Küppers Elektromechanik GmbH

Certified according to DIN ISO 9001

Manual

FAS 100 / FAW 100

Series of Panel Mount and Wall Mount Displays
with Analog and Digital Output

SW-Version

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1 General Information

1.1 Features

The FAS100 / FAW100 are compact, intelligent panel mount (FAS100) or wall mount (FAW100) displays for all flow meters with frequency output.

They can be adjusted to any flow meter, as the K- factor is freely settable. The selectable dimensions include virtually all worldwide used dimensions.

As an option the FAS / FAW100 can be used to display other measuring values like frequency, rpm, temperature, pressure and so on, as long, as these values are available as a frequency signal.

The frequency input is a 24v digital input according to IEC946.

With the built in 4 to 20 mA output the FAS/FAW100 can be used as frequency to current converters with settable frequency response as well.

The 20 point linearization of the input signal (FAS/FAW111, 151) provides the possibility to display also strongly nonlinear signals with high accuracy.

The RS485 interface (FAS/FAW111, 151) makes the implementation in an automatic system easy.

Additionally to the standard 24V DC power supply, also a wide input range 100 – 240V AC mains supply is available (FAW141, 151).

For fast test setups in the lab and easy setup of individual parameters, the PC based control SW EasyControl for WINDOWS ® XP and VISTA is available free of charge.

1.2 Safety

1.2.1 General Safety

All statements regarding safety of operation and technical data in this manual will only apply when the unit is operated correctly in accordance with this manual.

The data for Ingress Protection will only apply when all connectors are caped properly with the corresponding counterpart with the same or better IP rating. Cable glands must be populated with cables with the specified diameter and closed properly. The display cover must be closed.

During operation all openings of the housing must be closed unless otherwise noted in this manual.

All connections to the load and to the supply must be made with shielded cables unless otherwise noted in this manual. This unit must be grounded.

This unit must be supplied by a safety approved power supply with outputs which comply with Safety Extra Low Voltage (SELV).

As a protection against fire in the positive supply a fuse with a current rating not higher than the current carrying capacity of the cable used is required.

Before installing the flow meter and transmitter the user is responsible to ensure that all wetted parts are compatible with the fluid or gas to be measured.

The user has to adhere to the instructions for installing electrical devices and corresponding instructions.

The devices described in this manual may only be connected and operated by authorized and qualified personnel.

1.2.2 Warnings in this manual

NOTE:

Notes provide important information for the correct usage of the equipment. If the notes are not observed, a malfunction of the equipment is possible.

WARNING!

Warnings provide very important information for the correct usage of the equipment. Not observing the warnings may lead to danger for the equipment and to danger for health and life of the user

1.3 Ordering Codes and Accessories

1.3.1 Ordering Code

FAS101	Panel mount display with digital input for 24V signals, 24V DC supply
FAS111	FAS101 with RS485 interface and linearization
FAW101	Wall mount display with digital input for 24V signals, 24V DC supply
FAW111	FAW101 with RS485 interface and linearization
FAW141	FAW101 with additional 100 – 240V AC mains supply
FAW151	FAW111 with additional 100 – 240V AC mains supply

1.3.2 Accessories

Ordering Code	Description
HSA72	DIN Rail Adaptor for FAS100
IPS7-9	Protective front cover IP65 for FAS100
EWS*	Intrinsically safe pickup supply with isolation amplifier
Upon request	Connector M12; 5 pin, type 713
Upon request	cable, 5-pin, black, 5 m with connector M12

2 Getting started

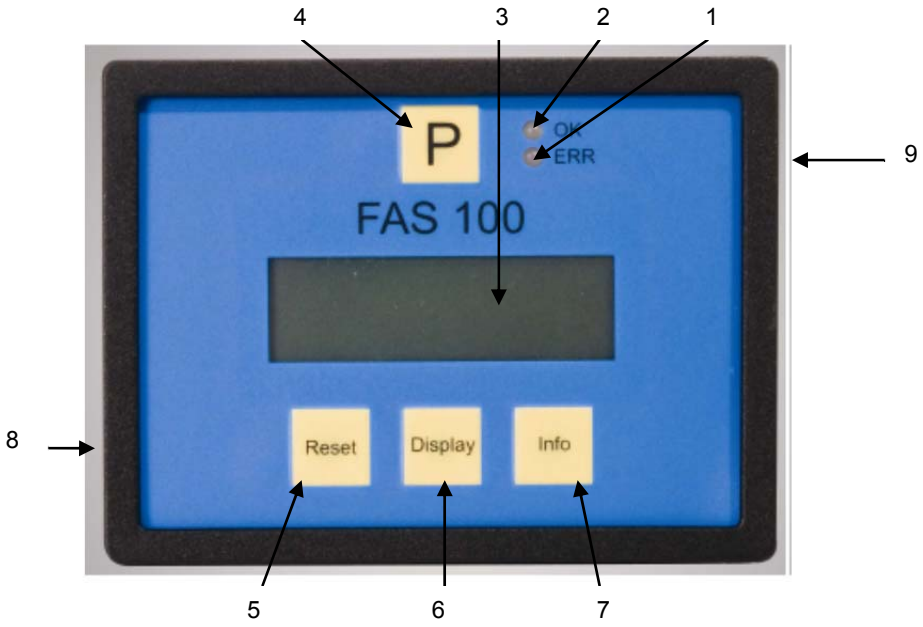
2.1 Unpacking

Verify that you have received the following items:

FAS100 or FAW100
2 fixing clamps (FAS100 only)
This manual

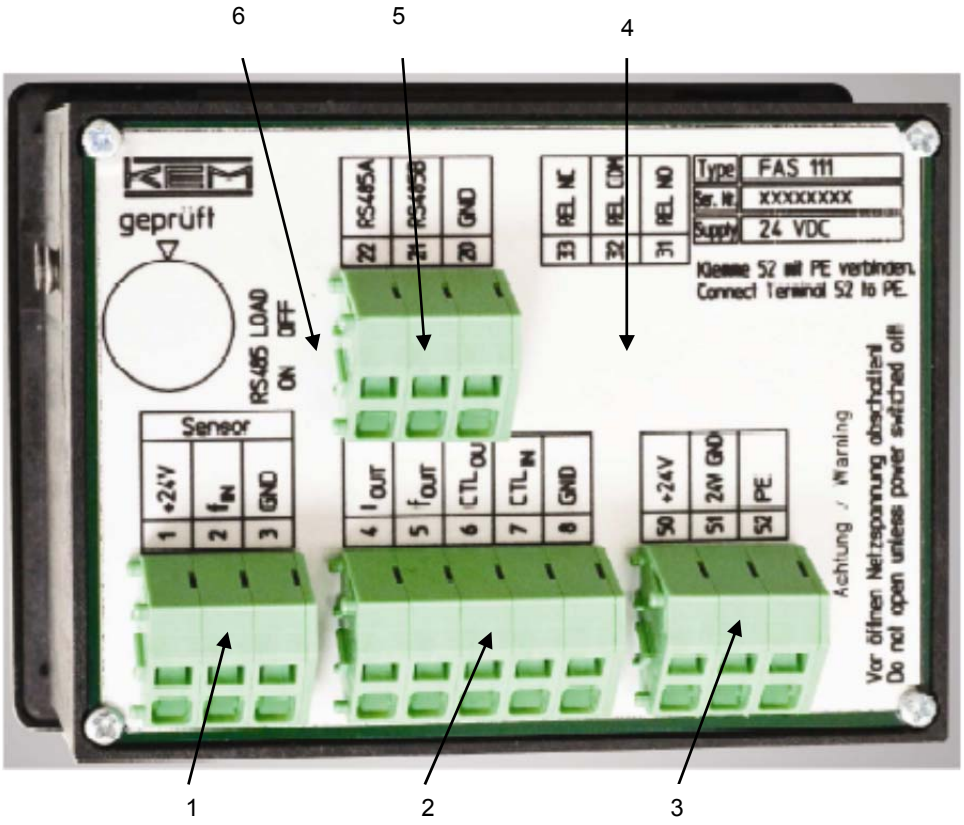
2.2 Operating Elements

2.2.1 Operating elements FAS100 Front Side



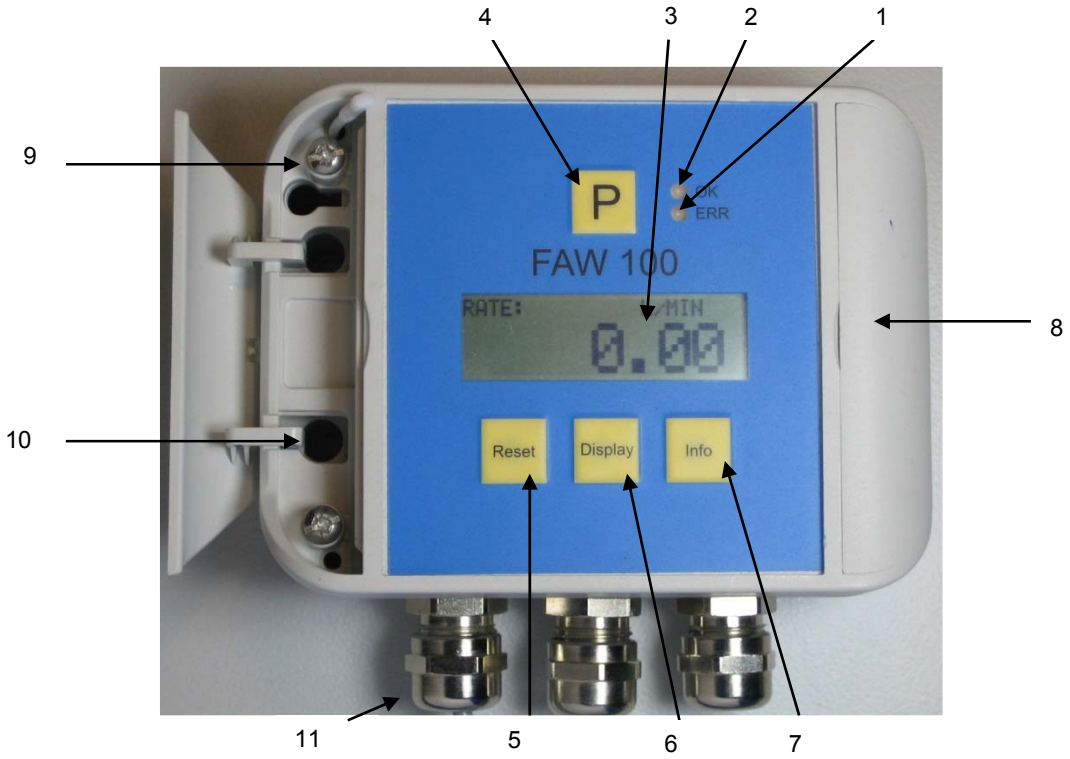
1 = LED „ERR“, flashes red in case of an error
2 = LED „OK“, lights up under normal operation
3 = Display
4 = Taste „P“, opens a selected menu and/or confirms the settings
5 = Taste „RESET“, Measuring: resets “batch”, Setup: Softkey
6 = Taste „DISPLAY“, Measuring: changes the display, Setup: Softkey
7 = Taste „INFO“, Measuring: opens the Info menu, Setup: Softkey
8 = removable fixing clamp left
9 = removable fixing clamp right

2.2.2 Operating Elements FAS100 Back Side



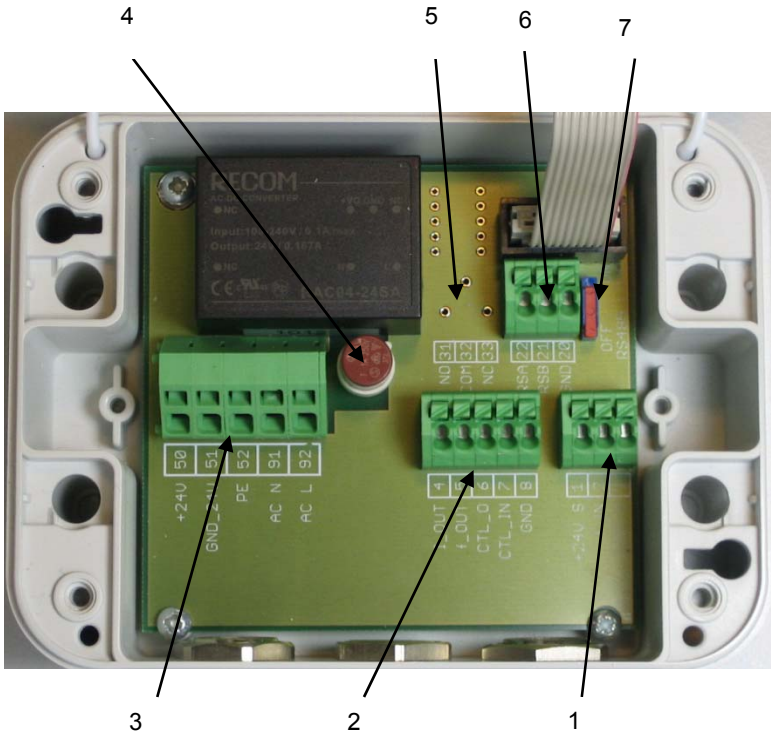
1 = Cage clamp terminals for the pickup
2 = Cage clamp terminals I/O signals
3 = Cage clamp terminals power supply
4 = Cage clamp terminals relay out (option)
5 = Cage clamp terminal RS485 Interface (Option)
6 = Sliding switch for the RS485 terminating resistor

2.2.3 Operating elements FAW100 Front Side



1 = LED „ERR“, flashes red in case of an error
2 = LED „OK“, lights up under normal operation
3 = Display
4 = Push button „P“, opens a selected menu and/or confirms the settings
5 = Push button „RESET“, Measuring: resets “batch”, Setup: Softkey
6 = Push button „DISPLAY“, Measuring: changes the display, Setup: Softkey
7 = Push button „INFO“, Measuring: opens the Info menu, Setup: Softkey
8 = Side cover
9 = Screw for opening the top cover
10 = Mounting hole
11 = Cable gland

2.2.4 Operating Elements FAW100 Connection Board



1 = Cage clamp terminals for the pickup
2 = Cage clamp terminals I/O signals
3 = Cage clamp terminals power supply
4 = Fuse 1AT for mains supply (Option)
5 = Cage clamp terminals relay out (option)
6 = Cage clamp terminal RS485 Interface (Option)
7 = Sliding switch for the RS485 terminating resistor (Option)

2.3 Pin Assignments

Nr	Name	Function
1	+24V	Positive supply for the sensor
2	f_{IN}	Frequency input
3	GND	Ground for the sensor
4	I_{OUT}	Current output 4 – 20mA
5	f_{OUT}	Frequency output (Digital Output A)
6	CTL_{OUT}	Control output (Digital Output B)
7	CTL_{IN}	Control Input
8	GND	Ground for the I/O Signals
20	GND	Ground for RS485
21	RS485B	RS485, Data „B“ resp.. „-„
22	RS485A	RS485, Data „A“ resp. „+„
31	REL NO	Relay, contact “normally open”
32	REL COM	Relay, center contact
33	REL NC	Relay, contact “normally closed”
50	+24V	Power Supply, +24V DC
51	24V GND	Power Supply Ground
52	PE	Protective Earth
91	AC N	Power Supply 100 – 240V AC Neutral
92	AC L	Power Supply 100 – 240V AC Life

For an exact description of all inputs and outputs see chapter 3.1.2.

2.4 Quick start

WARNING:

As for safety and accuracy reasons many precautions must be taken, read chapter 3 carefully before installing the unit!

In case the unit has only to be operated for testing or learning purpose, the following connections have to be made (see chapter 3.1.2):

- Connect the 24V DC or the mains supply
- Connect – if required – a pickup or a frequency generator
- The frequency and analog outputs as well as the interface may be connected as well, if those features are required

WARNING:

If the unit is connected to a bigger system, for your personal safety connect the protective ground as well!

2.4.1 First Operation

Make sure that all mechanical and electrical connections are made properly.

Switch on the power supply.

After the power up sequence the display shows the preselected values.

If a frequency is applied to the input, the corresponding flow will be calculated according to the set k- factor and will be displayed.

The display can be altered by pressing the key “Display”.

The device status information can be viewed by pressing the key “Info” for 3 seconds.

If the function is activated, the BATCH reading can be reset to zero by pressing the key “Reset”.

For entering the SETUP menu press “P” for 3 seconds.

2.4.2 Manual Control

In the manual control menus all configurations can be made. The submenus, in which the functionality of the FAS/FAW100 or any factors can be altered, are protected by passwords.

The menu itself is self-explaining, the function of the softkeys (5, 6, 7) is indicated in the display above the pushbutton.

For entering the manual control menu press the pushbutton “P” (4) for 3 seconds.

Select the desired submenu with “UP” or “DOWN” and confirm with “P” (4).

If the submenu is protected by password, the display shows:

Change the indicated number with the softkeys “LEFT” and “UP” (6) to “882207” and confirm with “P” (4).

Select the desired submenu or function with “UP” or “DOWN” and confirm with “P” (4).

Every setting must be confirmed with “P” (4) for storing the setting or with “EXIT” for exiting without storing.

For leaving any menu press “EXIT” (7) several times until the measuring menu reappears.

3 Installation

NOTE

All installations must only be executed by qualified personnel.

3.1 Mechanical Installation

3.1.1 Mechanical Installation of FAS100

Put the FAS100 from the front side into the prepared panel cut out.

The width of the cutout must be 92mm +0.8/-0.0mm, the height 68mm +0.7/-0.0mm.

Put the fixing clamps on the knobs on the side of the housing.

Fix the screws with a small screw driver until the housing is properly fixed.

3.1.2 Mechanical Installation of FAW100

Prepare the wall with the required holes or threads for mounting the FAW100 (see chapter 7.3.2).

Open the side covers of the FAW100.

Screw the FAW100 with suited screws to the wall.

For opening the FAW100 and making the electrical connections open the 4 screws underneath the side cover and remove the top cover.

3.2 Electrical Installation

Make sure that the unit is properly mounted before making the electrical connections.

NOTE:

Switch off the power supply before making changes at the electrical installation.

This unit must be grounded.

The FAS/FAW100 requires a regulated DC power supply of 24V nominal and works properly over a supply range of 11V to 30V.

For connecting the FAS/FAW100, shielded cables must be used. The shield should be connected to the PE terminal. If in bigger systems the shield must not present a DC connection for avoiding high ground loop currents, make the ground connection of the shield via a capacitor of e. g. 100nF.

WARNING

Improper grounding and shielding may lead to bad EMC behavior or danger to your health!

NOTE

Make sure that all cable and wires are connected and fixed properly before applying power to the FAS/FAW100.

3.2.1 Electrical Installation FAS100

Prepare the cable for installation:

- Separate the single conductors for the required length
- Strip the end for about 7mm and cover it with a cable end sleeve
- Connect if necessary a stranded wire to the shield

Connect the wire according to chapter 3.2.3 to 3.2.6.

3.2.2 Electrical Installation FAW100

Prepare the cable for installation:

- Separate the single conductors for about 8cm
- Strip the end for about 7mm and cover it with a cable end sleeve
- Connect if necessary a stranded wire to the shield

Feed the cable through the cable gland.

Connect the wire according to chapter3.2.3 to 3.2.6.

Adjust the position of the cable in the cable gland in that way that the single conductors remain short but free of tension and fix the cable in the cable gland.

Ex work 2 cable glands are closed with a blind cover. Use those blind covers for closing unused cable glands.

3.2.3 Power Supply and Grounding

3.2.3.1 24V DC Power Supply

The DC powered FAS/FAW100 requires a regulated power supply of 24V and works properly with 11V to 30V.

The power supply input of the FAS/FAW100 has an internal diode against reverse polarity and is protected by a 315mA fuse. As a protection against fire in case of a short in the supply cable, the output of the power supply must be equipped with a fuse with a rating not higher than the current carrying capacity of the cable used.

Connect the ground of your power supply to terminal 51 and the +24V to terminal 50. (See figure below)

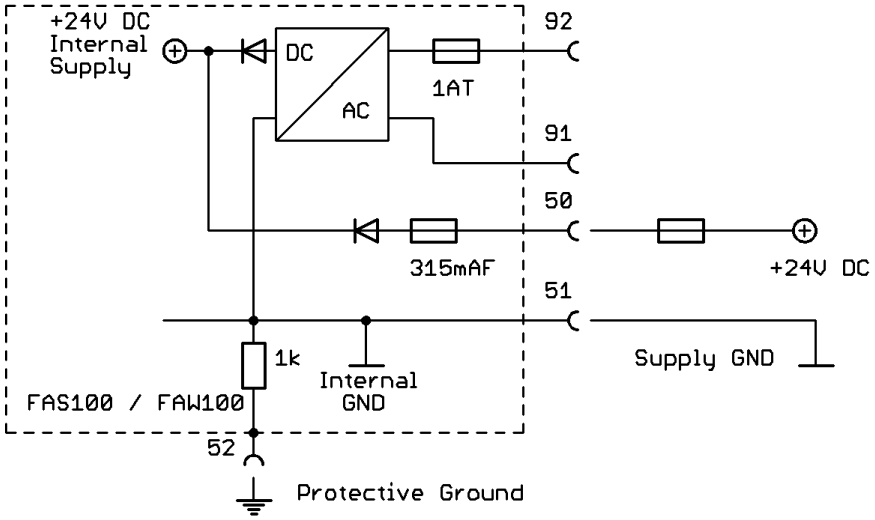


Fig. 1: Wiring diagram for power connections, DC supply

Terminal	Description
50	Positive supply Voltage, 24V, referred to pin 51
51	Ground potential for supply voltage
52	Protective ground

The ground terminals 3, 8, 20 and 51 are internally connected together.

Ground and protective ground are internally connected via a 10kΩ resistor and 100nF in parallel. For proper operation the difference between PE and GND should be limited to 5V.

NOTE:

For best EMC behavior a low ohmic external connection between PE and GND is recommended.

3.2.3.2 100 to 240V AC Mains Supply

The AC version of the FAW100 requires a nominal power supply of 100 – 240V AC and operates over a range of 90 – 264V AC.

The power supply input of the FAW100 is protected by a 1A slow blow fuse. As a protection against fire in case of a short in the supply cable, the output of the power supply must be equipped with a fuse with a rating not higher than the current carrying capacity of the cable used.

For the mains powered units a good connection of PE is mandatory. The cross section of the PE cable should be at least the cross section of the supply cable or 1mm², whichever is higher.

Connect the supply to terminal 91 (neutral) and 90 (life). (See Fig. 2)

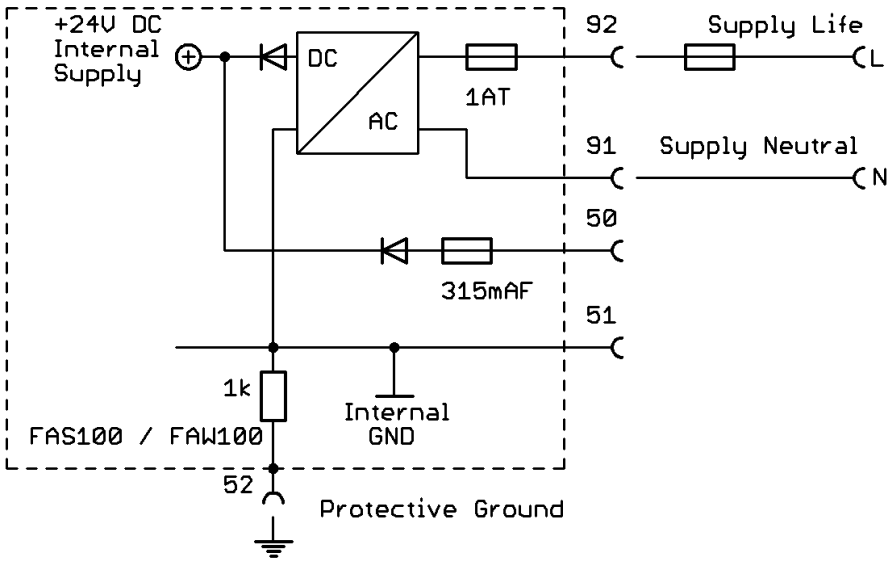


Fig. 2: Wiring diagram for power connections, AC supply

Terminal	Description
90	Mains life, referred to pin 91
91	Mains neutral
52	Protective ground

The ground terminals 8, 20 are not connected to terminal 91.

3.2.3.3 DC and AC supply

The FAW141 / 151 can be connected to a 24V DC and a mains supply simultaneously.

If the DC voltage is above 25V, the unit will be 100% powered by the DC supply. With a DC voltage below 23V, the unit will be fully powered by the AC supply. Between 23V DC and 25V DC the unit might be powered either by DC or by AC or by both supplies.

The unit will operate properly as long as one of the 2 supplies is present.

With an AC powered unit an uninterrupted power supply can be realized by just connecting a backup battery of 12 to 20V to the DC supply pins. Calculate the capacity of the backup battery according to the supply current of FAW100 (about 20mA) plus pickup and the desired operation time.

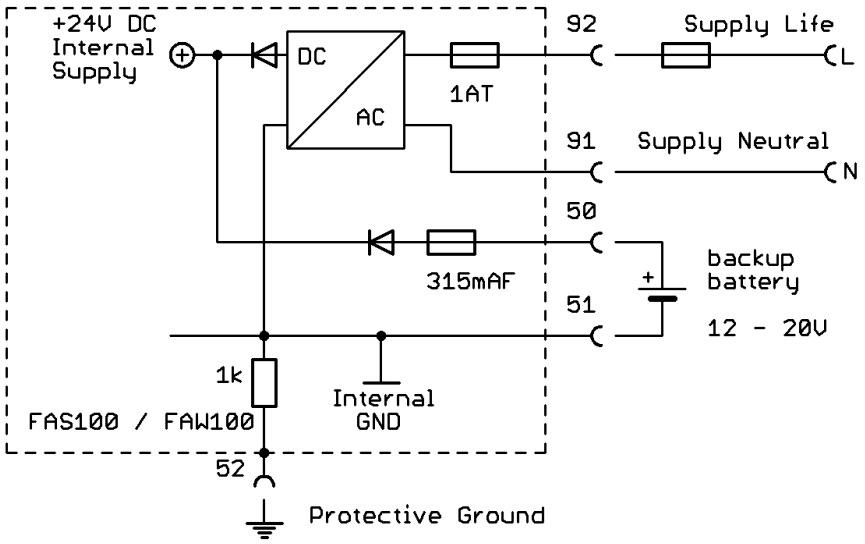


Fig. 3: Wiring diagram for AC supply with battery backup

NOTE

The backup battery will not be charged by the FAW100!

3.2.4 Pickup

The interface to the pickup is made that way that KEM pickups with push pull or open collector outputs can be connected directly.

With DC supply the sensor supply voltage (terminal 1) is about 0.5 to 1V lower than the supply voltage applied to the FAS/FAW100. With AC supply the sensor supply voltage is 24V ±10%.

The supply to the pickup is internally protected by a fuse. If the fuse blows, e.g. caused by a short circuit on the connection to the pickup, the FAS/FAW100 must be opened for replacing the fuse (see chapter 6.2).

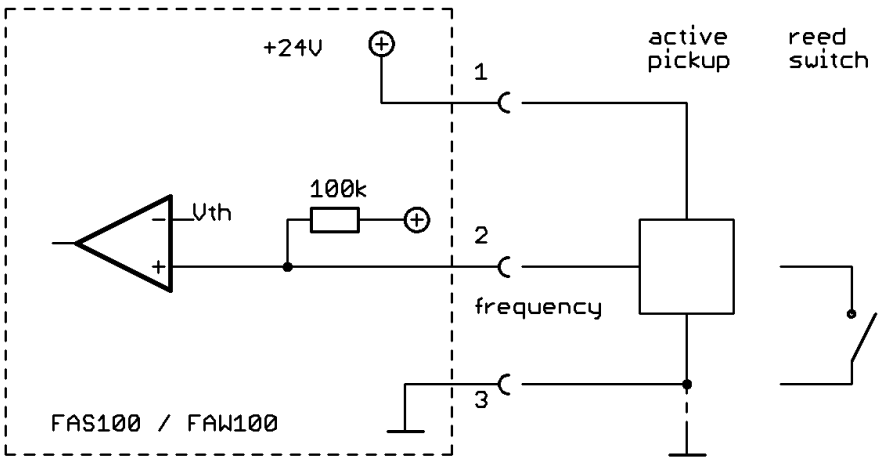


Fig. 4: Wiring diagram for the pickup

The frequency input (terminal 2) is built in accordance to DIN IEC 946. It has an internal pull up of 1MΩ. For pickups with open collector output, an additional external pull up with 10 kΩ – 100 kΩ might be recommended, especially if long cables are used.

With a 24V supply, the typical input threshold levels are about 11.9V for a low to high and about 9.7V for a high to low transition.

The ground terminals 3, 8, 20 and 51 are internally connected together.

3.2.5 Digital inputs and outputs

The control input (terminal 7) is built in accordance to DIN IEC 946. It has an internal pull up of 1MΩ. For pickups with open collector output, an additional external pull up with 10 kΩ – 100 kΩ might be recommended, especially if long cables are used.

With a 24V supply, the typical input threshold levels are about 11.9V for a low to high and about 9.7V for a high to low transition.

The input can be driven via a switch to GND, an open collector output or a push pull output.

The digital outputs (terminal 5 and 6) are push- pull outputs with 220Ω resistors (R1, R2).

In case of a load resistor to ground the output voltages are:

$V_{high} = (V_{supply} – 0.5V) * R_{load} / (220Ω + R_{load})$

$V_{low} < 0.5V$

In case of a load resistor to the positive supply the output voltages are:

$V_{high} > V_{supply} – 0.5V$

$V_{low} = V_{supply} - V_{supply} * R_{load} / (220Ω + R_{load}) + 0.5V$

The output current is internally limited to about 25mA and the outputs withstand a short circuit to GND or to the positive supply for infinite time.

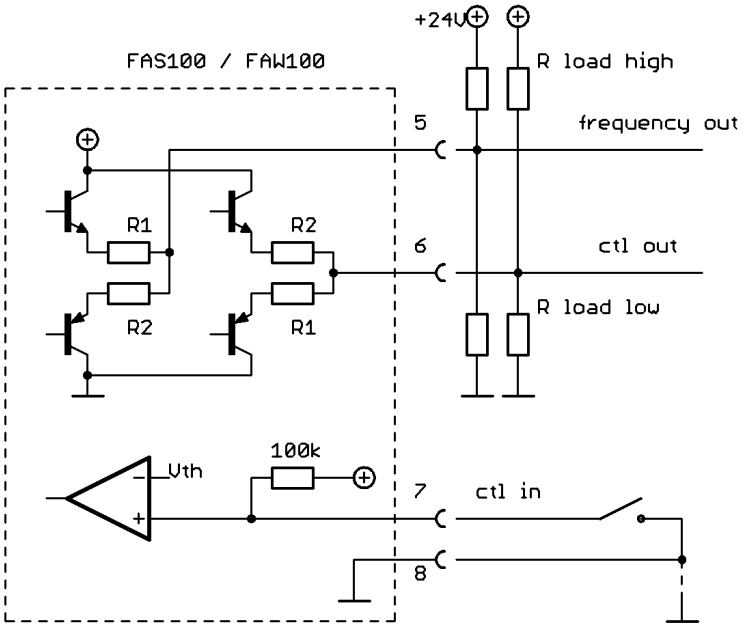


Fig. 5: Wiring diagram for the digital inputs and outputs

The ground terminals 3, 8, 20 and 51 are internally connected together.

3.2.6 Analog Output

The analog output (terminal 4) drives a current respect to GND (terminal 8).

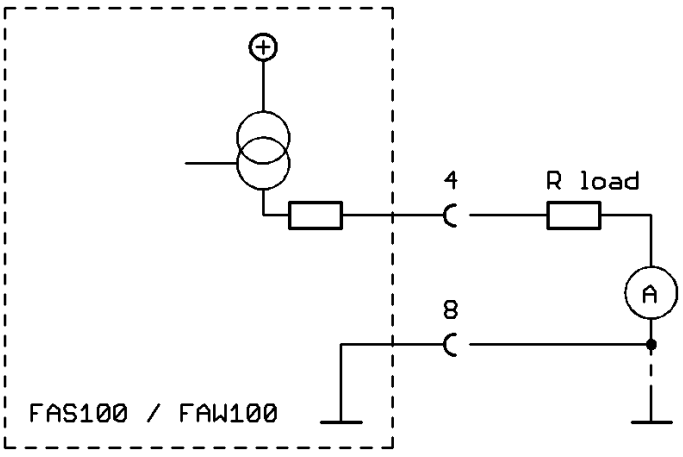


Fig. 6: Wiring diagram for the analog output

The maximum allowed load resistance is about:

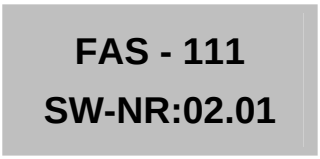
$R_{Load\ max} = (V_{supply} – 2V) / 21mA$

The output withstands a short circuit to GND for infinite time.

4 Manual Operation

4.1 Power On Sequence and Principles of Manual Control

For about 2 second the display shows the device name and the SW version:



Now the FAS100 switches to the measuring mode, displaying the default screen:

In case of an error the red LED “ERR” flashes.

In manual control the FAS100 is menu driven and provides 2 operational modes, the “Measuring Mode” and the “Control Mode”.

In the measuring mode the display shows the preselected measured values and all 4 pushbuttons have the function printed on them. The switch over between the different measuring displays and the INFO display can be made at any time without interrupting the measurements.

In the control mode the 3 pushbuttons below the display have varying functions. The actual function is indicated in the display, just above the pushbutton.

In the control menu all necessary settings can be made.

The control menu contains the submenus “DISPLAY”, “SETUP”, “LINEAR” (only units with built in linearization), “I/O-TEST” and “SERVICE”.

In the menu “DISPLAY” the local display of the unit can be adapted to the actual needs. All settings made in this menu have no influence on the measurements.

In the menu “SETUP” all settings to adapt the unit to the actual needs can be made, like configuring the inputs and outputs.

In the menu “I/O-TEST” all inputs and outputs can be tested after the installation.

In the menu “LINEAR” (linearization) the parameters for the built in linearization can be set.

The menu “SERVICE” allows for calibration of the unit.

For protecting the unit against unintentional changes by unauthorized personnel, the menus “SETUP”, “LINEAR” and “I/O-TEST” are protected by a user password and the menu “SERVICE” by a service password.

4.2 Measuring mode

4.2.1 Function of the keys

In the measuring mode all pushbuttons have a fixed function:

P	Opens the Control Menu if pressed for about 3 seconds
Reset	Resets the batch counter to zero, if the function “KEY RESET” is enabled
Display	Toggles the display between the different screens.
Info	Opens the info menu

4.2.2 Display selection

The FAS100 provides several display screens with different content.

For changing from on display to the other just press the pushbutton “Display”.

For changing the settings of the displays refer to chapter 4.3.3.1

4.2.3 Resetting the batch value

For easy batching in local operation the FAS100 provides the possibility to reset the batch value by pressing the pushbutton “Reset”.

For protecting the unit against unintentional resetting of the batch value, this function can be disabled.

Ex work the function is disabled.

For changing the setting refer to chapter 4.3.4.10

4.2.4 Error Menu

For easy debugging in case of a malfunction of the system, the FAS100 provides an info menu for the service personnel. It does not contain information required for normal operation.

For entering the menu press the pushbutton “Info” for about 3 seconds.

For returning to the normal menu press “Display”.

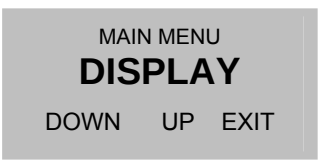
4.3 Control Mode

In the control mode the FAS100 can be adapted to the individual application. As unintentional changes of the settings might cause problems, some submenus are password protected.

To enter the control mode proceed as follows:

Press “P” for about 3 seconds

The display shows:



Select the desired submenu with “UP” and “DOWN” and confirm with “P” or skip with “EXIT”.

4.3.1 Function of the keys

In the setup menu some pushbuttons have changing functions, indicated in the display above the pushbutton:

P	Confirms the selection in a list or any kind of inputs
Reset	Performs the indicated function
Display	Performs the indicated function.
Info (EXIT)	Exits the current menu point without altering the original value

4.3.2 Submenus in the Main Menu

In the Main Menu the following submenus are addressable:

DISPLAY:
Presetting the display.
Changes made in this submenu have no influence on the general function as well on the accuracy of the unit.

SETUP:
Adjusting the FAS100 to the meter and configuring the inputs and outputs.
This submenu is password protected.

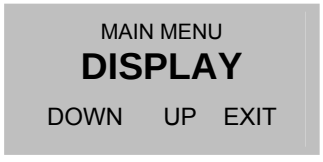
LINEAR:
Setting the parameters for the linearization.
Not available in all units of the FAS series.
This submenu is password protected.

I/O-TEST:
Setting the outputs to defined values and displaying the actual status of the control inputs for testing the electrical connections.
This submenu is password protected.

SERVICE:
Calibrating the outputs.
This submenu is password protected.

4.3.3 DISPLAY Menu

Select in the main menu



Press “P”. The display shows

The following submenus are available:

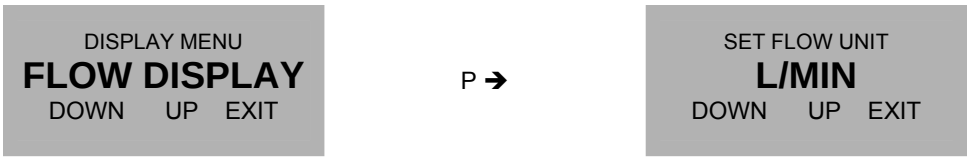
FLOW DISPLAY:
Setting the flow units, the flow decimal point and a flow filter for the display.

TOTAL DISPL:
Setting the total and batch units and the total and batch decimal point.

DENS DISPLAY:
Setting the density units.

4.3.3.1 FLOW DISPLAY menu

In the submenu “FLOW DISPLAY” the flow dimensions, the flow decimal point and the flow filter for the display can be set.



The following units (volume or mass per time) can be selected:

time-Unit	Description
S	second
MIN	minute
H	hour
D	day

Volume-Unit	Description
CC	cubic centimeter
L	liter
m3	cubic meter
UGAL	US gallon
LOZ	fluid ounce
EGAL	English gallon
BBL	English barrel

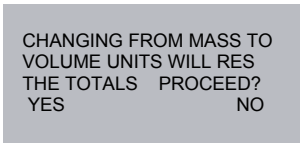
Mass-Unit	Description
G	gram
KG	kilogram
LB	pound
OZ	dry ounce
T	metric ton
ST	stone

NOTE:

When mass units are selected, a correct setting of the density (see chapter) is required.

Use the keys “UP” and “DOWN” to select setting the engineering unit and confirm with “P” or skip with “E”.

If the units are changed from volume to mass or vice versa, the display shows:

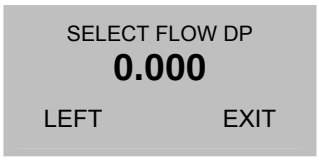


NOTE:

When changing from mass to volume units or vice versa, the total unit will be changed correspondingly.

When pressing “NO”, the changes will be discarded.

The display shows:



Use the key “LEFT” to select the desired decimal point position and confirm with “P” or skip with “EXIT”.

The display shows

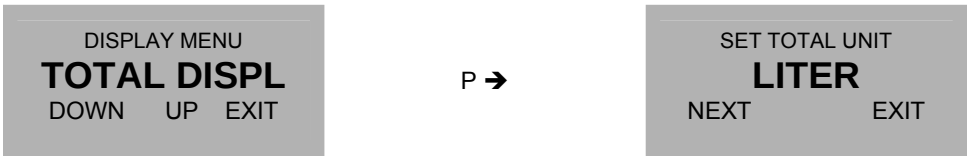
The time constant t is the time the output needs after a jump from x to 0 to go to x/e = x/2.72.

Use the keys “UP” and “LEFT” to select the desired time constant and confirm with “P” or skip with “EXIT”.

The display returns to the display menu

4.3.3.2 TOTAL DISPL menu

In the submenu “TOTAL DISPL” the total and batch dimensions and decimal point can be set.



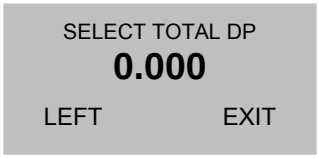
The following units (volume or mass, depending on the selected flow unit) can be selected:

Volume-Unit	Description
CC	cubic centimeter
L	liter
m3	cubic meter
UGAL	US gallon
LOZ	fluid ounce
EGAL	English gallon
BBL	English barrel

Mass-Unit	Description
G	gram
KG	kilogram
LB	pound
OZ	dry ounce
T	metric ton
ST	stone

Use the key “NEXT” to select setting the engineering unit and confirm with “P” or skip with “EXIT”.

The display shows:

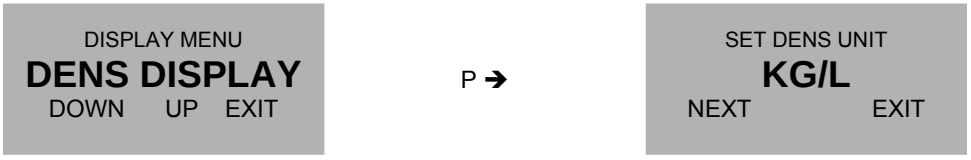


Use the key “LEFT” to select the desired decimal point position and confirm with “P” or skip with “EXIT”.

The display returns to the display menu

4.3.3.3 DENS DISPLAY menu

In the submenu “DENS DISPLAY” the density dimension can be set.



The following units (mass per volume) can be selected:

Unit	Description
G/CC	gram per cubic centimeter
g/L	gram per liter
KG/L	kilogram per liter
LB/FT3	pound per cubic feet
LB/UGAL	pound per US gallon
KG/M3	kilogram per cubic meter

Use the key “NEXT” to select setting the engineering unit and confirm with “P” or skip with “EXIT”.

The display returns to the display menu

4.3.4 SETUP Menu

Select in the main menu

Press “P”. The display shows

Change the indicated number with “LEFT” and “UP” to 882207 and confirm with “P”.

If a wrong code is entered, the display shows “ERROR” for about 2s and then asks for a new input.

When the correct code is entered the display shows:

The following submenus are available:

K-FACTOR:
Defines the relation between the input frequency and the calculated flow.

CUT-OFF:
Sets the cut off frequency for the flow.

FLOW-FILTER:
Sets the filter time constant for the flow.

DENSITY:
Sets the density required for calculating mass and mass flow.

DIG.OUT A:
Configures the digital output A (frequency and control output).

DIG.OUT B:
Configures the digital output B (control output).

ANALOG-OUT:
Configures the analog output.

CTL-INPUT:
Configures the control input.

LINEAR:
Enables / disables the linearization.

KEY-RESET:
Enables / disables the push button “Reset”.

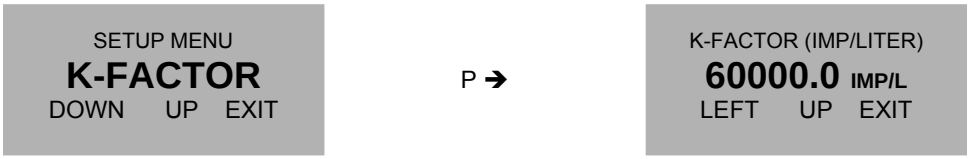
SAVE DATA:
Stores the current settings to the backup memory.

RECALL DATA:
Recalls the stored settings from the backup memory.

4.3.4.1 K-FACTOR menu

In the submenu “K-FACTOR” the k- factor for the flow calculation can be set.

The k- factor is normally given on the calibration sheet of the meter.



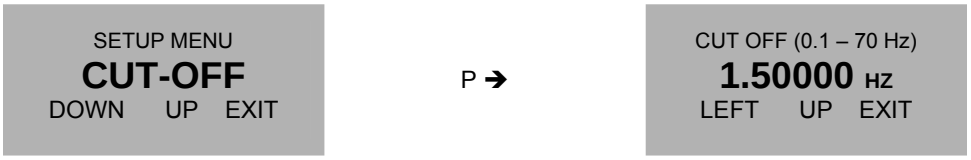
Use the keys “LEFT” and “UP” to select the desired value and confirm with “P” or skip with “EXIT”.

The display returns to the setup menu.

4.3.4.2 CUT-OFF menu

In the submenu “CUT-OFF” the cutoff frequency for the input can be set.

If the filtered input frequency is below the cutoff frequency, the calculated flow is “0” and consequently all outputs show zero flow and the total and batch value remain unchanged.



Use the keys “LEFT” and “UP” to select the desired value and confirm with “P” or skip with “E”.

The display returns to the setup menu.

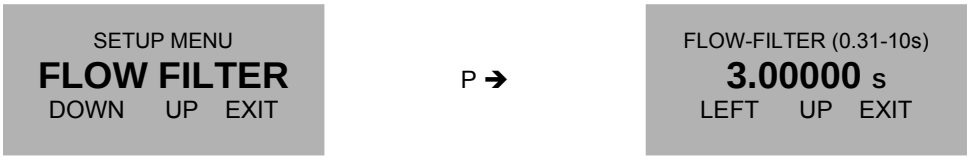
4.3.4.3 FLOW-FILTER menu

In the submenu “FLOW-FILTER” the time constant for the flow filter can be set.

The time constant t is the time the output needs after a jump from x to 0 to go to x/e = x/2.72.

A rough relation between the time and the filtered flow value after a jump is

Elapsed time	Remaining error (% of the step)
1 * t	30
2 * t	10
3 * t	3
4 * t	1



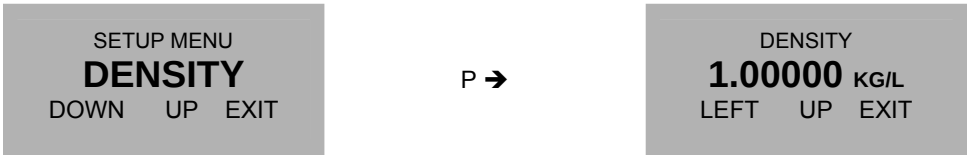
Use the keys “LEFT” and “UP” to select the desired value and confirm with “P” or skip with “EXIT”.

The display returns to the setup menu.

4.3.4.4 DENSITY menu

In the submenu “DENSITY” the density value for calculating mass and mass flow can be set.

A correct value for the density is required, if a mass and mass flow is to be measured.



Use the keys “LEFT” and “UP” to select the desired value and confirm with “P” or skip with “EXIT”.

The display returns to the setup menu.

4.3.4.5 DIG.OUT A menu

In the submenu “DIG.OUT A” the frequency output can be configured.

> **NOTE:**
>
> If the unit does not have an adjustable frequency output (e.g. a FAS101), this submenu is not available.

The following settings are possible:

F-OUT 1:1:
The output frequency equals the input frequency. A linearization will not be regarded.

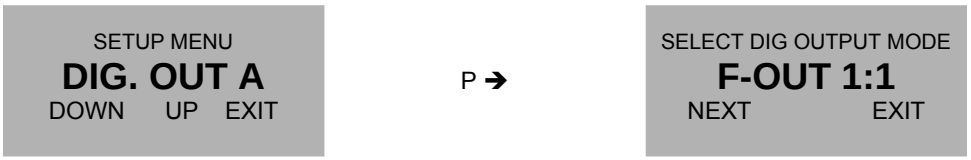
F OUT NORM:
The output frequency is derived from the calculated flow. If a linearization is active, the output frequency is linearized as well.
The output frequency range is 1.2 to 1000 Hz.

TOTAL COUNT:
For each selected increment of total the output produces a pulse.

FLOW LIMIT:
The output changes its state if the calculated flow exceeds the set limit value.

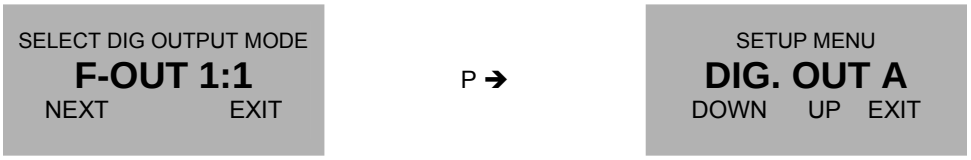
BATCH LIMIT:
The output changes its state if the batch value exceeds the set limit value.

OFF:
The output is disabled.



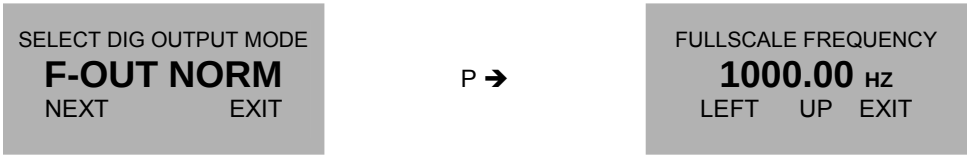
Use the key “NEXT” to select the desired operation mode and confirm with “P” or skip with “EXIT”.

F-OUT 1:1:



The unit sets the F-OUT 1:1 mode and returns to the setup menu.

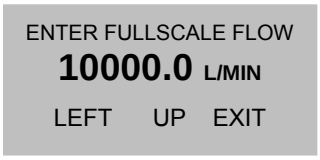
F OUT NORM:



Use the keys “LEFT” and “UP” to select the desired value and confirm with “P” or skip with “EXIT”.

> **NOTE:**
>
> The output frequency range is 1.2 to 1000Hz. Calculated frequencies lower than 1.2Hz produce a zero output, frequencies higher than 1000 Hz will be set to 1000 Hz.

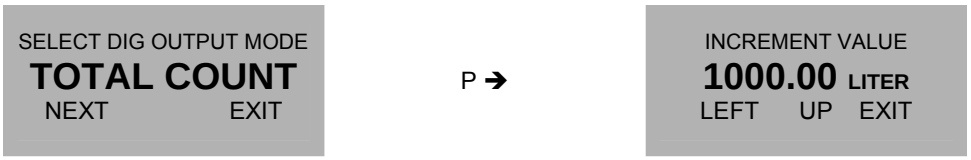
The display shows:



Use the keys “LEFT” and “UP” to select the desired value and confirm with “P” or skip with “EXIT”.

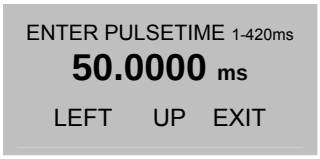
The display returns to the setup menu

TOTAL COUNT:



Use the keys “LEFT” and “UP” to select the desired value and confirm with “P” or skip with “EXIT”.

The display shows:



Use the keys “LEFT” and “UP” to select the desired value and confirm with “P” or skip with “EXIT”.

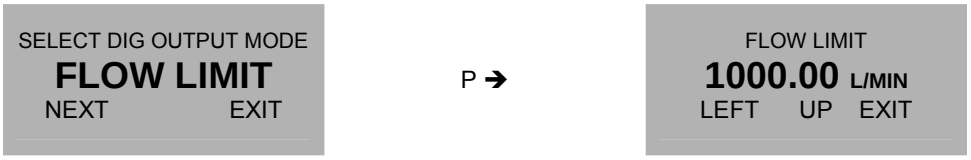
The display shows:

Active HIGH means that the output is normally low and produces a “HIGH” pulse, active low is the opposite.

Use the key “NEXT” to select the desired operation mode and confirm with “P” or skip with “EXIT”.

The display returns to the setup menu

FLOW LIMIT:



Use the keys “LEFT” and “UP” to select the desired value and confirm with “P” or skip with “EXIT”.

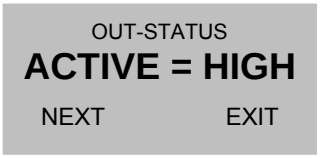
The display shows:

The high going threshold is FLOW LIMIT + HYSTERESIS, the low going is FLOW LIMIT – HYSTERESIS.

With a FLOW LIMIT of 10 l/min and 5% hysteresis, the active going value is 10.5 l/min, the inactive going value 9.5 l/min

Use the keys “LEFT” and “UP” to select the desired value and confirm with “P” or skip with “EXIT”.

The display shows:

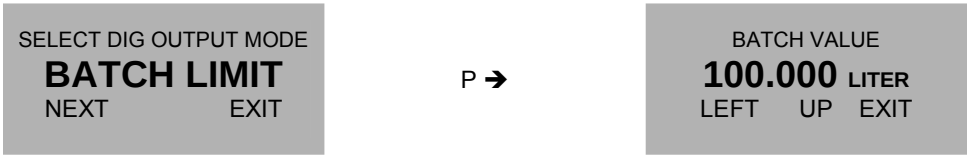


Active HIGH means that the output is low for low flow and high for a flow above the threshold, active low is the opposite.

Use the key “NEXT” to select the desired operation mode and confirm with “P” or skip with “EXIT”.

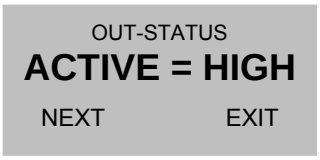
The display returns to the setup menu

BATCH LIMIT:



Use the keys “LEFT” and “UP” to select the desired value and confirm with “P” or skip with “EXIT”.

The display shows:



Active HIGH means that the output is low for a batch below the set “BATCH VALUE” and high for a batch above “BATCH VALUE”, active low is the opposite.

Use the key “NEXT” to select the desired operation mode and confirm with “P” or skip with “EXIT”.

The display returns to the setup menu

OFF:

The unit sets the output to OFF and returns to the setup menu.

4.3.4.6 DIG.OUT B menu

In the submenu “DIG.OUT B” the control output can be configured.

The following settings are possible:

FLOW LIMIT:
The output changes its state if the calculated flow exceeds the set limit value.

BATCH LIMIT:
The output changes its state if the batch value exceeds the set limit value.

For programming the control output see control output A (chapter 4.3.4.5).

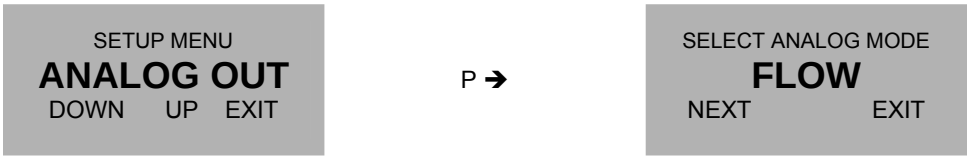
4.3.4.7 ANALOG-OUT menu

In the submenu “ANALOG-OUT” the 4 – 20 mA output can be configured.

The following settings are possible:

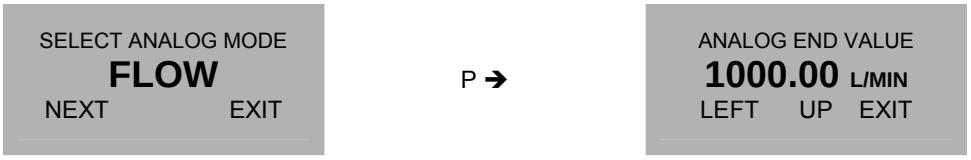
FLOW:
The output current is calculated from the measured flow value. A zero flow gives 4mA, the defined maximum flow gives 20mA.

OFF = 4mA:
The output is set inactive, a connected meter will see 4mA constant current.



Use the key “NEXT” to select the desired operation mode and confirm with “P” or skip with “E”.

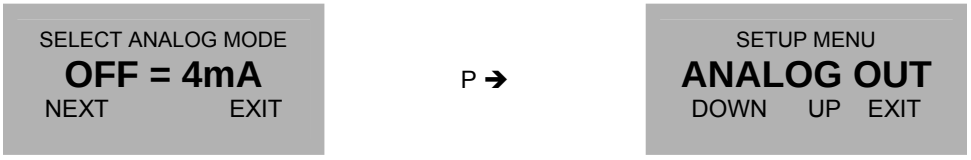
FLOW:



Use the keys “LEFT” and “UP” to select the desired value and confirm with “P” or skip with “E”.

The display returns to the setup menu

4mA:



The unit sets the output to 4mA and returns to the setup menu.

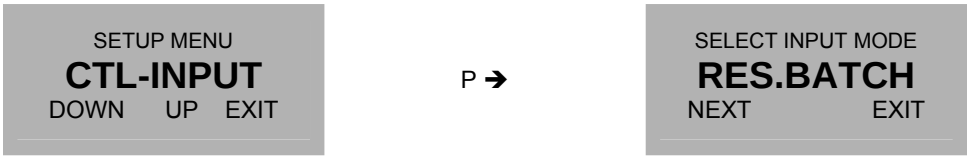
4.3.4.8 CTL-INPUT menu

In the submenu “CTL-INPUT” the control input output can be configured.

The following settings are possible:

RES. BATCH:
An active signal at the control input resets the batch counter to zero.

HOLD:
An active signal at the control input stops summing up the total and batch value.



Use the key “NEXT” to select the desired operation mode and confirm with “P” or skip with “EXIT”.

The display returns to the setup menu

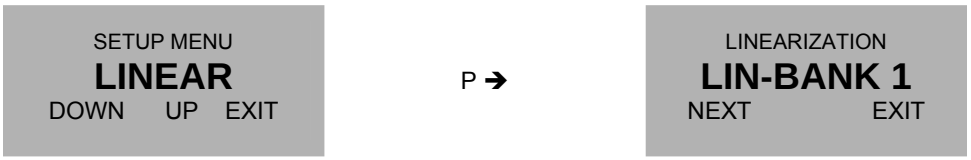
4.3.4.9 LINEAR menu

In the submenu “LINEAR” can be set, if the linearization is disabled or which of the linearization banks is to be used for linearization.

The following settings are possible:

LIN- BANK n:
Linearization bank n (1 … 3) is active.

OFF:
Linearization deactivated.



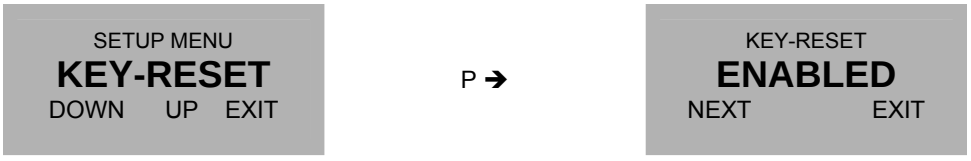
Use the key “NEXT” to select the desired linearization bank or linearization OFF and confirm with “P” or skip with “EXIT”.

The display returns to the setup menu

4.3.4.10 KEY-RESET menu

In the submenu “KEY-RESET” the pushbutton “Reset” can be enabled or disabled.

If the pushbutton Reset is active, it can be used to reset the batch counter.

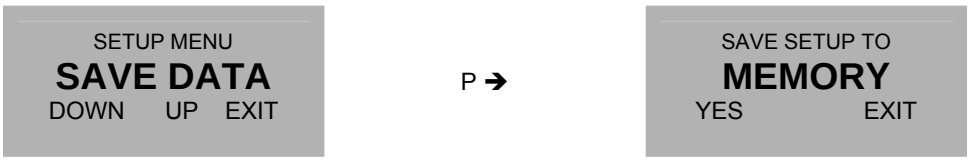


Use the key “NEXT” to enable or disable the pushbutton “Reset” and confirm with “P” or skip with “EXIT”.

The display returns to the setup menu

4.3.4.11 SAVE DATA menu

In the submenu “SAVE DATA” the current settings can be stored in a backup memory. The stored settings can be reactivated with “RELOAD DATA” (see chapter .4.3.4.12.).



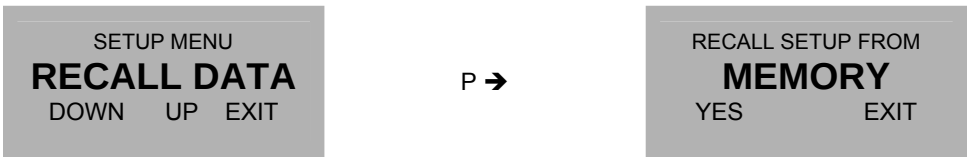
Save the data by pressing “YES” or skip with “EXIT”.

If “YES” is pressed, the display counts up for a few seconds and then shows for 2 seconds:

The display returns automatically to the setup menu

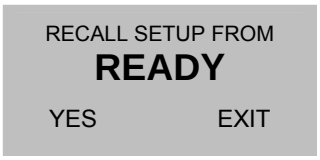
4.3.4.12 RECALL DATA menu

In the submenu “RECALL DATA” the stored settings can be reloaded from the backup memory. This is especially useful for returning to a running setup after trying different settings. For storing data in the backup memory refer to chapter 4.3.4.11.



Recall the data by pressing “YES” or skip with “EXIT”.

If “YES” is pressed, the display counts up for a few seconds and then shows for 2 seconds:



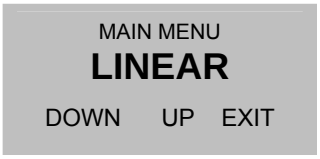
The display returns automatically to the setup menu

4.3.5 LINEAR Menu

In the “LINEAR” menu the data for the built in linearization can be entered.

The data set is organized in 3 independent data banks. In the SETUP menu can be selected, which of the banks (1, 2, 3 or none) is to be used for the linearization.

Select in the main menu



Press “P”. The display shows

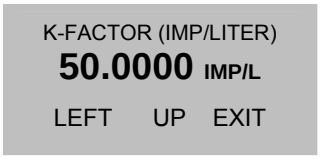
Change the indicated number with “LEFT” and “UP” to 882207 and confirm with “P”.

If a wrong code is entered, the display shows “ERROR” for about 2s and then asks for a new input.

When the correct code is entered the display shows:

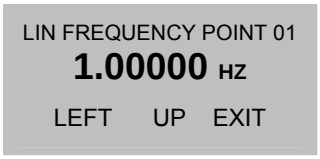
Use the key “NEXT” to select the desired linearization bank and confirm with “P” or skip with “EXIT”.

The display shows:



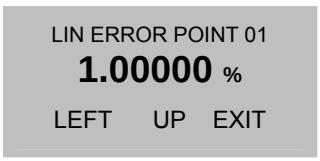
Use the keys “LEFT” and “UP” to select the desired value and confirm with “P” or skip with “EXIT”.

The display shows:



Use the keys “LEFT” and “UP” to select the desired value and confirm with “P” or skip with “EXIT”.

The display shows:

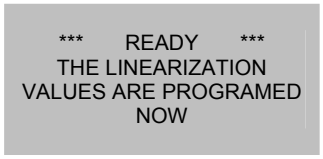


Use the keys “LEFT” and “UP” to select the desired value and confirm with “P” or skip with “EXIT”.

The sequence goes on with the points 2 to 20.

If n < 20 points are to be entered, set for the linearization point n+1 the frequency to “0”.

If the frequency “0” is entered or point 20 is set, the display shows:



After 2 second the display automatically returns to the main menu.

4.3.6 I/O TEST Menu

In the “I/O TEST” menu the inputs and outputs as well as the external wiring can be tested.

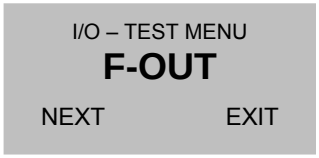
Select in the main menu

Press “P”. The display shows

Change the indicated number with “LEFT” and “UP” to 882207 and confirm with “P”.

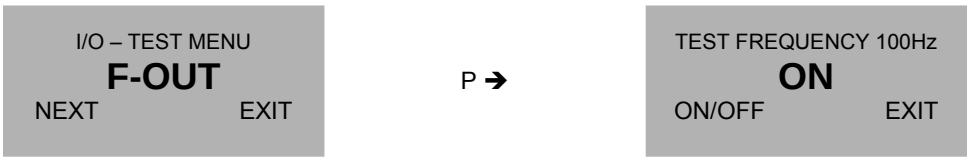
If a wrong code is entered, the display shows “ERROR” for about 2s and then asks for a new input.

When the correct code is entered the display shows:



Use the key “NEXT” to select the desired test point and confirm with “P” or skip with “EXIT”.

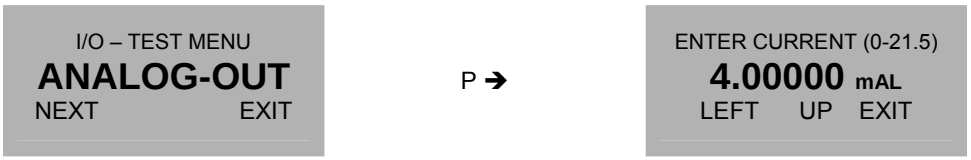
F-OUT:



Use the key “ON/OFF” and for switching on and off the100Hz output frequency and end the test with “EXIT”.

When “EXIT” is pressed, the display returns to the I/O test menu.

ANALOG OUT:

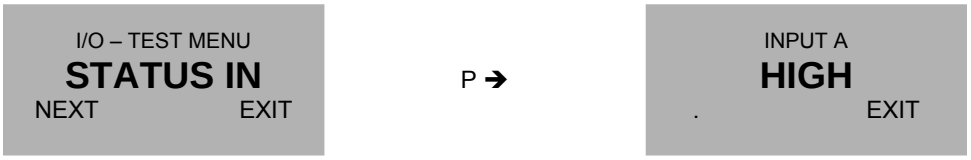


Use the keys “LEFT” and “UP” to select the desired value and confirm with “P” or skip with “EXIT”.

When “P” is pressed the unit sets the selected current, displays OKAY for 2 seconds and then waits for the next current.

When “EXIT” is pressed, the display returns to the I/O test menu.

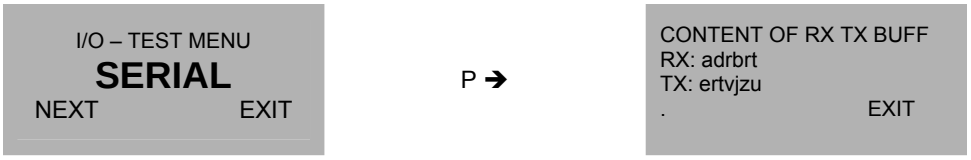
STATUS IN:



The display shows the current status at the control input.

When “EXIT” is pressed, the display returns to the I/O test menu.

SERIAL:



The display shows the current status in the UART send and receive buffers.

When “EXIT” is pressed, the display returns to the I/O test menu.

4.3.7 SERVICE Menu

The “SERVICE” menu is used to calibrate the 4-20mA output.

For a description of the menu refer to chapter 6.4.

5 Remote operation

Some versions of the FAS/FAW family are equipped with an RS-485 Interface.

5.1 Electrical connection of RS-485

Prepare the FAS/FAW100 and the cable as described in chapter 3.1.2.

Connect the signal RS-485A or RS-485+ (both names are used in the literature) to terminal 22 and RS-485- or RS-485B to terminal 21.

Terminal 20 is the ground reference pin for the interface and is connected to terminal 8 and to the supply ground of the DC supply (terminal 52)

NOTE:

The operating range of the data terminals (21 and 22) is -7V to +12V referred to ground (52). Voltages outside that range will destroy the FAS/FAW100.

5.2 RS485 Interface Protocol

The FAS100 uses a proprietary KEM communication protocol.

The parameters for the serial communication are:

4800 bit/s
8 data bit
no parity bit
1 stop bit

5.2.1 Protocol structure

Each command string consists of 8 to 18 bytes, depending on the amount of data to be sent.

SYN	STX	Len	SRC	DST	CMD	Data	END
1 Byte	1 Byte	1 Byte	1 Byte	1 Byte	2 Byte	max 10 Byte	1 Byte

SYN	synchronization byte (0x48)
STX	start of frame (0x02)
Len	length of frame (STX – END, min 0x07, max 0x11, not including SYN)
SRC	sender id (FAS – 0x01, PC – 0x02)
DST	receiver id (FAS – 0x01, PC – 0x02)
CMD	command number
Data	up to 10 Byte
END	end of frame (0x49)

Currently the FAS transmits 10 data bytes (that means Len = 0x11). If the used data length is shorter, the first n bytes contain the data, the rest (10 – n bytes) do not contain any information.

Every answer from the FAS repeats the “CMD” of the request for making identification easier.

5.2.2 Data format

Type	Length	Description
UC	1 byte	Unsigned Character
Int	2 byte	Integer
FL	4 byte	Float, IEEE 754, Big Endian
S n	n byte	Character String with n = 2 … 10 byte

5.2.3 Communication Example

1. Read actual input frequency

Send bytes (PC to FAS):

SYN	STX	Len	SRC	DST	CMD		END
0x48	0x02	0x07	0x02	0x01	0x30	0x3A	0x49

Receive bytes (from FAS):

SYN	STX	Len	SRC	DST	CMD		Data					END
0x48	0x02	0x11	0x01	0x02	0x30	0x3A	0x44	0xE8	0xDC	0x98	…	0x49

Data: 0x44 0xE8 0xDC 0x98 = 1862.8936 Hz

5.2.4 Command Codes

Refer to the code list available from KEM.

6 Service and Maintenance

6.1 Maintenance

The FAS/FAW100 does not require regular maintenance.

If for the specific application an obligatory calibration is required, refer to the corresponding national regulations for the necessary calibration intervals.

6.2 Changing the fuses

6.2.1 Changing the Fuse with FAS100

Switch off the power supply.

Remove the 4 screws in the back panel and pull out the back panel carefully.

Below the ribbon cable connector you find the following fuse in the fuse holder:

Littelfuse NANO 2 375mA slow blow, ordering code 0452.375

NOTE

For your own safety replace the fuse only by the same type and rating.

Replace the fuse and reclose the unit.

6.2.2 Changing the Fuse with FAW100

Switch off the power supply.

Flip the 2 protective covers beside the front panel to the side.

Open the 4 screws beside the front panel and open the top carefully.

6.2.2.1 DC Fuse

Remove the 4 screws in the corners of the PCB and remove the PCB.

On the bottom side of the PCB you find the following fuse in the fuse holder:

Littelfuse NANO 2 375mA slow blow, ordering code 0452.375

NOTE

For your own safety replace the fuse only by the same type and rating.

Replace the fuse and reclose the unit.

6.2.2.2 AC Fuse

Beside the AC terminals you find the following fuse:

Littelfuse TR5 1A slow blow, ordering code 372.1100

NOTE

For your own safety replace the fuse only by the same type and rating.

Replace the fuse and reclose the unit.

6.3 Service

The FAS/FAW100 does not contain any user serviceable parts except the fuses.

In case of malfunction, please contact your nearest dealer or directly KEM.
For the addresses see chapter 7.6.

6.4 Calibration

If necessary the current output of the FAS/FAW100 can be calibrated.

For calibrating the current output, a digital Ampere meter (DAM) with a measuring range up to 22mA, at least 4 ½ digits resolution and an accuracy better 0.05% is required.

For calibrating the FAS/FAW100 proceed as follows:

Connect the power supply (see chapter 3.2.3).

Connect the positive input of the DAM to the current output (terminal 4) and the negative input to GND (terminal 8)

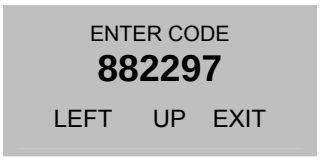
Press “P” for about 3 seconds.

The display shows:

Select in the main menu

Use the keys “DOWN” or “UP” to select SERVICE and press “P”.

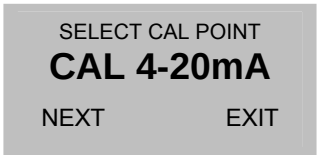
The display shows:



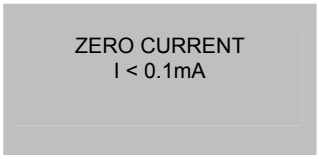
Change the indicated number with “LEFT” and “UP” to 882208 and confirm with “P”

If a wrong code is entered, the display shows “ERROR” for about 2s and then asks for a new input.

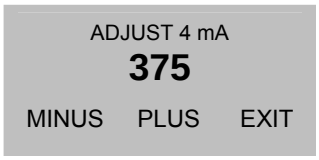
When the correct code is entered the display shows:



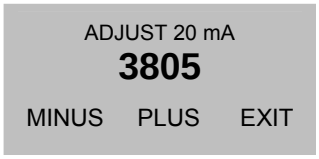
Press “P”. The display shows:



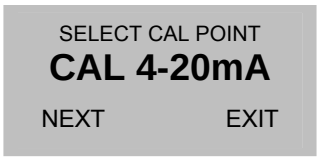
Check the current displayed on the DAM. If the current is higher than 0.1mA the unit has a fault.
Press “P”. The display shows:



Change with “MINUS” and “PLUS” the number in the display, until the DAM shows 4.00 mA.
Press “P”. The display shows:



Change with “MINUS” and “PLUS” the number in the display, until the DAM shows 20.00 mA.
Press “P”. The display shows:



Press “EXIT”. The display shows:

Enter the SETUP menu and store the calibrated values with “SAVE DATA” (see chapter 4.3.4.11).

6.5 Trouble shooting

In case the FAS/FAW100 does not work properly, first check the following items:

No display, no LED lighting
All cables properly connected?
➔ Connect the missing cables
Power supply switched on?
➔ Switch on the power supply
Internal fuse of the FAS/FAW100 blown?
➔ For checking and changing the fuses refer to chapter 6.2.

Output frequency too high or unstable
Most probably EMC problems
Shield and ground properly connected?
➔ Connect shield properly.
If necessary, try additional means of grounding and shielding

7 Listings

7.1 Warranty

KEM warrants material and production for a period of 18 months after installation and start up, max. 24 months from delivery date.

7.2 Certifications and compliances

Category	**Standards or description**	
EC Declaration of Conformity - EMC	Meets intent of Directive 2004 / 108 / EEC for Electromagnetic Compatibility. Compliance is given to the following specifications as listed in the Official Journal of the European Communities:	
	EN 61326 / 2006	EMC requirements for Class A electrical equipment for measurement, control and laboratory use, including Class A radiated and Conducted Emissions[1] and Immunity[1].
	IEC 61000-4-2 /2009	Electrostatic Discharge Immunity (Performance criterion B)
	IEC 61000-4-3 / 2008	Radiated RF Electromagnetic Field Immunity (Performance criterion B)
	IEC 61000-4-4 / A1-2009	Electrical Fast Transient / Burst Immunity (Performance criterion B)
	IEC 61000-4-5 / 2007[2]	Power Line Surge Immunity (Performance criterion B)
	IEC 61000-4-6 / 2009	Conducted RF Immunity (Performance criterion B)
	IEC 61000-4-11 / 2005[2]	Voltage Dips and Interruptions Immunity (Performance criterion B)
Australia / New Zealand Declaration of Conformity-EMC	Complies with the Radiocommunications Act and demonstrated per EMC Emission standard[1]	
	AS/NZS 2064	Industrial, Scientific, and Medical Equipment: 1992
FCC EMC Compliance	Emissions comply with the Clas A Limits of FCC Code of Federal Regulations 47, Part 15, Subpart B[1.]	

[1] Compliance demonstrated using high-quality shielded interface cables
[2] Applies only to units with AC mains supply instead of or additional to the SELV supply

.

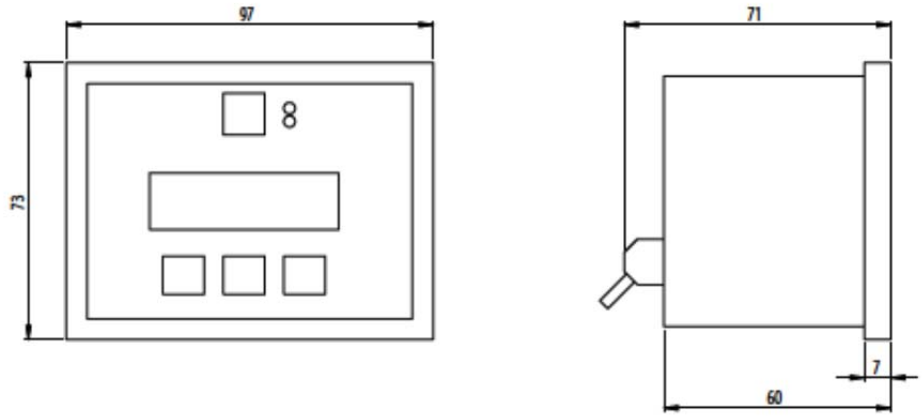
Category	**Standards or description**	
EC Declaration of Conformity – Low Voltage	Compliance is given to the following specification as listed in the Official Journal of the European Communities: Low Voltage Directive 2006/95/EEC	
	EN 61010-1 / 2002	Safety requirements for electrical equipment for measurement control and laboratory use.
U.S. Nationally Recognized Testing Laboratory Listing	UL 61010-1 / 2004	Standard for electrical measuring and test equipment.
Canadian Certification	CAN/CSA C22.2 no. 61010-1-4 / 2008	Safety requirements for electrical equipment for measurement, control, and laboratory use.
Additional Compliance	IEC61010-1 / 2002	Safety requirements for electrical equipment for measurement, control, and laboratory use.
Equipment Type	Test and measuring	
Safety Class	Class 1 (as defined in IEC 61010-1, Annex H) – grounded product	

7.3 Technical Data

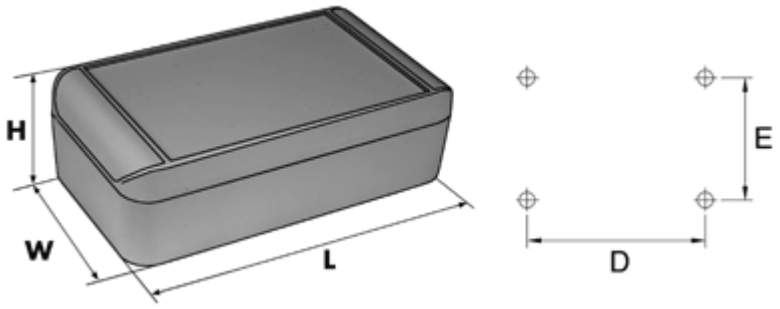
Input	
Input Signal	Frequency
Frequency range	1 Hz – 5 kHz
Input level	< 5V / > 13V at 24V Supply
Input Resistance	> 100 kΩ
Display and Manual Control	
Display:	Graphic, 132 x 32 dot
Viewing Area:	15mm * 50mm
Backlight	Yellow / green
Status Indicators	2 LED for Operation and Error
Programming:	4 softkeys
Analog Output	
Type	4-20 mA, active
Error Signal	3mA / 21mA
Resolution:	5 µA
Linearity:	± 0.05% of full scale
Temperature drift:	0.05% per 10K
Load:	< 800 Ω (at 24V supply)
Output signal	flow rate
Digital Outputs A and B	
Type	push pull, short circuit prove, (IEC946)
Frequency range	0.5 – 10 000 Hz (input frequency) 1.2 – 1000 Hz (normalized frequency)
Output Levels	<2 V / > 22 V (at 24V supply, no load)
Output Resistance	220 Ω
Output Current	20 mA max, internally limited
Output signal (A, FAS101)	Input Frequency
Output signal (A, FAS111)	Input Frequency, normalized Frequency, Total Count, flow limit, batch limit
Output signal (B)	flow limit, batch limit
Control Input	
Type	24V digital (IEC 946)

Min pulse duration	25 ms
Input level	< 5V / > 13V at 24V Supply
Input Resistance	> 100 kΩ
Interface	
Type	RS 485 (FAS111, FAW111, 151)
General	
Supply voltage DC:	24 V DC nominal, operating range: 11 – 30V
Supply Current DC	< 20 mA (at 24V supply, without pickup and load)
Sensor Supply (with DC supply)	Applied supply voltage minus 1V
Supply voltage AC:	100 – 240V AC nominal, operating range: 90 – 264V AC
Supply Current AC	< 20 mA (at 230V supply, without pickup and load)
Sensor Supply (with AC supply)	24V DC
Reaction time	< 250ms @ input frequency > 5Hz
Connections	Cage Clamp Terminals for 0.14 to 1.5 mm²
EMC:	according to EN 50 081-2 and EN 50 082-2
Temperature:	operation: 0 to 50°C storage and transport: -20 up to 70°C
FAS100	
Dimensions:	72mm x 96mm x 70mm (h * w * d)
Material:	Noryl
Weight:	approx. 500g
Protection class:	front: IP 60 (IP65 with IPS7-9), rear: IP 30
FAW100	
Dimensions:	120mm x 90mm x 50mm (h * w * d)
Material:	Noryl
Weight:	approx. 500g
Protection class:	IP 65

7.3.1 Dimensional Drawings FAS100



7.3.2 Dimensional Drawings FAW100



Dimensions

L	120mm
W	90mm
H	50mm

Mounting

D	99mm
E	34mm
Mounting Screw	3.0 – 4.5mm Ø
Screw Head Diameter	6.0 – 7.0mm Ø

7.4 WEEE and RoHS

The unit described herein is not subject to the WEEE directive and the corresponding national laws.

At the end of life forward the unit to a specialized recycling company and do not dispose it off as domestic waste.

The unit described herein fully complies with the RoHS directive.

7.5 List of figures

FIG. 1: WIRING DIAGRAM FOR POWER CONNECTIONS, DC SUPPLY 15
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7.6 Addresses

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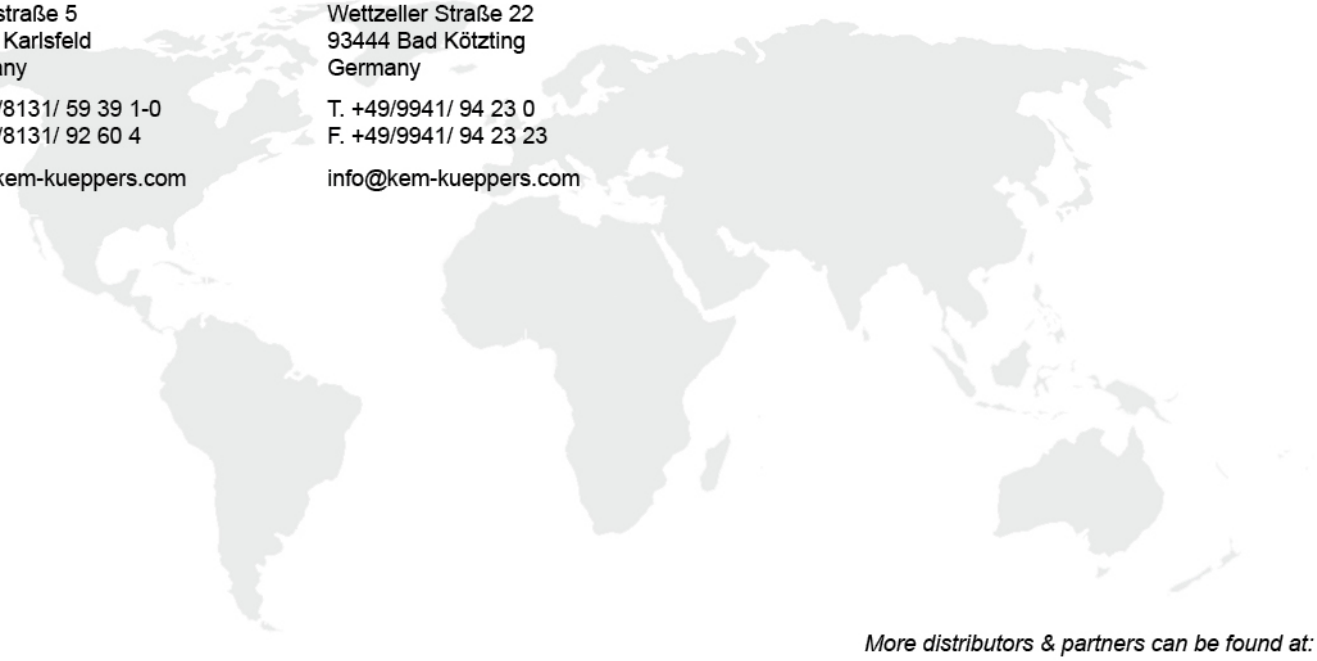
F. +49/9941/ 94 23 23

info@kem-kueppers.com



More distributors & partners can be found at:
www.kem-kueppers.com

Your local partner:

www.kem-kueppers.com
info@kem-kueppers.com