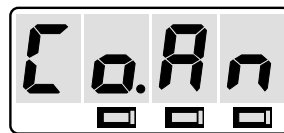


- Use buttons 1 and 2 to set
 - max. number of pulses to be counted (for upwards counter)
 - number of pulses as of which to start downwards counting (for downwards counter).

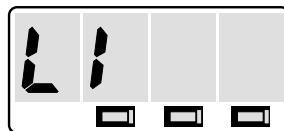
A value of 9999 has to be set for the required number of pulses from 10000 to 32767.

Please note: At this point, set number of pulses to be transferred to the EV-94 after the scaler. In order to calculate overall number of pulses, this value has to be multiplied by the scaler value set.

- Acknowledge input by pressing button 3 once again. The display will show Co.An again.
- Press button 3 once again. The display will continue showing Co.An, with An (display) flashing.



- Use buttons 1 and 2 to enter the value to be displayed by the EV-94 for any preselected number of pulses.
- Acknowledge display value by pressing button 3. The display will show Co.An again.
- Press button 3 once again. The display will show LI (Limit).
- Select desired limitation of measuring range by pressing buttons 1 and 2.



Display	Limitation of measuring range	Application
0	Frequencies up to 10kHz will be measured!	Standard setting
1	Frequencies exceeding the highest possible frequency set will result in erroneous displays.	In case signals exceed the highest frequency this will result in erroneous display values: Example: rel. humidity > 100%

- Acknowledge selection by pressing button 3. The display will show LI again.

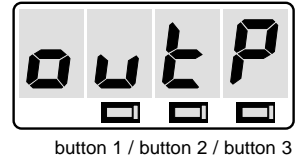
You have now completed adjusting the counter input. Please proceed to the next step of commissioning, ie configuration of EV-94 outputs as described in chapter 4.

4. OUTPUT CONFIGURATION

The switching outputs of the EV-94 must never be configured prior to the configuration of the input (please refer to chapter 3).

4.1. Setting of output function

- Commission EV-94 and wait for segment test to be completed.
- Press button 3 till outP (Output) will be displayed.
- Select desired output function by pressing buttons 1 and 2.



Display	Description	Function	
		Output 1	Output 2
no	no function EV-94 used as display only	-----	-----
2-Pl.	2-level controller	digital 2-level controller	-----
ALF1	common min./max. alarm	min. and max. alarm	-----
3-Pl.	3-level controller	digital 2-level controller	digital 2-level controller
2P.AL	2-level controller with min./max. alarm	min. and max. alarm	digital 2-level controller
ALF2	individual min./max. alarm	max. alarm	min. alarm

- Acknowledge output function selected by pressing button 3. The display will show outP again.

Depending on the output signal selected, the various making/breaking points respectively min./max. alarm limits will have to be entered. Please proceed as per the instructions given in

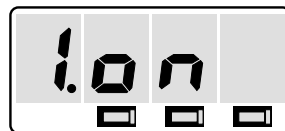
chapter 4.2.	for	2-level controller
chapter 4.3.	for	common min./max. alarm
chapter 4.2.	for	3-level controller
chapter 4.4.	for	2-level controller with min./max. alarm
chapter 4.3.	for	individual min./max. alarm

If you have not selected any function, the configuration of the EV-94 is now completed. Press button 3 to switch over to display of measuring value.

4.2. Two-level controller, three-level controller

This chapter describes the setting of the making points when using the EV-94 as digital 2-level controller or 3-level controller. The following instructions are based on the assumption that you have selected output function “2-level controller” or “3-level controller” as described in chapter 4.1. The display should show outP.

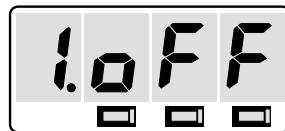
- Press button 3, the display will show I.on
(making point of output 1).
- Use buttons 1 and 2 to set value at which output 1 is to be made.



button 1 / button 2 / button 3

Rolling function: Buttons 1 and 2 are equipped with a rolling function for entering values. Short pressing of the buttons increases (button 1) respectively decreases (button 2) value by one digit. After pressing of the buttons (>1s) for an extended time the values start counting up- or downwards, with the counting speed being increased after 8 s.

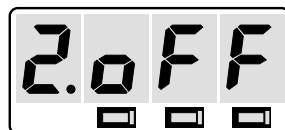
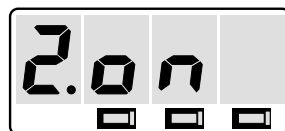
- Acknowledge making point set by pressing button 3. The display will show I.on again.
- Press button 3 once again, the display will show I.oFF
(breaking point of output 1).
- Use buttons 1 and 2 to set value at which output 1 is to be broken.
- Acknowledge value by pressing button 3. The display will show I.oFF again.



If you have selected the “2-level controller” function the configuration of the EV-94 is now completed. Press button 3 once again to switch over to display of measuring value.

If you have selected the “3-level controller” function, please proceed as follows:

- Press button 3. The display will show 2.on (making point of output 2).
- Use buttons 1 and 2 to set making point of output 2.
- Acknowledge by pressing button 3. The display will show 2.on again.
- Press button 3 once again. The display will show 2.oFF
(breaking point of output 2).
- Use buttons 1 and 2 to set breaking point.
- Acknowledge breaking point by pressing button 3.
The display will show 2.oFF again.

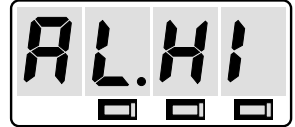


The configuration of the EV-94 is now completed. Press button 3 once again to switch over to display of measuring value.

4.3. Min./max. alarm

This chapter describes the setting of the making points when using the EV-94 for min./max value monitoring. The following instructions are based on the assumption that you have selected output function "common min./max. alarm" or "individual min./max. alarm" as described in chapter 4.1. The display should show outP.

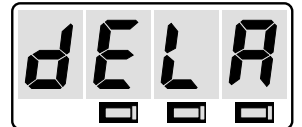
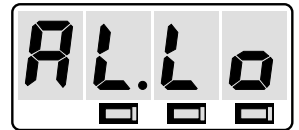
- Press button 3, the display will show AL.HI (max. alarm limit).
- Use buttons 1 and 2 to set max. alarm limit.



button 1 / button 2 / button 3

Rolling function: Buttons 1 and 2 are equipped with a rolling function for entering values. Short pressing of the buttons increases (button 1) respectively decreases (button 2) value by one digit. After pressing of the buttons (>1s) for an extended time the values start counting up- or downwards, with the counting speed being increased after 8 s.

- Acknowledge alarm limit set by pressing button 3. The display will show AL.HI again.
- Press button 3 once again. The display will show AL.Lo (min. alarm limit).
- Use buttons 1 and 2 to set minimum alarm limit.
- Acknowledge by pressing button 3. The display will show AL.Lo again.
- Press button 3 once again. The display will show dELA (alarm delay).
- Use buttons 1 and 2 to set alarm delay.



The value displayed corresponds to the delay time minutes.

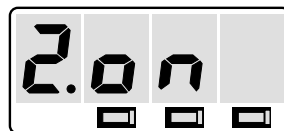
- Acknowledge delay set by pressing button 3. The display will show dELA again.

The configuration of the EV-94 is now completed. Press button 3 once again to switch over to display of measuring value.

4.4. 2-level controller with min./max. alarm

This chapter describes the setting of the making points when using the EV-94 as digital 2-level controller with min./max. alarm. The following instructions are based on the assumption that you have selected output function "2-level controller with min./max. alarm" as described in chapter 4.1. The display should show outP.

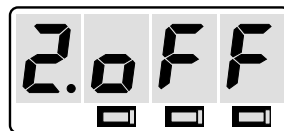
- Press button 3, the display will show 2.on
(making point of output 2)
- Use buttons 1 and 2 to set making point of output 2.



button 1 / button 2 / button 3

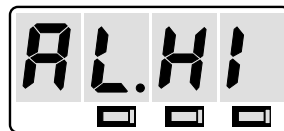
Rolling function: Buttons 1 and 2 are equipped with a rolling function for entering values. Short pressing of the buttons increases (button 1) respectively decreases (button 2) value by one digit. After pressing of the buttons (>1s) for an extended time the values start counting up- or downwards, with the counting speed being increased after 8 s.

- Acknowledge making point by pressing button 3.
The display will show 2.on again.
- Press button 3 once again, the display will show 2.oFF
(breaking point of output 2).

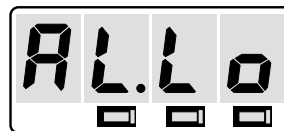


- Use buttons 1 and 2 to set breaking point.
- Acknowledge breaking point by pressing button 3.
The display will show 2.oFF again.

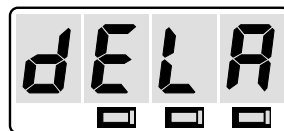
- Press button 3. The display will show AL.HI
(max. alarm limit).



- Use buttons 1 and 2 to set max. alarm limit.
- Acknowledge alarm limit set by pressing button 3. The display will show AL.HI again.
- Press button 3 once again. The display will show AL.Lo (minimum alarm limit).



- Use buttons 1 and 2 to set minimum alarm limit.
- Acknowledge by pressing button 3.
The display will show AL.Lo. again.
- Press button 3 once again. The display will show dELA
(alarm delay).



- Use buttons 1 and 2 to set alarm delay.
The value displayed corresponds to the delay time in minutes.

- Acknowledge delay set by pressing button 3. The display will show dELA again.

The configuration of the EV-94 is now completed. Press button 3 once again to switch over to display of measuring value.

5. RS485-INTERFACE

The serial interface of the EV-94 allows communication of the unit with a host computer. Data polling and transfer is done in the master/slave mode, ie the EV-94 will only transmit data upon request. A separate unit address can be attributed to each EV-94. Addresses 0 to 15 are implemented. The EV-94 will only respond if requested to do so by the host, provided the unit number of the request string corresponds to the one set. This method as well as the fact that the interface operates in the half-duplex mode ensure that up to 16 devices can be called via only one 2-wire line.

5.1. Interface configuration

Type: RS485
 Transfer mode: half-duplex
 Connection: 2-pin screw/plug-in connection
 Connection cable: 2-pin, twisted

5.2. Data transfer format

2400 Baud no parity bit
 1 start bit 1 stop bit
 7 data bits

Communication is entirely achieved by means of printable ASCII code.

5.3. Data transfer processing protocol

Request data from EV-94

Request string to EV-94

	!	Nr.	Nr.	F1	F2	/
Byte	1	2	3	4	5	6

Response from EV-94

	#	F1	F2	\$	D1	D2	D3	D4	/
Byte	1	2	3	4	5	6	7	8	9

Send data to EV-94:

Send string to EV-94

	!	Nr.	Nr.	#	F1	F2	\$	D1	D2	D3	D4	/
Byte	1	2	3	4	5	6	7	8	9	10	11	12

Response from EV-94

	#	a	/
Byte	1	2	3

if data have been successfully taken over

5.4. Description of characters used

- !: ASCII-Code: 21H
This character interrupts a connection, if any is existing, and resets all EV-94 units connected to their original state thus initialising a check to ensure that the following two characters correspond to their respective unit numbers.
- Nr.: Permissible area "0" to "9" and "A" to "F"
(corresponding to ASCII code 30h to 39H and 41H to 46H)
As a precaution unit number will be transmitted twice.
Data will not be processed by the EV-94 unit unless the unit number transmitted is identical to the one set in the respective EV-94. If numbers are not identical the unit will only check if the data stream contains another "!" character thus indicating a new data circuit.
- F1, F2: Permissible range see table 1
Functional codes, specifying the parameter and/or value to be processed. For assignments please refer to table 1 of chapter 5.5 "Functional code".
- /: ASCII-code: 2FH
Indicates the end of a data transfer process.
Each data transfer process, either from host to EV-94 or from EV-94 to host is completed by putting "/".
- #: ASCII-code: 23H
Indicates the beginning of a data transfer process.
"#" is issued by the EV-94 prior to starting transfer of data to the host. If the character "#" is transferred by the host after issuing of the unit number, the EV-94 unit will know that data are to be transferred from the host to the EV-94 (programming of EV-94).
- \$:: ASCII-code: 24H
Signals that the data following will be transferred in hexadecimal code.
- D1..D4: Permissible range "0".."9" and "A".."F"
(corresponding to ASCII code 30H to 39H and 41H to 46H)
Data will be presented in the hexadecimal mode. For more detailed information please refer to chapter 5.6 "Data formats".
- a: ASCII-code: 61H
Transferred as hand-shake signal by the EV-94 after successful data input to the memory.

5.5. Functional code

The value (parameter) to be read respectively re-programmed is specified by two bytes, designed F1 and F2 in the data transfer protocol.

Table 1 illustrates the assignment of functional code and value (parameter) as well as of the correspondingly valid data format.

It is vital to ensure that only those functional codes and their permissible data as stated in table 1 are transmitted to the EV-94 unit as otherwise internal settings of the unit could be changed.

Parameter resp. value	ASCII character		ASCII code		Data format
	F1	F2	F1	F2	
Display value	0	0	30H	30H	1
System state	0	3	30H	33H	2
Input signal	0	4	30H	34H	3
Position of decimal point	0	5	30H	35H	4
Scaler of counter function	0	6	30H	36H	5
Display value for 0mA, 4mA resp. 0V Highest frequency to be measured Max. number of pulses	0	7	30H	37H	1 11 11
Display value for 20mA, 1V resp. 10V Display value for max. frequency Display value for max. nr. of pulses	0	8	30H	38H	1
Limitation of measuring range	0	9	30H	39H	6
Filter	0	A	30H	41H	7
Unit adress	0	B	30H	42H	8
Output prompt	0	C	30H	43H	9
Marking point, switching output 1	0	D	30H	44H	1
Breaking point, switching output 1	0	E	30H	45H	1
Marking point, switching output 2	0	F	30H	46H	1
Breaking point, switching output 2	1	0	31H	30H	1
Max. alarm limit	1	1	31H	31H	1
Min. alarm limit	1	2	31H	32H	1
Alarm delay	1	3	31H	33H	10

Table 1

5.6. Data formats

General information: The four bytes termed D1 to D4 in the data transfer protocol represent the parameter value specified by F1 and F2.

The value is represented in hexadecimal printable ASCII characters.

The EV-94 unit treats all values as 16 bit words, which means that a range of values from -32768 to +32767 and correspondingly a range from 8000H to 7FFFH can be displayed.

The following 4 data bytes contain the 16 bits mentioned above:

D1	equalising	Bit 15	to	12
D2	equalising	Bit 11	to	8
D3	equalising	Bit 7	to	4
D4	equalising	Bit 3	to	0

Examples:

Value		ASCII character				ASCII code			
decimal	hex	D1	D2	D3	D4	D1	D2	D3	D4
0	0000H	0	0	0	0	30H	30H	30H	30H
-1	FFFFH	F	F	F	F	46H	46H	46H	46H
-1999	F831H	F	8	3	1	46H	38H	33H	31H
+9999	270FH	2	7	0	F	32H	37H	30H	46H
-100	FF9CH	F	F	9	C	46H	46H	39H	43H
+100	0064H	0	0	6	4	30H	30H	36H	34H

Data format 1:

Data format 1 corresponds to the general data format. It is only the range of values that is limited to the display range of -1999 to +9999 equalising F831H to 270FH.

The decimal point will not be considered. The decimal point position can be called up separately.

Data format 2:

This format is used to call up and reset the system state. Data bytes D1 to D4 contain information regarding the alarm and fault state of the EV-94.

The assignment is as follows:

Data byte D1:	Bit 0 = 1 :	Fault FE5 active
	Bit 2 = 1 :	Fault FE7 active
	Bit 3 = 1 :	Fault FE8 active
Data byte D2:	Bit 0 = 1 :	Fault FE1 active
	Bit 1 = 1 :	Fault FE2 active
Data byte D4:	Bit 0 = 1 :	max. alarm
	Bit 1 = 1 :	min. alarm
	Bit 3 = 1 :	alarm

Data format 3:

This format is used to call up and program the input signal. The assignment is as follows:

- 0 : Current input 0 - 20mA
- 1 : Current input 4 - 20mA
- 2 : Voltage input 0 - 1 Volt
- 3 : Voltage input 0 - 10 Volt
- 4 : Resistance input KTY87-205
- 5 : Resistance input Pt1000
- 6 : Frequency input
- 7 : Upwards counter
- 8 : Downwards counter
- 9 : Digital display: Mode 1 (can only be activated with a serial interface)
- 10 : Digital display: Mode 2 (can only be activated with a serial interface)

Data format 4:

This format is used to call up and/or program the position of the decimal point. The assignment is as follows:

- 0 : no decimal point
- 1 : decimal point after 2 digits (10)
- 2 : decimal point after 3 digits (100)
- 3 : decimal point after 4 digits (1000)

Data format 5:

This format is used to call up and program the scaler for the counter function. The scaler can be set to a value between 1 and 255.

Data format 5 corresponds to the general data format. It is only the range of values that is limited to the permissible scaler range of 1 to 255 equalising 0001H to 00FF.

Data format 6:

This format is used to program the limitation of the measuring range. The assignment is as follows:

- 0 : extended measuring range limits (LI = 0)
- 1 : narrow measuring range limits (LI = 1)

Data format 7:

This format is used to call up and program the filter. The assignment is as follows:

- 0 : filter off (FILt = 0)
- 1 : filter on with "calculation of average value" (FILt = 1)
- 2 : filter on with FE7 message being active (FILt = 2)

Data format 8:

This format is used to program the unit address. Permissible addresses range from 0 to 15. Data format 8 corresponds to the general data format. It is only the range of values that is limited to the permissible unit addresses from 0 to 15 equalising 0000H to 000FH.

Data format 9:

This format is used to call up and program the output configuration application. The assignment is as follows:

- 0 : no output active, EV-94 used as display only
- 1 : 2-level controller
- 2 : common min./max. alarm
- 3 : 3-level controller
- 4 : 2-level controller with alarm
- 5 : individual min./max. alarm

Data format 10:

This format is used to call up and/or program the alarm delay time. The delay time programme range is 0 to 99 minutes.

Data format 10 corresponds to the general data format. It is only the range of values that is limited to the permissible delay time of 0 to 99 minutes equalising 0000H to 0063H.

Data format 11:

Correspondence to the general data format.

5.7. Availability

The RS485 interface cannot be used if the EV-94 unit is configured as upwards or downwards counters.

When used in connection with the frequency measuring function, the following limitations have to be taken into account:

Any data exchange whatsoever at the RS485 input of the EV-94 will interrupt the frequency measuring. The display will continue to show the value measured last. In case of the data exchange lasting for some time, the display will show the fault code FE5, thus signalling that frequency measuring has been interrupted.

In order to allow frequency measuring and data communication to take place simultaneously, a break of at least 2 s will have to be introduced between two data request/transfer processes.

6. FAULT CODES

A corresponding fault code will be displayed as soon as the EV-94 unit detects an operating state that is not permissible. Fault codes are defined as follows:

FE1: Measuring range has been exceeded

This fault code indicates that the measuring range of the EV-94 unit has been exceeded.

Potential causes: Input signal too high
 Sensor broken (KTY87-205 and Pt1000)
 Sensor short circuit (0(4) to 20 mA)
 Counter overflow

Remedies: The fault code is reset as soon as the input signal has returned to within the permissible limits. Check sensor, measuring transducer and/or frequency generator. Reset counter.

FE2: Values below measuring range

This fault code indicates that the values of the A/D converter are below the measuring range.

Potential causes: Input signal negative
 Current below 4mA
 Sensor short circuit (0(4) to 20 mA)
 Sensor broken (4 to 20 mA)
 Counter underflow

Remedies: The fault code is reset as soon as the input signal has returned to within the permissible limits. Check sensor, measuring transducer and/or frequency generator. Reset counter.

FE3: Display range has been exceeded

This fault code indicates that the permissible display range of the EV-94 unit has been exceeded.

Potential causes: Please refer to FE1

Remedies: Please refer to FE1

FE4: Values below display range

This fault signal indicates that the values are below the permissible display range of the EV-94 unit.

Potential causes: Please refer to FE2

Remedies: Please refer to FE2

FE5: Measuring signal interference

This signal indicates that the measuring signal at the input of the EV-94 unit is unstable.

Potential causes: Strong EMC interferences
 Defective measuring transducer

Remedies: The fault message will disappear as soon as the measuring values detected by the EV-94 unit are stable again.
 Check wiring, sensor and/or measuring transducer.
 Use screened cables if operating in an environment with strong interferences.

FE7: System fault

The EV-94 unit is equipped with a self-diagnosis function for constantly checking essential parts of the unit. In case of a defect, the fault message FE7 is displayed.

Potential causes: Permissible operating temperature has been exceeded
 Operating temperature below permissible range
 EV-94 unit defective

Remedies: Observe permissible operating temperature.
 Exchange defective EV-94 unit.

FE8: Frequency measuring interrupted

This signal indicates that the frequency measuring can not be executed.

Potential causes: Active data communication over RS485-interface.

Remedies: Increase break between data request and data transfer (> 2 s).

7. SPECIFICATION

Sensor inputs:

Can be selected via 3 buttons located under the removable front plate or via the standard RS485 interface.

Standard signals:

4 to 20 mA	Ri = 50 Ohm
0 to 20 mA	Ri = 50 Ohm
0 to 1 V	Ri = 30 kOhm
0 to 10 V	Ri = 300 kOhm

Resistance input:

For temperature measuring (2-wire). Two characteristic sensor curves are implemented:
 KTY87-205: -40...100 °C resolution: 0.1 °C
 Pt1000: -50...600 °C resolution: 1 °C
 Digital zero point offset can be carried out via buttons or interface.

Please note: Any temperature sensor with measuring transducer (Pt100, NiCr-Ni, PtRh-Pt, etc.) can be connected via standard signal input.

Frequency input:

Measured frequency:	0 to 9999 Hz. resolution 1 Hz
Level:	"LOW" < 0.8 Volt "HIGH" > 2.4 Volt
Permissible voltage:	0 to 28 Volt

Application eg for: frequency measurements, flow meters, rotational speed meters, tachometers etc.

Counter input (counter):

Up- and downwards counter up to max.	32678 pulses.
Display:	max. 9999.
Level:	"LOW" < 0.8 Volt "HIGH" > 2.4 Volt
Permissible voltage:	0 to 28 Volt

Switchable scaler (can be programmed from 1 to 255). Pulse frequency up to 20 pulses/second, in connection with max. scaler value up to 5100 pulses/second. Cascade arrangement of several EV-94 units possible, thus allowing unlimited extension of counting range (4 places per unit).

Application eg for: flow quantity (overall quantity counter), piece counter, pulse counter, travel counter, sum counter etc.

Accuracy:

< +/- 0.5% ±1 digit

Display:

Red LED with 4 digits, 10 mm high.

Range of application:

Standard signal inputs:

- 1999 to 9999 digits. Recommended display range: max. 2000 digits.

KTY87-205: 40.0 to +100.0 °C

Pt1000: -50 to +600 °C

Frequency and counter:

-1999 to 9999 digits

Scale:

(can be adjusted via buttons or interface).

Standard signal inputs:

Any decimal point can be selected. Display range freely adjustable by entering of start and end values.

Resistance input:

Two characteristic sensor curves with preset measuring range implemented. Zero point offset can be carried out after entering an offset value.

Frequency:

Any decimal point can be selected. Freely adjustable gradient by entering the highest possible frequency and the corresponding display value.

Counter input (counter):

Any decimal point can be selected. Freely adjustable gradient by entering the number of pulses and the corresponding display value. Switchable scaler (1 to 255).

Filter:

Digital filter, can be selected via buttons or interface.

0 = no interference rejection
(approx. 2 to 3 measurements/second).

1 = interference rejection filter active
(approx. 1.5 seconds delay).

2 = Interference filter active (same as 1 but fault code FE5 displayed in addition in case of continuous measuring interference).

Switching outputs:

2 individual transistor switching outputs (GND switching).

Switching current: 50 mA

Switching voltage: 30 V DC

Possible configurations:

Display

2-level controller

Common min./max. alarm

2-level controller with min./max. alarm

3-level controller

Individual min./max. alarm generator

Counter with preselector switch

Alarm delay:

Range from 0 to 99 minutes can be set.

Limitation of set-point value:

Automatic with regard to the display range set.

Supervisory function:

Broken sensor and sensor short-circuit

Values above/below permissible range

Self-diagnosis integrated

Hardware-Watchdog.

Segment test:

Automatic whenever unit is switched on.

Data storage:

All values programmed will be stored for at least 10 years even without current supply (EEPROM).

Interface:

Standard RS485-interface. Up to 16 units can be connected in a network via this 2-wire interface (Units no. 0 to 15 can be directly addressed via front-side keys or via interface).

Connection to interface RS232: Via interface converter GRS 485 or via any commercial interface adaptor RS232 to RS485.

Supply voltage:

9 to 28 V DC

Current consumption:

Max. 60mA at 12V DC (without interface!)

Housing:

Glass-fibre reinforced Noryl.

Dimensions: 24 x 48 mm

Mounting depth: approx. 65 mm

Panel mounting:

With stainless steel spring clip.

Panel thickness from 1 to approx. 10 mm.

Panel cutout: $21.7^{+0.5} \times 45^{+0.5}$ (h x w)

Electric connection:

Standard connection by means of screw type/plug-in terminals: 2-pin for interface and 8-pin for all remaining connections. Wire diameters from 0.14 to 1.5².

IP-rating:

IP54 with optional O-rings for front side.

Special accessories:

GNR 10: power pack with switching relay.

GRS 485: power pack converter.

GSOFT10: software package for personal computer.

EV-94 Config: Configuration-Software for PC

8. EXAMPLES

8.1. Pressure display with KELLER pressure transmitter

Measuring range: 0...200.0 bar
Output signal: 4 to 20 mA

Adjustment of EV-94 to the transmitter.

- Remove red front plate.
- Apply supply voltage and wait for segment test to be completed.
- Start configuration process by briefly pressing button 3. The display will show **INP**. *If the EV-94 unit is still running in the normal display mode, pressing of button 3 will initiate the configuration mode. The first menu prompt is always INP (select input signal).*
- Press button 1 or 2 several times till the display shows **4-20**. *When pressing button 1 or 2 for the first time, the EV-94 unit will switch from the menu prompt INP to the input signal actually set. You can, then, select an input signals with the same buttons, ie 4 to 20 mA in our example.*
- Acknowledge input signal selected by pressing button 3. The display will show **INP** again. *After selecting the respective input signal, it has to be acknowledged by pressing button 3. Only then will it be taken over into the internal memory of the EV-94 unit. The EV-94 unit switches back to the menu prompt display.*
- The following menu prompt is called up by pressing button 3 again. The display will show **dP**. *As soon as button 3 has been pressed again, the unit will switch to the next menu prompt.*
- Press button 1 respectively 2 several times till the display shows **---.**
- Acknowledge decimal point selected by pressing button 3 once again. The display will show **dP** again.
- Call up next menu prompt by pressing button 3 again. The display will show **4-20**, with **4** flashing. *The EV-94 unit requests the value, which is to be displayed if an input signal of 4mA has been applied, ie 00.0 in our example.*
- If this is not the case: Set display value to **00.0** using buttons 1 and 2. *Rolling function to be considered.*
- Acknowledge display value by pressing button 3. The display will show **4-20** again.
- Press button 3 once again. The display will show **4-20** with **20** flashing. *The EV-94 unit requests the value which is to be displayed if an input signal of 20mA has been applied, ie 200.0 in our example.*

- Set display value to **200.0** using buttons 1 and 2. *Rolling function to be considered.*
- Press button 3 once again. The display will show **LI**.
- Set display to **0** using buttons 1 and 2.
- Acknowledge by pressing button 3. The display will show **LI** again.
- Press button 3 once again. The display will show **FILt**.
- Set display to **1** using buttons 1 and 2.
- Acknowledge by pressing button 3. The display will show **FILt** again.
- Press button 3 once again. The display will show **nr**. *As we are not using the serial interface in our example, no unit address has to be entered.*

The adjustment of the EV-94 unit to the measuring transducer has been completed. Please proceed to **selecting of the control/supervisory functions and to setting the making/breaking points and alarm limits.**

- Press button 3 once again. The display will show **OutP**. *The first menu prompt of the output configuration is always OutP (select output function).*
- Use buttons 1 and 2 to set display to **no**. *In our example the EV-94 unit is used as a display device only. The outputs are, therefore, not required and will be de-activated by using the parameter no (no output).*
- Acknowledge by pressing button 3. The display will show **OutP**. *As the parameter no has been selected for the menu prompt OutP, the process control integrated in the EV-94 unit will know that no additional inputs are required for the configuration of the making/breaking outputs. The configuration process will be completed by pressing button 3 again.*
- Press button 3 once again. The display will show the actual pressure. The configuration of the EV-94 unit has been completed.

Correct wiring of the EV-94 unit and of the measuring transducer is the main precondition for the unit displaying the correct pressure. Configuration of the EV-94 unit is also possible with the transmitter not connected. In such a case the EV-94 unit will display FE2 (sensor broken) after completion of the configuration.

8.2. Two level humidity control with min./max. alarm

Measuring transducer, measuring range:	0.0 to 100.0 % r.h.	
Output signal:	0 to 10 Volt	
Control (humidity),	Unit on:	50.0 % r.h.
	Unit off:	52.0 % r.h.
Alarm monitoring:	Alarm to be issued if humidity exceeds a value of 60% or falls below 45% for more than 10 minutes.	

Adjustment of EV-94 to the measuring transducer.

- Remove red front plate
 - Apply supply voltage and wait for segment test to be completed.
 - Start configuration process by briefly pressing button 3. The display will show **INP**. *If the EV-94 unit is still running in the normal display mode, pressing of button 3 will initiate the configuration mode. The first menu prompt is always **INP** (select input signal).*
 - Press button 1 or 2 several times till the display shows **0-10**. *When pressing button 1 or 2 for the first time, the EV-94 unit will switch from the menu prompt **INP** to the input signal actually set. You can, then, select an input signal with the same buttons, ie 0 to 10 Volt in our example.*
 - Acknowledge input signal selected by pressing button 3. The display will show **INP** again. *After selecting the respective input signal, it has to be acknowledged by pressing button 3. Only then will it be taken over into the internal memory of the EV-94 unit. The EV-94 unit switches back to the menu prompt display.*
 - The following menu prompt is called up by pressing button 3 again. The display will show **dP**.
 - Press button 1 respectively 2 several times till the display shows **---.**. *Programming of the decimal point will also determine the display resolution. In our example we can choose between resolutions of 1% (display 0 to 100) or 0.1% (0.0 to 100.0) Resolution 0.1% will be selected.*
 - Acknowledge decimal point selected by pressing button 3 once again. The display will show **dP** again.
 - Call up next menu prompt by pressing button 3 again. The display will show **0-10**, with 0 flashing. *The EV-94 unit requests the value, which is to be displayed if an input signal of 0 Volt has been applied, ie 0.0 in our example.*
 - Set display value to 0.0 using buttons 1 and 2. *Rolling function to be considered.*
 - Acknowledge display value by pressing button 3. The display will show **0-10** again.
 - Press button 3 once again. The display will show **0-10** flashing. *The EV-94 unit requests the value which is to be displayed if an input signal of 10 Volt has been applied ie 100.0 in our example.*
 - Set display value to 100.0 using buttons 1 and 2. *Rolling function to be considered.*
 - Acknowledge display value by pressing button 3. The display will show **0-10** again.
 - Press button 3 once again. The display will show **LI**. *In order to prevent the display of incorrect values such as 100.5% r.h. when temperature sensor comes into contact with condensation, the display range of the EV-94 unit has to be limited to the permissible measuring range limits. This is done by selecting 1 in the menu prompt "LI".*
 - Set display to 1 using buttons 1 and 2.
 - Acknowledge by pressing button 3. The display will show **LI** again.
 - Press button 3 once again. The display will show **FILT**.
 - Set display to 1 using buttons 1 and 2.
 - Acknowledge by pressing button 3. The display will show **FILT** again.
 - Press button 3 once again. The display will show **nr**. *As we will not use the serial interface in our example no unit address will have to be entered.*
- The adjustment of the EV-94 unit to the measuring transducer has been completed. Please proceed to **selecting of the control/supervisory functions and to setting the making/breaking points and alarm limits.**
- Press button 3 once again. The display will show **OutP**. *The first menu prompt of the output configuration is always **OutP** (select output function).*
 - Use buttons 1 and 2 to set display to **2P.AL** (2-level controller with alarm).
 - Acknowledge by pressing button 3. The display will show **OutP**.
 - Press button 3 once again. The display will show **2.on**. *The EV-94 unit requests the making point of switching output 2, ie 50.0 in our example.*

- Set switching point to 50.0 using buttons 1 and 2.
- Acknowledge making point by pressing button 3. The display will show **2.on** again.
- Press button 3 once again. The display will show **2.off**. *The EV-94 requests the breaking point of switching output 2, ie 52.0 in our example.*
- Set switching point to 52.0 using buttons 1 and 2.
- Acknowledge breaking point by pressing button 3. The display will show **2.off** again.
- Press button 3 once again. The display will show **AL.HI**. *The EV-94 unit requests the max. alarm limit ie 60.0 in our example.*
- Set unit to alarm limit 60.0 using buttons 1 and 2.
- Acknowledge max. alarm limit by pressing button 3. The display will show **AL.HI**.
- Press button 3 once again. The display will show **AL.Lo**. *The EV-94 requests the min. alarm limit, ie 45.0 in our example.*
- Set unit to alarm limit 45.0 using buttons 1 and 2.
- Acknowledge min. alarm limit by pressing button 3. The display will show **AL.Lo**.
- Press button 3 once again. The display will show **dELA**. *The EV-94 requests input of the alarm delay. This value indicates for how long an alarm condition needs to be active before the digital display unit will issue an alarm, ie 10 minutes in our example.*
- Set display to 10 using buttons 1 and 2. *The delay time will be displayed in minutes.*
- Acknowledge delay time by pressing button 3. The display will show **dELA**.
- Press button 3 once again. The display will show the current humidity.

The configuration of the digital display unit has now been completed.

Correct wiring of the digital display unit and of the measuring transducer is the main precondition for the EV-94 displaying the correct humidity. Configuration of the digital display unit is also possible with the measuring transducer not connected.