Küppers Elektromechanik GmbH

## Manual



## FAS 100/FAW 100

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

## Version

## Manual-Version

FAS-FAW_M_EN_170307_E002

## SW-Version

This manual is valid for
Main SW: V02.22 and higher

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## 1. General Information

### 1.1. Features

The FAS/FAW 100 are compact, intelligent panel mount (FAS 100) or wall mount (FAW 100) 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/FAW 100 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 24 V digital input according to IEC946. Additionally to the standard 24 V DC power supply, also a wide input range 100-240 V AC mains supply is available (FAW 141, 151).

With the built in 4 to 20 mA output the FAS/FAW 100 can be used as frequency to current converters with settable frequency response as well. The 20 point linearization of the input signal (FAS/FAW 111, 151) provides the possibility to display also strongly nonlinear signals with high accuracy.
The RS485 interface (FAS/FAW 111, 151) makes the implementation in an automatic system easy.
For fast test setups in the lab and easy setup of individual parameters, the PC based control SW EasyControl for WINDOWS ${ }^{\circledR}$ 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.
National and international installation instructions must be observed.
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

## Ordering Code

Description
FAS $101 \quad$ Panel mount display with digital input for 24 V signals, 24 V DC supply
FAS 111 FAS 101 with RS485 interface and linearization
FAW $101 \quad$ Wall mount display with digital input for 24 V signals, 24 V DC supply
FAW 111 FAW 101 with RS485 interface and linearization
FAW $141 \quad$ FAW 101 with additional 100-240 V AC mains supply
FAW $151 \quad$ FAW 111 with additional 100-240 V AC mains supply

### 1.3.2. Accessories

## Ordering Code

HSA72 Description
DIN Rail Adaptor for FAS 100
IPS7-9 Protective front cover IP65 for FAS 100
EWS* Intrinsically safe pickup supply with isolation amplifier
Upon request Connector M12; 5 pin, type 713
Upon request

## 2. Getting started

### 2.1. Unpacking

Verify that you have received the following items:

- FAS 100 or FAW 100
- 2 fixing clamps (FAS 100 only)
- This manual


### 2.2. Operating Elements

### 2.2.1. Operating elements FAS 100 Front Side



Fig. 1: Operating elements FAS 100 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 FAS 100 Back Side



Fig. 2: Operating Elements FAS 100 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
5 = Cage clamp terminal RS485 Interface
$6=$ Sliding switch for the RS485 terminating resistor

### 2.2.3. Operating elements FAW 100 Front Side



Fig. 3: Operating elements FAW 100 Front Side

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

### 2.2.4. Operating Elements FAW 100 Connection Board



Fig. 4: Operating Elements FAW 100 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
6 = Cage clamp terminal RS485 Interface
7 = Sliding switch for the RS485 terminating resistor

### 2.3. Pin Assignments

| Nr | Name | Function |
| :--- | :--- | :--- |
| 1 | +24 V | Positive supply for the sensor |
| 2 | fin | Frequency input |
| 3 | GND | Ground for the sensor |
| 4 | lout | Current output 4-20 mA |
| 5 | fout | Frequency output (Digital Output A) |
| 6 | CTLout | Control output (Digital Output B) |
| 7 | CTLIN | 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 „," "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 | 24 V GND | Power Supply Ground |
| 52 | PE | Protective Earth |
| 91 | AC N | Power Supply 100 - 240 V AC Neutral |
| 92 | AC L | Power Supply 100 - 240 V 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 3.2):

- Connect the 24 V 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/FAW 100 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:

```
    ENTER CODE
    882297
LEFT UP EXIT
```

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 FAS 100

Put the FAS 100 from the front side into the prepared panel cut out.
The width of the cutout must be $92 \mathrm{~mm}+0.8 /-0.0 \mathrm{~mm}$, the height $68 \mathrm{~mm}+0.7 /-0.0 \mathrm{~mm}$.
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 FAW 100

Prepare the wall with the required holes or threads for mounting the FAW 100 (see chapter 7.3.2).
Open the side covers of the FAW.
Screw the FAW 100 with suited screws to the wall.
For opening the FAW 100 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/FAW 100 requires a regulated DC power supply of 24 V nominal and works properly over a supply range of 11 V to 30 V .

For connecting the FAS/FAW 100, 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. 100 nF .

## 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/FAW 100.

### 3.2.1. Electrical Installation FAS 100

Prepare the cable for installation:

- Separate the single conductors for the required length
- Strip the end for about 7 mm 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 FAW 100

Prepare the cable for installation:

- Separate the single conductors for about 8 cm
- Strip the end for about 7 mm 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 chapter 3.2.3 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. 24 V DC Power Supply

The DC powered FAS/FAW 100 requires a regulated power supply of 24 V and works properly with 11 V to 30 V .
The power supply input of the FAS/FAW 100 has an internal diode against reverse polarity and is protected by a 315 mA fuse. Should the fuse trigger, eg by a short circuit on the supply line to the sensor, it can be easily changed.
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 +24 V to terminal 50 . ( See figure below)


Fig. 5: Wiring diagram for power connections, DC supply

## Terminal <br> Description

$50 \quad$ Positive supply voltage, 24 V , referred to pin 51
51 Ground potential for supply voltage
$52 \quad$ Protective ground
The ground terminals 3, 8, 20 and 51 are internally connected together.
Ground and protective ground are internally connected via a $10 \mathrm{k} \Omega$ resistor and 100 nF in parallel. For proper operation the difference between PE and GND should be limited to 5 V .

## NOTE:

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

### 3.2.3.2. 100 to 240 V AC Mains Supply

The AC version of the FAW 100 requires a nominal power supply of $100-240 \mathrm{~V}$ AC and operates over a range of 90-264 V AC.

The power supply input of the FAW 100 is protected by a 1 A slow blow fuse. Should the fuse trigger, eg by a short circuit on the supply line to the sensor, it can be easily changed.

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 $1 \mathrm{~mm}^{2}$, whichever is higher.

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


Fig. 6: Wiring diagram for power connections, AC supply
Terminal Description
$90 \quad$ Mains life, referred to pin 91
91 Mains neutral
52
Protective ground
The ground terminals $3,8,20$ are not connected to terminal 91 .

### 3.2.3.3. DC and AC supply

The FAW 141/151 can be connected to a 24 V DC and a mains supply simultaneously.
If the DC voltage is above 25 V , the unit will be $100 \%$ powered by the DC supply. With a DC voltage below 23 V , the unit will be fully powered by the AC supply. Between $23 \mathrm{~V} D C$ and $25 \mathrm{~V} D \mathrm{C}$ 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 20 V to the DC supply pins $(50,51)$. Calculate the capacity of the backup battery according to the supply current of FAW 100 (about 20 mA ) plus pickup and the desired operation time.


Fig. 7: Wiring diagram for AC supply with battery backup

## NOTE

The backup battery will not be charged by the FAW 100!

### 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 1 V lower than the supply voltage applied to the FAS/FAW 100. With AC supply the sensor supply voltage is $24 \mathrm{~V} \pm 10 \%$.

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/FAW 100 must be opened for replacing the fuse (see chapter 6.2).


Fig. 8: 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 $1 \mathrm{M} \Omega$. For pickups with open collector output, an additional external pull up with $10 \mathrm{k} \Omega-100 \mathrm{k} \Omega$ might be recommended, especially if long cables are used.
With a 24 V supply, the typical input threshold levels are about 11.9 V for a low to high and about 9.7 V 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 2) is built in accordance to DIN IEC 946. It has an internal pull up of $1 \mathrm{M} \Omega$. For pickups with open collector output, an additional external pull up with $10 \mathrm{k} \Omega-100 \mathrm{k} \Omega$ might be recommended, especially if long cables are used.

With a 24 V supply, the typical input threshold levels are about 11.9 V for a low to high and about 9.7 V 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 $220 \Omega$ resistors (R1, R2).
In case of a load resistor to ground the output voltages are:
$\mathrm{V}_{\text {high }}=\left(\mathrm{V}_{\text {supply }}-0.5 \mathrm{~V}\right){ }^{*} \mathrm{R}_{\text {load }} /\left(220 \Omega+\mathrm{R}_{\text {load }}\right)$
$\mathrm{V}_{\text {low }}<0.5 \mathrm{~V}$
In case of a load resistor to the positive supply the output voltages are:
$V_{\text {high }}>V_{\text {supply }}-0.5 \mathrm{~V}$
$\mathrm{V}_{\text {low }}=\mathrm{V}_{\text {supply }}-\mathrm{V}_{\text {supply }}{ }^{*} \mathrm{R}_{\text {load }} /\left(220 \Omega+\mathrm{R}_{\text {load }}\right)+0.5 \mathrm{~V}$
The output current is internally limited to about 25 mA and the outputs withstand a short circuit to GND or to the positive supply for infinite time.


Fig. 9: 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. 10: Wiring diagram for the analog output

The maximum allowed load resistance is about:
$R_{\text {Last max }}=\left(\mathrm{V}_{\text {supply }}-2 \mathrm{~V}\right) / 21 \mathrm{~mA}$
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:

FAS - 111
SW-NR:02.01

Now the FAS 100 switches to the measuring mode, displaying the default screen:
$0.000^{\text {Rate }}$
$0.00^{\text {Total }}$

In case of an error the red LED "ERR" flashes.
In manual control the FAS 100 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 "//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 FAS/FAW 100 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.

### 4.2.3. Resetting the batch value

For easy batching in local operation the FAS 100 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 4.2.3.

### 4.2.4. Info Menu

For easy debugging in case of a malfunction of the system, the FAS/FAW 100 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 FAS/FAW 100 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".

## Manual Operation

### 4.3.1. Function of the keys

In the setup menu some pushbuttons have changing functions, indicated in the display above the pushbutton:
$P \quad$ 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 FAS 100 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 4.3.3.4) 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:

```
CHANGING FROM MASS TO
VOLUME UNITS WILL RES
THE TOTALS PROCEED?
    YES NO
```


## 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:

```
SELECT FLOW DP
0.000
LEFT EXIT
```

Use the key "LEFT" to select the desired decimal point position and confirm with "P" or skip with "EXIT". The display shows:

DISPLAY FILTER (0-99s)
1.00000 s

LEFT UP EXIT

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:

SELECT TOTAL DP
0.000

LEFT EXIT

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.

## Manual Operation

### 4.3.4. SETUP Menu

Select in the main menu

MAIN MENU
SETUP
DOWN UP EXIT

Press "P". The display shows:

```
ENTER CODE
882297
LEFT UP EXIT
```

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 2 s and then asks for a new input.
When the correct code is entered the display shows:

> SETUP MENU
> K-FACTOR
> DOWN UP EXIT

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 $\mathrm{go} \mathrm{to} \mathrm{x} / \mathrm{e}=\mathrm{x} / 2.72$.
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 FAS 101), 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 $1,000 \mathrm{~Hz}$.

## 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:

| SELECT DIG OUTPUT MODE |  |  |
| :---: | :---: | :---: |
| F_OUT NORM | FULLSCALE FREQUENCY |  |
| NEXT | EXIT |  |

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 $1,000 \mathrm{~Hz}$. Calculated frequencies lower than 1.2 Hz produce a zero output, frequencies higher than 1000 Hz will be set to $1,000 \mathrm{~Hz}$.

The display shows:

```
ENTER FULLSCALE FLOW
    10000.0 L/MIN
    LEFT UP EXIT
```

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".

## Manual Operation

The display shows:

```
ENTER PULSETIME 1-420ms
```

    50.0000 ms
    LEFT UP EXIT
    Use the keys "LEFT" and "UP" to select the desired value and confirm with "P" or skip with "EXIT".
The display shows:

OUT-STATUS
ACTIVE $=\mathrm{HIGH}$
NEXT
EXIT

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:

## ENTER HYSTERESIS

1.00000 \%

LEFT UP EXIT

The high going threshold is FLOW LIMIT + HYSTERESIS, the low going is FLOW LIMIT - HYSTERESIS.
With a FLOW LIMIT of $10 \mathrm{I} / \mathrm{min}$ and $5 \%$ hysteresis, the active going value is $10.5 \mathrm{I} / \mathrm{min}$, the inactive going value $9.5 \mathrm{I} / \mathrm{min}$

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

## Manual Operation

The display shows:

> OUT-STATUS ACTIVE $=\underset{\text { NEXT }}{\text { HIGH }} \underset{\text { EXIT }}{\text { AIG }}$

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:

```
    OUT-STATUS
ACTIVE = HIGH
    NEXT
    EXIT
```

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 4 mA , the defined maximum flow gives 20 mA .

## 4mA:

The output is set inactive, a connected meter will see 4 mA 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 4 mA 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 $\mathrm{n}(1 \ldots 3)$ 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:

```
    SAVE SETUP
    READY
YES EXIT
```

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.

| SETUP MENU |  |
| :---: | :---: |
| RECALL DATA | $P \rightarrow$ |
| DOWN UP EXIT |  |
| MEALL SETUP FROM |  |
| DEMORY |  |

Recall the data by pressing "YES" or skip with "EXIT".

## Manual Operation

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

RECALL SETUP FROM
READY
YES EXIT

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

MAIN MENU
LINEAR
DOWN UP EXIT

Press "P". The display shows:

```
ENTER CODE
882297
LEFT UP EXIT
```

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 $2 s$ and then asks for a new input.
When the correct code is entered the display shows:

> SELECT LIN BANK
> LIN BANK 1
> NEXT EXIT

Use the key "NEXT" to select the desired linearization bank and confirm with "P" or skip with "EXIT".
The display shows:

```
K-FACTOR (IMP/LITER)
    50.000 IMP/L
LEFT UP EXIT
```


## Manual Operation

Use the keys "LEFT" and "UP" to select the desired value and confirm with "P" or skip with "EXIT". The display shows:

```
LIN FREQUENCY POINT 01
    1.00000 Hz
    LEFT UP EXIT
```

Use the keys "LEFT" and "UP" to select the desired value and confirm with "P" or skip with "EXIT". The display shows:

LIN ERROR POINT 01
1.00000 \%

LEFT UP EXIT

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 $\mathrm{n}<20$ points are to be entered, set for the linearization point $\mathrm{n}+1$ the frequency to " 0 ".
If the frequency " 0 " is entered or point 20 is set, the display shows:

```
READY
THE LINEARIZATION
VALUES ARE
PROGRAMMED NOW
```

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:

```
    ENTER CODE
    882297
LEFT UP EXIT
```

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 2 s and then asks for a new input.
When the correct code is entered the display shows:

I/O-TEST MENU
F-OUT
NEXT EXIT

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 the 100 Hz 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.

## Manual Operation

## STATUS IN:

| I/O-TEST MENU |  | INPUT A |
| :---: | :---: | :---: |
| STATUS IN |  |  |
| NEXT |  | HIGH |
| EXIT |  |  |
| EXIT |  |  |

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 4-20 mA 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 RS485 Interface.

### 5.1. Electrical connection of RS485

Prepare the FAS/FAW 100 and the cable as described in chapter 3.1.2.
Connect the signal RS485A or RS485+ (both names are used in the literature) to terminal 22 and RS485- or RS485B 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 -7 V to +12 V referred to ground (52). Voltages outside that range will destroy the FAS/FAW 100.

### 5.2. RS485 Interface Protocol

The FAS 100 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 $(0 \times 48)$ |  |  |  |  |  |  |
| STX | start of frame $(0 x 02)$ |  |  |  |  |  |  |
| Len | length of frame (STX - END, min 0x07, max 0x11, not including SYN) |  |  |  |  |  |  |
| SRC | sender id (FAS $-0 \times 01$, PC $-0 \times 02)$ |  |  |  |  |  |  |
| DST | receiver id (FAS $-0 \times 01$, PC $-0 \times 02)$ |  |  |  |  |  |  |
| CMD | command number |  |  |  |  |  |  |
| Data | up to 10 Byte |  |  |  |  |  |  |
| END | end of frame $(0 \times 49)$ |  |  |  |  |  |  |

Currently the FAS transmits 10 data bytes (that means Len $=0 \times 11$ ). If the used data length is shorter, the first n bytes contain the data, the rest ( $10-\mathrm{n}$ 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 $n=2 \ldots$ 10 Byte |

### 5.2.3. Communication Example

Read actual input frequency
Send bytes (PC to FAS ):

| SYN | STX | Len | SRC | DST | CMD | END |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| $0 \times 48$ | $0 \times 02$ | $0 \times 07$ | $0 \times 02$ | $0 \times 01$ | $0 \times 30$ | $0 \times 3 A$ | $0 \times 49$ |

Receive bytes (from FAS):

| SYN | STX | Len | SRC | DST | CMD | Data |  |  |  |  | END |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| $0 \times 48$ | $0 \times 02$ | $0 \times 11$ | $0 \times 01$ | $0 \times 02$ | $0 \times 30$ | $0 \times 3 A$ | $0 \times 44$ | $0 \times E 8$ | $0 \times D C$ | $0 \times 98$ | $\ldots$ | $0 \times 49$ |

Data: $0 \times 440 \times$ E8 $0 \times$ DC $0 \times 98=1862,8936 \mathrm{~Hz}$

### 5.2.4. Command Codes

Refer to the code list available from KEM.

## 6. Service and Maintenance

### 6.1. Maintenance

The FAS/FAW 100 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 FAS 100

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 FAW 100

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.

## Service and Maintenance

### 6.3. Service

The FAS/FAW 100 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 the last page of this document.

### 6.4. Calibration

If necessary the current output of the FAS/FAW 100 can be calibrated.
For calibrating the current output, a digital Ampere meter (DAM) with a measuring range up to 22 mA , at least $41 / 2$ digits resolution and an accuracy better $0.05 \%$ is required.
For calibrating the FAS/FAW 100 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:

MAIN MENU
DISPLAY
DOWN UP EXIT

Use the keys "DOWN" or "UP" to select SERVICE and press "P".
The display shows:

## ENTER CODE

882297
LEFT UP EXIT

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 2 s and then asks for a new input.

When the correct code is entered the display shows:

SELECT CAL POINT
CAL $4-20 \mathrm{~mA}$
NEXT
EXIT

Press "P". The display shows:

## ZERO CURRENT

I < 0.1mA

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

ADJUST 4 mA
375
MINUS PLUS EXIT

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

ADJUST 20 mA
3805
MINUS PLUS EXIT

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

## SELECT CAL POINT

CAL 4-20mA
NEXT
EXIT

Press "EXIT". The display shows:

MAIN MENU
DISPLAY
DOWN UP EXIT

Enter the SETUP menu and store the calibrated values with "SAVE DATA" (see chapter 4.3.3.11).

### 6.5. Trouble shooting

In case the FAS/FAW 100 does not work properly, first check the following items:

## No display, no LED lighting

All cables properly connected?
$\Rightarrow$ Connect the missing cables.
Power supply switched on?
$\rightarrow$ Switch on the power supply
Internal fuse of the FAS/FAW 100 blown?
$\rightarrow$ For checking and changing the fuses refer to chapter 6.2.

## Flow indicator constant at „0"

Cable to sensor properly connected?
$\Rightarrow$ Connect the missing cables.
Is there a signal from the sensor?
$\Rightarrow$ Check the input signal.
If necessary, check the function of the sensor.

## Output frequency too high or unstable

Most probably EMC problems
Shield and ground properly connected?
$\rightarrow$ Connect shield properly.
If necessary, try additional means of grounding and shielding

## 7. Listings

### 7.1.Warranty

For warranty refer to the general terms and conditions of KEM Küppers Elektromechanik GmbH, which can be found on the corresponding website (www.kem-kueppers.com).

### 7.2. Certifications and Compliances

| Category | Standards or description |  |
| :---: | :---: | :---: |
| EU Declaration of Conformity - EMC | Meets intent of Directive 2014/30/EU for Electromagnetic Compatibility. Compliance is given to the following specifications as listed in the Official Journal of the European Union: |  |
|  | 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 61000-4-3/2011 | Radiated RF Electromagnetic Field Immunity (Performance criterion B) |
|  | IEC 61000-4-4/A1-2013 | Electrical Fast Transient/Burst Immunity (Performance criterion B) |
|  | IEC 61000-4-5/2015 ${ }^{2}$ | Power Line Surge Immunity (Performance criterion B) |
|  | IEC 61000-4-6/2014 | Conducted RF Immunity (Performance criterion B) |
|  | IEC 61000-4-11/2005 ${ }^{2}$ | Voltage Dips and Interruptions Immunity (Performance criterion B) |
| Australia/New Zealand | Complies with the EMC Emission standard ${ }^{1}$ |  |
| EMC | AS/NZS 2064 |  |
| FCC EMC Compliance | Emissions comply with the Class A Limits of FCC Code of Federal Regulations 47, Part 15, Subpart B1. |  |

[^0]
## Listings

| Category | Standards or description |  |
| :--- | :--- | :--- |
| EU Declaration of <br> Conformity - Low Voltage | Compliance is given to the following specification as listed in the Official <br> Journal of the European Union: <br> Low Voltage Directive 2014/35/EU |  |
|  | EN 61010-1/2010 | Safety requirements for electrical <br> equipment for measurement control and <br> laboratory use. |
| Designed to meet the <br> following US standards | UL 61010-1/2012 | Standard for electrical measuring and test <br> equipment. |
| Designed to meet the <br> following Canadian <br> standards | CAN/CSA C22.2 no. <br> 61010-1-4/2008 | Safety requirements for electrical <br> equipment for measurement, control, and <br> laboratory use. |
| International standards | IEC61010-1/2010 | Safety requirements for electrical <br> equipment for measurement, control, and <br> 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 | $1 \mathrm{~Hz}-5 \mathrm{kHz}$ |
| Input Level | $<5 \mathrm{~V} />13 \mathrm{~V}$ at 24 V supply |
| Input Resistance | $>100 \mathrm{k} \Omega$ |
| Display and Manual Control |  |
| Display | Graphic, $132 \times 32$ dot |
| Viewing Area | 15 mm * 50 mm |
| Backlight | Yellow/green |
| Status Indicators | LED for operation and error |
| Programming | 4 softkeys |
| Analog Output |  |
| Type | 4-20 mA, active |
| Error Signal | $3 \mathrm{~mA} / 21 \mathrm{~mA}$ |
| Resolution: | $5 \mu \mathrm{~A}$ |
| Linearity | $\pm 0.05 \%$ of full scale |
| Temperature Drift | $0.05 \%$ per 10K |
| Load | < $800 \Omega$ (at 24 V supply) |
| Output Signal | Flow rate |
| Digital Outputs A and B |  |
| Type | push pull, short circuit prove, (IEC946) |
| Frequency Range | $0.5-10,000 \mathrm{~Hz}$ (input frequency) <br> $1.2-1,000 \mathrm{~Hz}$ (normalized frequency) |
| Output Levels | $<2 \mathrm{~V} />22 \mathrm{~V}$ (at 24 V supply, no load) |
| Output Resistance | $220 \Omega$ |
| Output Current | 20 mA max., internally limited |
| Output Signal (A, FAS 101) | Input Frequency |
| Output Signal (A, FAS 111) | Input Frequency, normalized Frequency, Total Count, flow limit, batch limit |
| Output Signal (B) | Flow limit, batch limit |
| Control Input |  |
| Type | 24 V digital (IEC 946) |
| Min Pulse Duration | 25 ms |
| Input Level | $<5 \mathrm{~V} />13 \mathrm{~V}$ at 24 V supply |
| Input Resistance | $>100 \mathrm{k} \Omega$ |
| Interface |  |
| Type | RS485 (FAS 111, FAW 111, 151) |


| General |  |
| :---: | :---: |
| Supply Voltage DC | 24 V DC nominal, operating range: $11-30 \mathrm{~V}$ |
| Supply Current DC | $<20 \mathrm{~mA}$ (at 24 V supply, without pickup and load) |
| Sensor Supply (with DC supply) | Applied supply voltage minus 1 V |
| Supply Voltage AC | 100-240 V AC nominal, operating range: 90-264 V AC |
| Supply Current AC | < 20 mA (at 230 V supply, without pickup and load) |
| Sensor Supply (with AC supply) | 24 V DC |
| Reaction Time | < 250ms @ input frequency > 5 Hz |
| Connections | Cage clamp terminals for 0.14 to $1.5 \mathrm{~mm}^{2}$ |
| EMC | according to EN 50 081-2 and EN 50 082-2 |
| Temperature | Operation: $+32^{\circ} \mathrm{F}$ bis $+122^{\circ} \mathrm{F}\left[0^{\circ} \mathrm{C}\right.$ bis $\left.+50^{\circ} \mathrm{C}\right]$ <br> Storage and transport: $-4^{\circ} \mathrm{F}$ bis $+158^{\circ} \mathrm{F}\left[-20^{\circ} \mathrm{C}\right.$ bis $\left.+70^{\circ} \mathrm{C}\right]$ |
| FAS 100 |  |
| Dimensions | $72 \mathrm{~mm} \times 96 \mathrm{~mm} \times 70 \mathrm{~mm}$ ( $\mathrm{h}^{*} \mathrm{w}$ * d) |
| Material | Noryl |
| Weight | approx. 500 g |
| Protection Class | Front: IP60 (IP65 with IPS7-9), rear: IP30 |
| FAW 100 |  |
| Dimensions | $120 \mathrm{~mm} \times 90 \mathrm{~mm} \times 50 \mathrm{~mm} \mathrm{(h} \mathrm{*} \mathrm{b} \mathrm{*} \mathrm{d)}$ |
| Material | Noryl |
| Weight | approx. 500 g |
| Protection Class | IP65 |

7.3.1. Dimensional Drawings FAS 100


Fig. 11: Dimensional Drawings FAS 100
7.3.2. Dimensional Drawings FAW 100


Fig. 12: Dimensional Drawings FAW 100

### 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.

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[^0]:    ${ }^{1}$ 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.

