User Manual

MFA 2001

Universal Multifunction Meter

Automatische Mess- und
Steuerungstechnik GmbH
91275 Auerbach • Enge Gasse 1
91270 Auerbach • Postfach 1180
Phone +49 (0) 96 43 / 92 05 - 0
Telefax +49 (0) 96 43 / 92 05 - 90
Internet: www.ams-messtechnik.de
e-mail: info@ams-messtechnik.de

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1 Product description

1.1 Application

The multifunction meter MFA 2001 is an electronic universal measuring device for measuring and monitoring all the important parameters in a three-phase supply network with a centre tap connection. The MFA 2001 is designed for fixed installation and registers voltages, currents, frequencies and phase shift. It then calculates the active power and reactive power as well as the power factor for each phase and for the entire network. Furthermore active energy and reactive energy are being displayed for the entire network. An operating time counter is included.
Two limit values can be defined for each network parameter (LIMIT 1, LIMIT 2) which trigger an alarm if any reading is either exceeding or falling below the specified programmed parameters. Output is triggered via a switching transistor. The alarm outputs can also be configured as impulse outputs then sending a chain of impulses. The impulse ratio is proportional to the active energy. Optionally a galvanically separated current loop signal (0 / 4 ... 20 mA) is available. An RS 485 interface or alternatively a Profibus DP V0 interface is also optionally available.
On request the MFA 2001 can be equipped with a separate input to connect an auxiliary power supply (230 V AC or 24 V DC).

1.2 Working principle

The MFA 2001 is based on a highly integrated measuring system employing a very modern manufacturing process. All voltages and currents are being fed directly into the system, which detects all network parameters. A high-performance micro processor then utilizes the data to accurately display the active values using the calibration settings stored in its flash memory.

1.3 Calibration

The MFA 2001 leaves the production line ready calibrated. All details concerning accuracy apply only to the product itself and exclude phase faults generated by any upstream current transformers that might be connected.

2 Installation and starting up

2.1 Installation notes

The multifunction meter is designed for the fixed installation in low and medium-high voltage systems. The device may be mounted in any position.
The installation of the MFA 2001 must be carried out by a qualified technician. The legal regulations applying to a specific application have to be taken into account by the qualified technician.

<u>Switchboard installation:</u>
Metal switchboards or switchboard doors must be earthed.

Before connecting the MFA 2001 make sure that the condition of the local network corresponds to the information supplied on the identification plate.

The device does not have its own power on/off-switch. Therefore, when mounting the device the following must be observed:
- a switch must be installed with the power supply
- the switch must be fitted near the device for easy reach
- the switch must be labelled as being the separator switch for the device

Connections:
All connections of the MFA 2001 are situated on the back of the casing. The block terminals are using screws to ensure safe and reliable connections with the network.

For your attention !
- Voltages above the permitted voltage range can destroy the device!
- Any current transformer terminals that are not earthed, might be dangerous when touched!
- Secondary current transformers that are not under load can hold voltages high enough to be dangerous when touched and should therefore be short-circuited!

2.2 Inputs, outputs and interfaces

Voltage input:
It is possible to measure phase voltages of up to 475 V in a three-phase network without using external transformers. For measurements in medium-high voltage networks voltage transformers can be used.
Available designs:

Standard, without auxiliary power:
340 ... 400 ... 475 V AC, L-L (196 ... 230 ... 275 V AC, L-N)

Measuring range 2 (optional), without auxiliary power:
94 ... 110 ... 132 V AC, L-L (54 ... 63.5 ... 76 V AC, L-N)

Standard, with auxiliary power:
40 ... 400 ... 475 V AC, L-L (23 ... 230 ... 275 V AC, L-N)

Measuring range 2 (optional), with auxiliary power:
11 ... 110 ... 132 V AC, L-L (7 ... 63.5 ... 76 V AC, L-N)

All voltage inputs must be connected through lines protected by a fuse (2-6 A).

Current input:
The current inputs are **not** galvanically separated within the device. Current transformers must be used for measuring currents. Their primary and secondary current values can be programmed enabling the current values to be directly displayed.
Two measuring ranges are available:

Standard	0.05 ... 5 ... 6 A
Measuring range 2 (optional)	0.01 ... 1 ...1.2 A

For your attention !
- If the current transformers are being earthed at the secondary end the connection must be made on terminals “l” to ensure correct functioning of the device!
- If any of the current display shows “-“ the respective current direction is wrong. In that case the terminals “k” and “l” must be checked and the polarity should be reversed if necessary.

Auxiliary power:
With the standard option the auxiliary power needed to operate the MFA 2001 is supplied via the phase L1. Optionally the system is available with a separate auxiliary power input for voltages of either 230 V AC or 24 V DC.
The supply voltage must correspond to the information supplied on the identification plate. Attention has to be paid to making the correct connections.

Limit values/impulse output:
Of each of the measured or calculated network parameters limit values can be monitored. These limit values can be assigned to both of the switched outputs.

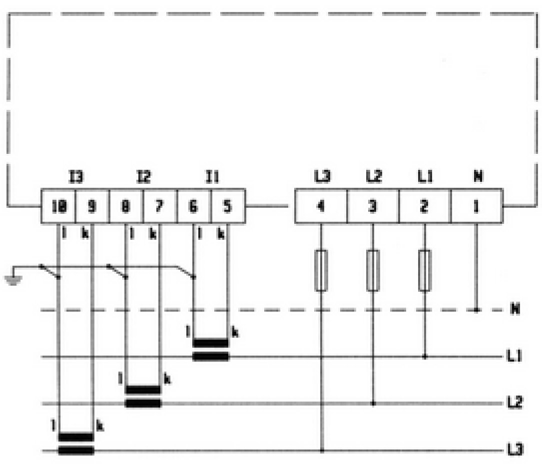
One or both of the limit value outputs can optionally be set as impulse output. Then a chain of impulses with the impulse ratio being proportional to the active energy is sent to the output.

Communication interface (optional):
The MFA 2001 can be optionally equipped with an RS-485 Interface. Alternatively a Profibus DP communication interface is available.

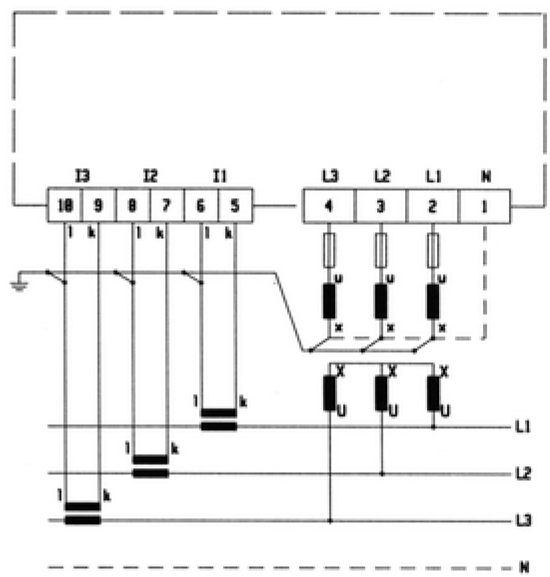
Analogue output (optional):
Any of the measured or calculated network parameters can be assigned to the analogue output. With this option external logging or running secondary control loops is possible.
The output is a current output freely programmable from 0 ... 20 mA or 4 ... 20 mA.

2.3 Possible connections

Connection in a 4-phase network with 3 current transformers



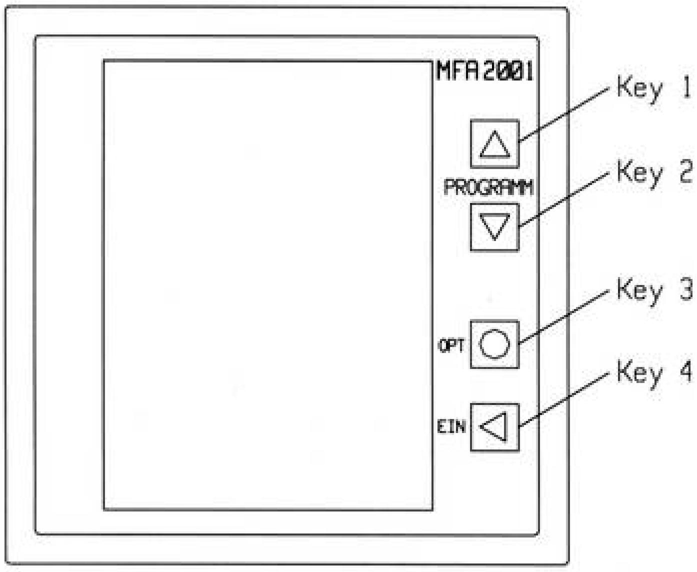
Connection in a 3-/4-phase network with 3 current and voltage transformers



3. Operation

3.1 Controls

The multifunction meter is operated by 4 control keys:



When in **display mode** the 4 keys serve as hotkeys to activate pre-programmed display combinations. When in **setup mode** the keys are used to select the desired menus or program the device.
Key **T2(↓)** moves the display mode of the three main displays up one position, the key **T1 (↑)** moves down one position. Key **T3 (OPT)** selects the options of a specific display combination. Key **T4 (EIN)** selects the display mode of the 8-digit additional display layouts (operating time counter, active energy, reactive energy or 'no display').

3.2 Display layouts

The following table shows the display layout presets:

Display selection T2 (↓)	Option T3 (OPT)	Display	Description
1	1	U_{L1-N} U_{L2-N} U_{L3-N}	Present voltage phase-zero
	2	$U_{L1-N\ min}$ $U_{L2-N\ min}$ $U_{L3-N\ min}$	Minimum voltage phase-zero since last reset
2	1	U_{L1-L2} U_{L2-L3} U_{L3-L1}	Present voltage phase-phase
	2	$U_{L1-L2\ min}$ $U_{L2-L3\ min}$ $U_{L3-L1\ min}$	Minimum voltage phase-phase since last reset

3	1	I_{L1} I_{L2} I_{L3}	Present current
	2	$I_{L1\ mean}$ $I_{L2\ mean}$ $I_{L3\ mean}$	Average current in relation to the programmed integration time
	3	$I_{L1\ max}$ $I_{L2\ max}$ $I_{L3\ max}$	Maximum current (measured) since last reset
	4	$I_{L1\ mean\ max}$ $I_{L2\ mean\ max}$ $I_{L3\ mean\ max}$	Maximum current (average) since last reset
4		f_{L1} f_{L2} f_{L3}	Mains frequency of the displayed phase
5	1	P_{L1} P_{L2} P_{L3}	Present value of active power
	2	$P_{L1\ mean}$ $P_{L2\ mean}$ $P_{L3\ mean}$	Average active power in relation to the programmed integration time
	3	$P_{L1\ max}$ $P_{L2\ max}$ $P_{L3\ max}$	Maximum active power (measured) since last reset
6	1	Q_{L1} Q_{L2} Q_{L3}	Present value of reactive power
	2	$Q_{L1\ mean}$ $Q_{L2\ mean}$ $Q_{L3\ mean}$	Average reactive power in relation to the programmed integration time
	3	$Q_{L1\ max}$ $Q_{L2\ max}$ $Q_{L3\ max}$	Maximum active power (measured) since last reset
7		$\cos f_{L1}$ $\cos f_{L2}$ $\cos f_{L3}$	Power factor
8	1	P_{sum} Q_{sum} $\cos f_{sum}$	Total active power (L1, L2, L3) Total reactive power (L1, L2, L3) Power factor of the entire network (L1, L2, L3)
	2	$P_{mean\ sum}$ $Q_{mean\ sum}$ $\cos f_{mean\ sum}$	Average total active power Average total reactive power Average power factor of the entire network

3.3 Additional display

The additional displays can be accessed via the T4 (EIN) key.
The additional parameters displayed are: operating time in h, received active energy in Wh, kWh, or MWh and inductive reactive energy in varh, kvarh or Mvarh.

Display parameters of the additional display:

Display selection T4 (EIN)	Display	Description
1	h	operating time
2	Wh	active energy, received
3	varh	reactive energy, inductive
4		display OFF

4. Setup

4.1 General notes

When using the multifunction meter for the first time in a specific environment the MFA 2001 needs to be adapted to the attached periphery using the setup mode.

To activate setup mode press both the T1 and T2 key simultaneously for at least 3 seconds.

The MFA 2001 always starts in setup mode with the setup option

► Setup of the voltage transformer translation ratio („V, V, ADJUST“)

The T2 (↓) key can be used to proceed through the selection in the following order:

► Setup of the current transformer translation ratio („A, A, ADJUST“)

► Selection of the integration time to calculate average values („sec“)

► Selection of all criteria for limit value 1 („LIMIT 1 ADJUST“)

► Selection of all criteria for limit value 2 („LIMIT 2 ADJUST“)

► Delete and reset functions („LOE ADJUST“)

► Password („PAS ADJUST“)

► RS 485 alt. Profibus DP („OP1 ADJUST“), *option 1*

► Analogue output („OP2 ADJUST“), *option 2*

The displayed setup option is activated by pressing the T3 (OPT).

Press the T3 (OPT) key again to exit the setup menu.

It is possible to exit setup mode at any point by pressing the T4 key.
Any changes made up to that point are saved.

4.2 Possible parameters and factory presets

Description	Adjustment range	Factory presets
Primary voltage transformer		
Identification plate, 400 V AC	1 V ... 999 kV	400 V
Identification plate, 110 V AC	1 V ... 999 kV	400 V
Secondary voltage transformer		
Identification plate, 400 V AC	400 V, 110 V, 100 V	400 V
Identification plate, 110 V AC	400 V, 110 V, 100 V	400 V
Primary current transformer		
Identification plate, 1 A	1 A ... 999 kA	5 A
Identification plate, 5 A	1 A ... 999 kA	5 A
Secondary current transformer		
Identification plate, 1 A	1 A, 5 A	5 A
Identification plate, 5 A	1 A, 5 A	5 A
Integration time	5; 10; ... 870; 900 sec	900 sec
Switching output 1 (LIMIT 1)		
Measured value	U, I, f, P, Q, cos f , P_{sum}, Q_{sum}, cos f $_{sum}$, Wh, varh, h,	
Channel	L1-N, L2-N, L3-N, L1-L2, L2-L3, L3-L1 L1-N/L2-N/L3-N, L1-L2/L2-L3/L3-L1	
Response time	0 ... 60 sec	
Limit value	*freely programmable*	
Alarm type	min, max	
Deactivation		„AUS“
Switching output 2 (LIMIT 2)		
Measured value	U, I, f, P, Q, cos f , P_{sum}, Q_{sum}, cos f $_{sum}$, Wh, varh, h,	
Channel	L1-N, L2-N, L3-N, L1-L2, L2-L3, L3-L1 L1-N/L2-N/L3-N, L1-L2/L2-L3/L3-L1	
Response time	0 ... 60 sec	
Limit value	*freely programmable*	
Alarm type	min, max	
Deactivation		„AUS“
Impulse output (optional)		
Energy type	active energy Wh	active energy Wh
Energy flow direction	received	received
Impulse rate	1Wh ... 999 kWh / Impulse	100 Wh / Impulse
Delete functions	U_{min}, I_{max}, $I_{mean\ max}$, P_{max}, Q_{max}, h, Wh, varh, ALL	
User password	000 ... 999	„000“ = no password
RS 485 (optional)		
Baud rate	9.6 ... 57.6 kBaud	9.6 kBaud
Address	0 ... 31	0

Profibus DP (optional)		
Baud rate	*fixed setting*	38.4 kBaud
Address	1 ... 125	1
Analogue output (optional)		
Output	0 ... 20 mA, 4 ...20 mA	
Measured value	U, I, f, P, Q, cos φ, P_{sum}, Q_{sum}, cos $φ_{sum}$	
Channel	L1-N, L2-N, L3-N, L1-L2, L2-L3, L3-L1	
Initial source value	*freely programmable*	
Final source value	*freely programmable*	
Deactivation		„AUS“

4.3 Setting the voltage transformer translation ratio

General notes:
The factory setting for the voltage transformer translation ratio is set to 400/400 V.
The preset voltage transformer translation ratio must be changed only if a voltage transformer is used.

Setup:
In order to change the displayed setup option („V, V, ADJUST“) press the T3 (OPT) key.
The preset setting „400V, 400V“ (1:1) is displayed with the first digit of the primary value flashing. With the T1 (↑) key the value can be increased starting at “0” through to “9”. To access a lower value press the T1 (↑) key past “9” to start again with “0”.

Press the T2 (↓) key to access the next digit. The digit starts flashing. To change the value press T1 (↑) key.

After setting the last digit the decimal point starts flashing and can now be moved by pressing the T1 (↑) key. For primary voltages above 1 kV the display can be changed over from “V” to “kV”. As a result the primary voltage can be set to a minimum value of 1 V and a maximum value of 999 kV.

By pressing the T2 (↓) key the setting for the primary voltage is stored and the menu for selecting the secondary voltage is displayed. By pressing the T1 (↑) key values of 400 V, 110 V or 100 V can be selected.

By pressing the T2 (↓) key the complete process of setting the primary and secondary voltages can be repeated.

The process is completed by pressing T3 (OPT) key. The setup menu is displayed.

4.4 Setting the current transformer translation ratio

General notes:
The secondary value of the connected current transformer must match the value displayed on the identification plate of the MFA 2001.

As standard a choice of 1 A or 5 A is available ex factory.

Setup:
Proceed to setting the current transformer parameters („A, A, ADJUST“) by pressing the T2 (↓) key. Activate the selection by pressing the T3 (OPT) key.
The value “5A, 5A” (1:1) is displayed with the first digit of the primary value flashing. By using the T1 (↑) key the value can be increased starting at “0” through to “9”. To access a lower value press the T1 (↑) key past “9” to start again with “0”.

Press the T2 (↓) key to access the next digit. The digit starts flashing. To change the value press T1 (↑) key.

After setting the last digit the decimal point starts flashing and can now be moved by pressing the T1 (↑) key. For primary currents above 1 kA the display can be changed over from “A” to “kA”. As a result the primary current can be set to a minimum value of 1 A and a maximum value of 999 kA.

By pressing the T2 (↓) key the setting for the primary current is stored and the menu for selecting the secondary current is displayed. By pressing the T1 (↑) key values of 1 A or 5 A can be selected.

By pressing the T2 (↓) key the complete process of setting the primary and secondary currents can be repeated.

The process is completed by pressing T3 (OPT) key. The setup menu is displayed.

4.5 Setting the integration time (bimetal function)

<u>General notes:</u>
An average value is calculated using the measured values for current and power. A shared value for the time interval used for the calculation can be set.
Factory preset: 900 seconds

<u>Setup:</u>
Activate the setup menu by pressing the T3 key (OPT).

By pressing either the T1 (↑) or T2 (↓) keys a value {5; 10; 15; 20; ... 900 sec} can be selected from the list of available values.

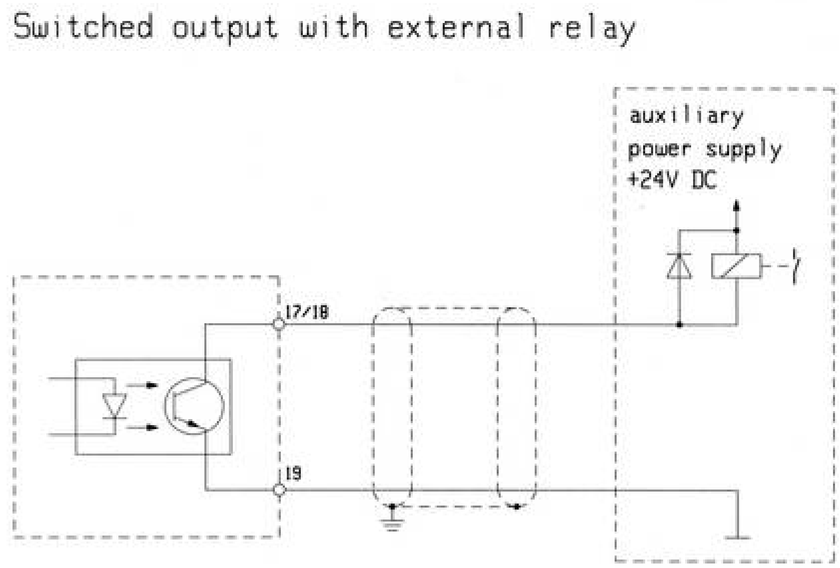
Exit by pressing T3 (OPT).

4.6 Setting the limit values

<u>General notes:</u>
The MFA 2001 is shipped with two outputs. Each of the two outputs can optionally be used as switched output or impulse output.

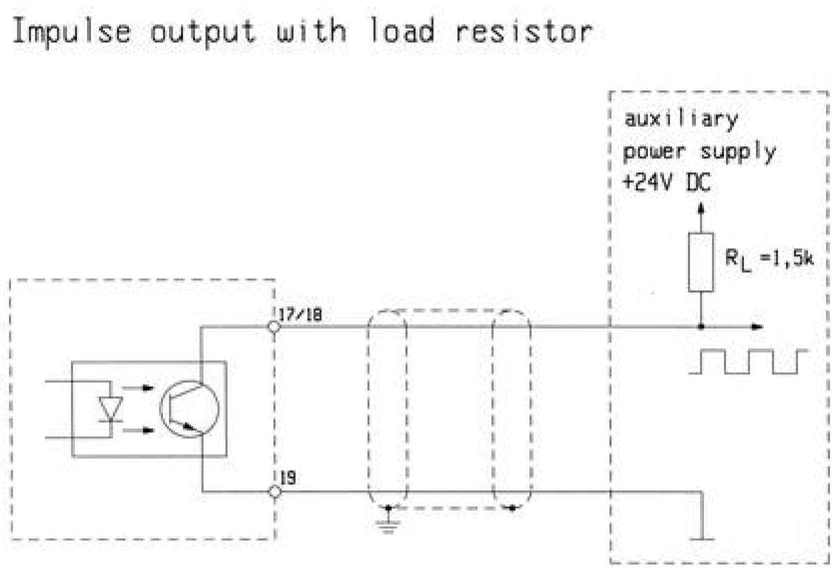
<u>Switched output:</u>
Two limit values (LIMIT 1, LIMIT 2) can be defined for each network parameter which lead to the triggering of the alarm signal if the measured value either exceeds or falls below the set limits (depending on the settings).
The status of the switched outputs is indicated by the symbols “LIMIT 1” and “LIMIT 2” on the LC screen.
If any values are set for a specific switched output this symbol appears in the display in the corresponding display window, like e.g. 3x voltage L-N.
If the threshold monitoring responds and an alarm is triggered, the corresponding display starts flashing. The flashing symbol now appears in <u>every</u> display window in order to ensure that exceeding the voltage limit is also indicated in other display windows (e.g. 3x current).

Connection example:



<u>Impulse output:</u>
If the switched output is programmed to function as an impulse output a chain of impulses with an impulse ratio proportional to the **active energy** is transmitted to the output.
An impulse valency (Wh / impulse) can be assigned to the impulse output. The system calculates an optimum time period to then collect the impulses within this time period and transmits them with an impulse length of 75 ms to the output. The maximum frequency is 6,5 Hz. The impulse intervals are variable depending on the output frequency and are **not** proportional to the power.
If the measured active energy exceeds the set impulse valency and therefore the maximum frequency for the impulse output is exceeded, the remaining impulses are stored temporarily and sent to the output later.
The active energy counter uses a **reflux lock** to ensure that impulses are only transmitted when electric energy is **received**.

Connection example:



Switched output setup:

1. Press the T3 (OPT) key to activate the setup mode („LIMIT 1 ADJUST“).

2. Press the T1 (↑) or T2 (↓) keys to set the **parameters** to be monitored.

The following parameters can be selected:

Voltage U	„V“		
Current I	„A“		
Frequency f	„Hz“		
Active power P, received	„W“		
Reactive power Q, inductive	„var“		
Power factor, inductive /value/	„cos φ“		
Accumulated values	„sum“	T3→	Accumulated active power „W sum“
			Accumulated reactive power „var sum“
			Power factor entire network „cos φ sum“
Active energy	„Wh“		
Reactive energy	„varh“		
Operating time	„h“		

Additional options:

Impulse counter function	„PUL“	*see below* ‚Setup as impulse output’
Deactivation	„AUS“	*see below* ‚Deactivating the limit output’

After the selection has been made press the T3 (OPT) key to proceed to the next step.

3. Press the T1 (↑) or T2 (↓) keys to select the **phase** (channel) of the network parameter to be monitored.

The following options are available:

for voltage	L1-N L2-N L3-N L1-L2 L2-L3 L3-L1
for voltage (3-phase monitoring)	L1-N, L2-N, L3-N L1-L2, L2-L3, L3-L1
for current, frequency, power, power factor	L1 L2 L3
for accumulated active power, accumulated reactive power, power factor entire network, active energy, reactive energy, operating time	no selection (phase-independent)

After the selection has been made press the T3 (OPT) key to proceed to the next step.

4. Setting the **response time**. The response time is the time interval during which the limit value is exceeded (resp. fallen below) in order to trigger an alarm.

Use the T1 (↑) or T2 (↓) keys to set the response time.

Adjustment range: 0....60 seconds

After the response time has been selected press the T3 (OPT) key to proceed to the next step.

The response time also applies if the switched output is reset because the programmed value has been fallen below (resp. exceeded).

5. Setting the **response value**. A preset value relevant to the selection of parameters and phases is displayed with the first digit flashing.

With the T1 (↑) key the value can be increased starting at “0” through to “9”. To access a lower value press the T1 (↑) key past “9” to start again with “0”.

Press the T2 (↓) key to access the next digit. The digit starts flashing. To change the value press T1 (↑) key.

After setting the last digit the decimal point starts flashing and can now be moved by pressing the T1 (↑) key. Also the measuring range “k” can be selected or changed to “M” where required.

6. Press the T2 (↓) key again and the “min” display starts flashing.
„min“: Alarm is triggered when falling below the set value
„max“: Alarm is triggered when exceeding the set value

Press the T1 (↑) key to select „min“ or „max“.

By pressing the T2 (↓) key the complete process of setting response value can be repeated.

The process is completed by pressing T3 (OPT) key. The setup menu is displayed.

Setup as impulse output:
The impulse valancy specified in Wh/impulse or kWh/impulse.
Impulse valancy = energy per impulse
Due to technical reasons the denomination “Wh” appears at the bottom of the display. If the range “kWh” is selected the “k” apears apart from the “Wh” right hand from the impulse valency to be set.

1. Select and activate the impulse counter function (see 2. above) by pressing T3 (OPT).

2. Setting the **impulse rate**. A preset value relevant to the impulse rate is displayed with the first digit flashing.

With the T1 (↑) key the value can be increased starting at “0” through to “9”. To access a lower value press the T1 (↑) key past “9” to start again with “0”.

Press the T2 (↓) key to access the next digit. The digit starts flashing. To change the value press T1 (↑) key.

After setting the last digit the decimal point starts flashing and can now be moved by pressing the T1 (↑) key. Also the measuring range “k” can be selected where required.

The process is completed by pressing T3 (OPT) key. The setup menu is displayed.

Deactivating the limit value output
The limit output can also be deactivated.

1. Select deactivation and activation of the limit output (see 2. above) by pressing T3 (OPT).

2. LIMIT 1 AUS ADJUST
is displayed with “AUS” flashing.

3. By pressing T3 (OPT) key the limit output is deactivated and the setup menu is displayed.

The parameters for limit value 2 (LIMIT 2) are set the same way.

For your attention !

- For the switched output the latest set values for LIMIT 1 and LIMIT 2 are used. For better support we recommend to keep written protocol about settings and changes!
- It is possible to set either outputs LIMIT 1 or LIMIT 2 the impulse counter function. However, the impulse rate must be identical for both the outputs.
  Setting different impulse valancies for the limit outputs is not possible.

4.7 Deleting and resetting

General notes:
The following values stored by the MFA 2001 can be deleted:

Description		Display	Memory Type
Minimum voltage	U_{min}	*min V*	
Maximum measured current	I_{max}	*max A*	
Maximum average current	$I_{mean\ max}$	*mean max A*	
Maximum active power	P_{max}	*max W*	
Maximum reactive power	Q_{max}	*max var*	
Operating time		*h*	*flash*
Active energy		*Wh*	*flash*
Reactive energy		*varh*	*flash*
Delete all			

The parameters seen above can be deleted individually.
There is also the possibility to delete or reset all parameters together at the same time.

Deleting individual parameters:
1. Press the T3 (OPT) key to activate the setup mode („LOE ADJUST“).

2. Press the T1 (↑) or T2 (↓) keys to navigate within the menu (see table above).

3. Activate the desired option by pressing T3 (OPT)
   Press the T1 (↑) or T2 (↓) keys to select further phase dependent parameters

4. Confirm the parameter to be deleted by pressing the T3 (OPT) key.
HAL appears flashing in the display.
Use the T1 (↑) or T2 (↓) keys to change from HAL to LOE.
HAL: delete nothing (hold)
LOE: delete

5. Press T3 (OPT) again.
The selected command is executed.

The selection menu LOE ADJUST is displayed.

6. Repeat the process to delete any other individual parameters by pressing T3 (OPT) key.
Use the T1 (↑) or T2 (↓) keys to proceed to the next option within the selection menu.

Deleting all parameters:
1. Press the T3 (OPT) key to activate the setup mode („LOE ADJUST“).

2. Press the T1 (↑) or T2 (↓) keys until “LOE” and “All” is displayed flashing alternately.

3. Press the T3 (OPT) key

Display ALL
HAL flashing
Use the T1 (↑) or T2 (↓) keys to change from HAL to LOE.
HAL: delete nothing (hold)
LOE: delete

4. Press T3 (OPT) again.
The selected command is executed
The selection menu LOE ADJUST is displayed.

5. Use the T1 (↑) or T2 (↓) keys to proceed to the next option within the selection menu.

For your attention !
The parameters stored in the flash memory (operating time, active energy, reactive energy) are retained when the operating power is switched off.
However, the values for U_{min}, I_{max}, $I_{mean\ max}$, P_{max}, Q_{max} are deleted automatically when the device is switched off.

4.8 Setting the password

General notes:
The multifunction meter can be protected against unintentional changes by setting a 3-digit password. By using the password unwanted programming access can also be prevented.
If the 3-digit numerical password is set the setup mode can only be accessed when the password is entered and confirmed by pressing the T3 (OPT) key. If the password is correct the setup menu is displayed.
If the password is incorrect the device returns to display mode.

The factory preset is “000”. If the password is set to “000” the MFA 2001 does not request a password and jumps directly to the setup menu.

For your attention !
If the user password is lost (except “000”) the device can only be reset by the manufacturer.

Setup:
Activate the setup menu („PAS ADJUST“) by pressing the T3 key (OPT).

The setting „000.“ is displayed with the first digit flashing.

With the T1 (↑) key the value can be increased starting at “0” through to “9”. To access a lower value press the T1 (↑) key past “9” to start again with “0”.

Press the T2 (↓) key to access the next digit. The digit starts flashing. To change the value press T1 (↑) key.

The process is completed by pressing T3 (OPT) key. The setup menu is displayed.

Store the set parameters in the flash memory by pressing T4 and exit setup mode.

4.9 RS 485 settings (optional)

General notes: The device can optionally be equipped with an RS-485 interface which makes it possible to receive and display the data with a PC (e.g. by using an RS 485 to RS 232 converter) The necessary software is shipped together with the RS 485 option.

Setup:
Press the T3 (OPT) key to activate the setup menu („OP1 ADJUST“).

Press the T1 (↑) or T2 (↓) keys to set the **baud rate**.
The following baud rates can be selected:
{ 9.6; 19.2; 38.4; 57.6 } kBaud

Press the T3 (OPT) key.

Press the T1 (↑) or T2 (↓) keys to set the **address**.
Address values from 0 ... 31 can be selected.

Exit the setup menu by pressing T3 (OPT).

4.10 Profibus DP V0 settings (optional)

General notes:
The device can optionally be shipped with a Profibus DP V0 interface.
A detailed description of the instruction set is shipped together with the Profibus DP V0 option.

Setup:
Press the T3 (OPT) key to activate the setup menu („OP1 ADJUST).

Baud rate:
Die baud rate is preset to 38.4 kBaud and can not be changed.

Press the T3 (OPT) key.

Press the T1 (↑) or T2 (↓) keys to set the **address**.
Address values from 1 ... 125 can be selected.

Exit the setup menu by pressing T3 (OPT).

In order to activate the address changes the device has to be turned off and then on again after the setup is completed. After the restart the changed address is activated.

For your attention !
- It is not possible to equip the MFA 2001 with both the RS 485 (4.9) and the Profibus DP V0 (4.10) option at the same time. The device is shipped only with either one option.
- The RS 485 option or the Profibus DP V0 option is automatically detected by the device.

4.11 Setting the analogue output (optional)

General notes:
The multifunction meter can optionally be equipped with an analogue interface. The device can be set for values from 0 ... 20 mA or from 4 ... 20 mA. The analogue signal is galvanically separated from the inner circuitry. No external power source is needed.

Setup:
1. Press the T3 (OPT) key to activate the setup menu („OP2 ADJUST“).

2. Press the T1 (↑) or T2 (↓) keys to set the desired **type of analogue output signal**.
   The following two choices are available:
   0 ... 20 mA or 4 ... 20 mA.

Press the T3 (OPT) key.

3. Press the T1 (↑) or T2 (↓) keys to set the desired **parameters** for the analogue output signal.
The following parameters can be selected:

Voltage U	„V“			
Current I	„A“			
Frequency f	„Hz“			
Active power P, received	„W“			
Reactive power Q, inductive	„var“			
Power factor, inductive /value/	„cos φ“			
Accumulated values	„sum“	T3→	Accumulated active power	„W sum“
			Accumulated reactive power	„var sum“
			Power factor entire network	„cos φ sum“

Additional option:
Deactivation „AUS“ *see below* ‚Deactivation of the analogue output’

After the selection has been made press the T3 (OPT) key to proceed to the next step.

4. Press the T1 (↑) or T2 (↓) keys to select the **phase** (channel).
The following options are available:

for voltage	L1-N
	L2-N
	L3-N
	L1-L2
	L2-L3
	L3-L1
for current, frequency, power, power factor	L1
	L2
	L3
for accumulated active power, accumulated reactive power, power factor entire network	no selection (phase-independent)

After the selection has been made press the T3 (OPT) key to proceed to the next step.

5. Setting the **start value** (*additional display: “**min**”*). A preset value relevant to the selection of parameters and phases is displayed with the first digit flashing.

With the T1 (↑) key the value can be increased starting at “0” through to “9”. To access a lower value press the T1 (↑) key past “9” to start again with “0”.

Press the T2 (↓) key to access the next digit. The digit starts flashing. To change the value press T1 (↑) key.

After setting the last digit the decimal point starts flashing and can now be moved by pressing the T1 (↑) key. Also the measuring range “k” can be selected where required.

By pressing the T2 (↓) key the complete process of setting start value can be repeated.

Press T3 (OPT) to proceed.

6. Setting the **final value** *(additional display: „**max**“)*. A preset value relevant to the selection of parameters and phases is displayed with the first digit flashing.

With the T1 (↑) key the value can be increased starting at “0” through to “9”. To access a lower value press the T1 (↑) key past “9” to start again with “0”.

Press the T2 (↓) key to access the next digit. The digit starts flashing. To change the value press T1 (↑) key.

After setting the last digit the decimal point starts flashing and can now be moved by pressing the T1 (↑) key. Also the measuring range “k” can be selected where required.

By pressing the T2 (↓) key the complete process of setting the final value can be repeated.

7. Press T3 (OPT) to exit the setup menu.

<u>Deactivation of the analogue output</u>
The analogue output can also be deactivated.

1. Select deactivation (see 3. above) and activation of the analogue output by pressing T3 (OPT).

2. OP2 AUS ADJUST
   is displayed with „AUS“ and „OP2“ flashing alternately.

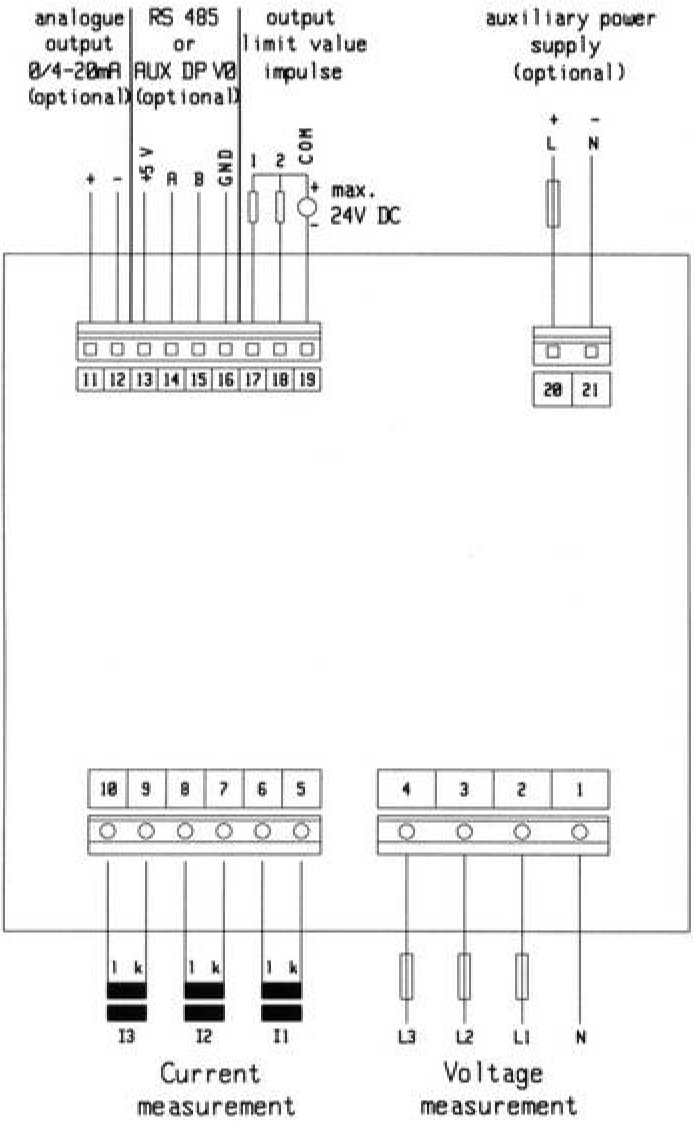
3. By pressing T3 (OPT) key the analogue output is deactivated and the setup menu is displayed.

Store the set parameters in the flash memory by pressing T4 and exit setup mode.

5 Terminal configuration

Auxiliary power source (see identification plate):

230 V AC, 45 ... 65 Hz
-15% / +20%, max. 16 VA
alternatively
24 V DC,
± 15 %, max. 7 VA



6 Technical details

Measuring inputs

Voltage inputs

Standard, without auxiliary power	340 ... 400 ... 475 V AC	Phase - Phase,
	196 ... 230 ... 275 V AC	Phase - Zero
Standard, with auxiliary power	40 ... 400 ... 475 V AC	Phase - Phase,
	23 ... 230 ... 275 V AC	Phase - Zero
Measuring range 2 (optional), without auxiliary power	94 ... 110 ... 132 V AC	Phase - Phase,
	54 ... 63.5 ... 76 V AC	Phase - Zero
Measuring range 2 (optional), *with auxiliary power*	11 ... 110 ... 132 V AC	Phase - Phase,
	7 ... 63.5 ... 76 V AC	Phase - Zero

Power consumption per input (L-N)	
23 ... 230 ...275 V	< 0.1 VA / Phase (When operating without auxiliary power in L1 additional 16 VA max)
7 ... 63.5 ... 76 V	< 0.07 VA / Phase
Input impedance (Ph-Ph)	> 1.6 MΩ
Fuse	2 A ... 6 A (medium time lag)
Frequency of basic frequency	45 ... 65 Hz

Current inputs

Standard	0.05 ... 5 ...6 A
Measuring range 2 (optional)	0.01 ... 1 ...1.2 A
Power consumption per input	< 0.6 VA

Outputs

Switched outputs

Type	Open Collector, (NPN-Transistor)
Switching frequency	6.5 Hz max
External voltage	5 ... 30 V DC
Operating current	40 mA max
Impulse length	75 ms
Impulse gap	= 75 ms

Analogue output (optional)

Output value	current, configurable
Ranges	0 ... 20 mA, 4 ... 20 mA
Burden	0 ... 750 Ω
Resolution	0.5 % of dynamic range

Accuracy

of MR: measuring range
of NV: nominal value

Voltage	± (1.0 % of MR + 1 digit)
Current	± (1.0 % of MR + 1 digit) for I > 2 % of NV
Power, energy	± (1.5 % of MR + 1 digit)
Power factor	± 0.02 for U and I > 10 % of NV
Frequency	± 0.1 Hz in a 3-phase network
Operating time counter	± 10 seconds/day

Power supply

Standard	no auxiliary power necessary, power supply via L1
Option 1	
Auxiliary power	230 V AC (-15% / +20%), 45 ... 65 Hz, 16 VA max
Option 2	
Auxiliary power	24 V DC (± 15 %), 7 VA max

Electrical safety

Requirements	IEC / EN 61010-1
Protection class	II
Overvoltage category	CAT III inputs, CAT II outputs
Contamination level	2
Type of protection	
Front	IP 52 according to IEC / EN 60529
Front with additional seal (optional)	IP 65 according to IEC / EN 60529
Back	IP 20 according to IEC / EN 60529

EMC

Interfering transmissions	IEC / EN 61326-1
Interference resistance	IEC / EN 61326-1 / A1, industrial use

Climatic category

Operating temperature	-10 ... 55 °C
Storage temperature	-25 ... 70 °C
Relative humidity	15 % ... 95 % without condensation

Housing

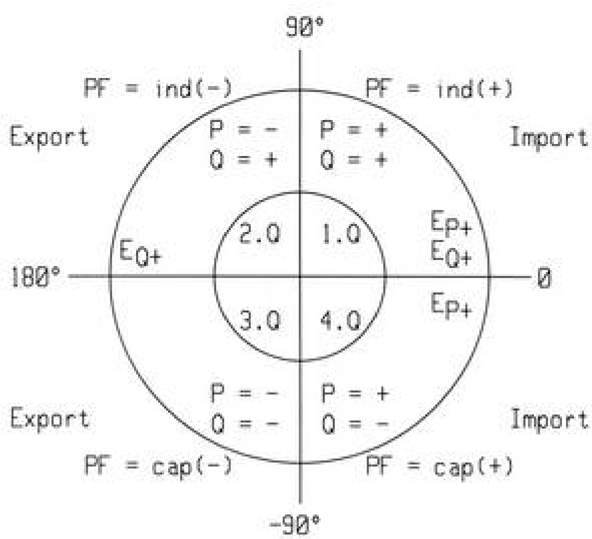
Front	95.4 x 95.4 mm
Switchboard cut-out	$91.0^{+0.8}$ x $91.0^{+0.8}$ mm
Front frame height	7.0 mm
Installation depth	62 mm
Weight	about 450 g (without packaging)
Type of mounting	screw clamps

Connection

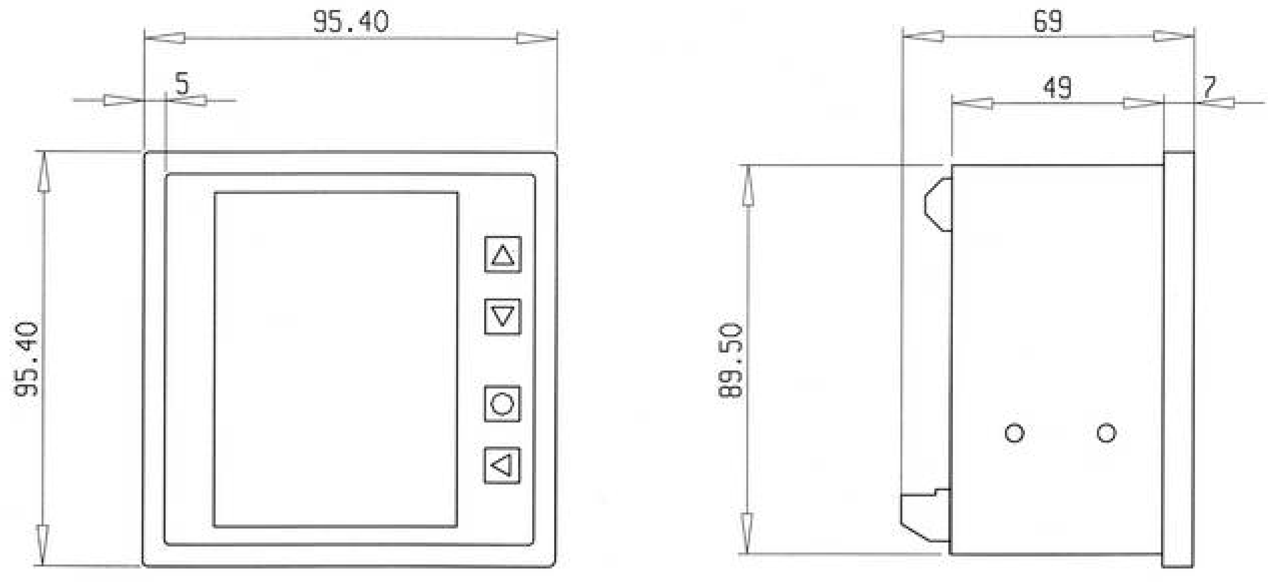
Type of connection	screw block terminals
Voltage	4.0 mm^2 max (rigid), 2.5 mm^2 max (flexible)
Current	4.0 mm^2 max (rigid), 2.5 mm^2 max (flexible)
Auxiliary power	1.5 mm^2 max
Limit and analogue output and RS 485 / AUX DP V0	1.5 mm^2 max (rigid), 1.0 mm^2 max (flexible)

4-quadrant operation display

Calculated reactive power
is signed



7 Dimension drawing



Measurements in mm
Switchboard cut-out: $91.0^{+0.8}$ x $91.0^{+0.8}$ mm

8 Maintenance

Front display
The front display should be cleaned with a soft cloth using a standard household cleaner. Acidic cleaning agents should not be used and may destroy the surface.

Repairs and calibration
Repair and calibrating work can only be carried out by the manufacturer.

Waste disposal
The device can be disposed of according to the legal regulations for recycling electronic waste.

For your attention !
Any manipulations on the device result in the expiration of all warranty claims.

9 Product service

For support please contact

AMS
Automatische Mess- und
Steuerungstechnik GmbH
Enge Gasse 1 D-91275 Auerbach/Opf.
Postfach 1180 D-91270 Auerbach/Opf.
Phone +49 (0) 96 43 / 92 05 - 0
Telefax +49 (0) 96 43 / 92 05 - 90
e-mail info@ams-messtechnik.de