Multi-Measuring-Interface
MMI 7000

Manual

Version 1.0 E

CAUTIONS !

1. High voltage !

2. The MMI7000 must not be operated without protective earth conductor connected!

3. The measuring device is suitable only for usage in low-voltage switchgear systems. The maximum permissible input voltages (see technical data) must not be exceeded!

4. The device must only be operated by qualified staff!

CONTENTS

Section 1: GENERAL

The measuring device MMI7000 has been developed for three-phase measuring, display, and storage of electric parameters in low-voltage grids.
In order to allow a simple handling, the concept of graphical menu navigation has consistently been used. An integrated help (HELP-button) is available to make handling easier.
The graphical display permits the display of different font sizes, bar charts and diagrams.
Several interfaces as well as a data storage (changeable SD-card) and an processing software for PC are available

Series range:

- ☑ MMI7000-B Basic version
- ☑ MMI7000-S additional two independent potential free interfaces RS485
- ☑ MMI7000-E extended version:
  - 1 interface RS485, 1 switching input (programmable)
  - 4 relay outputs (programmable), 1 impulse output (transistor)
  - 1 card slot for SD-card (storage of grid values)
  - 1 CD with Windows-based evaluation software

Technical features:

- ☑ Operating voltage: 110...230VAC (+/- 15%)
- ☑ Measuring voltage: 3x 30...440VAC (L-N); 50...760VAC (L-L)
- ☑ Measuring current: 3x X:5A / X:1A
- ☑ Illuminated graphic display 128x64 dot
- ☑ 3-phase display of several grid-parameters (V, I, f, Q, P, S, W, THD-V, THD-I, ...)
- ☑ Display and internal storage of minimum and maximum values with time stamp
- ☑ Display of date and time
- ☑ Display of harmonics, bar diagram available
- ☑ Large number of display options e.g. rotating display and adjustment of font size
- ☑ External input as well as 4 freely programmable relay outputs*
- ☑ Programming as operation-hours-counter possible
- ☑ (Transistor-) impulse output for energy impulse*
- ☑ Equipped with a SD memory card slot for data storage and easy passing on without online connection*
- ☑ Recording up to 720 days in one data file possible (at interval 15 min.)*
- ☑ Comfortable programming of recording interval and duration via timers*

Easy to use Windows-based software included in delivery*:

- ☑ Windows-based software for evaluation of recorded grid parameters
- ☑ Several pre-configured graphical display of standard values
- ☑ Large number of configuration options
- ☑ Graphical display of selected grid values
- ☑ Comfortable editing of parameters
- ☑ Comfortable editing of recording time intervall
- ☑ Display as line graph or bar diagram
- ☑ Simultaneous display of several diagrams
- ☑ Zoom-functions
- ☑ Copy into clipboard and print function available

*MMI7000-E only

Section 2: INSTALLATION AND IMPORTANT NOTES

The measuring device MMI7000 has been designed for three-phase measuring, display, and storage of electrical measuring values in a low-voltage-grid.
It is designed to be incorporated into the front panel of a switchboard and requires a switchboard section of 138 x 138 mm to DIN 43700/ IEC61554.

The device must only be operated by qualified personnel and must only be operated according to the given safety instructions. In addition, the relevant legal and safety regulations for live operation have to be obeyed.

The measurement can be used for single and three phase systems with or without neutral conductor. The maximum measuring voltage is 3 x 440 V ~ (L-N) or 3 x 760 V ~ (L-L).
The supply voltage is 110 ... 230 V +/- 15 %.
The connection wires that are used have to be suitable for the particulars voltages. Feed lines have to be protected by an over-voltage-protection device. The supply voltage has to be protected by a fuse and it must be sure that it can be switched off by a separating device.
All connection clamps may only be plugged at zero-voltage state!
The MMI7000 must not be operated without protective earth conductor connected!

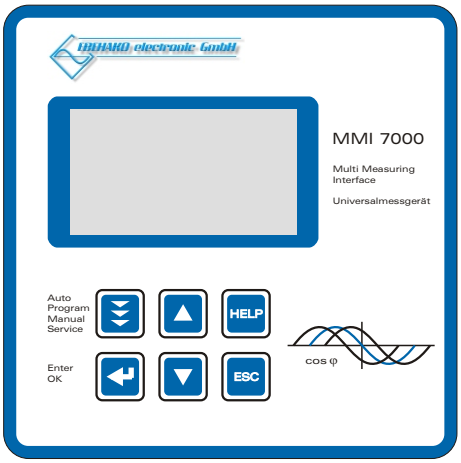
Before the device is connected up, all leads and cables must be checked to ensure that no current is flowing through them and the current converter must be short-circuited. Care should be taken to ensure that the measuring voltage and current are in the correct phase position. The measuring-current circuit must be wired with copper leads of 2.5mm^2. The connection should be set up as shown in next section. The specified safety regulations must be observed.

The measuring device is only designed for the usage in low-voltage switchgear systems.

Attention!
Connection to over voltage may result in the destruction of the device!

Section 3: APPEARANCE AND CONTROL

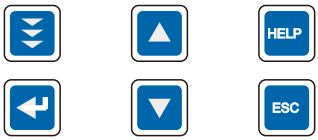
MMI7000: Front view



Operating Mode:
- Automatic
- Program.
- In-/Out-Mode
- Record-Mode
- Service
- Expert-Mode
- Osci-Mode
- Display Editor

Increase selected parameter

HELP opens help-pages

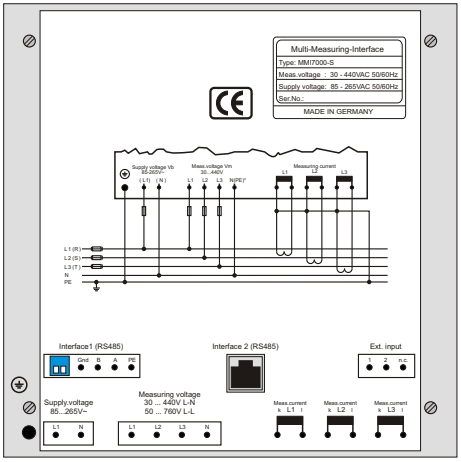


ENTER/OK Confirmation/ storage of values

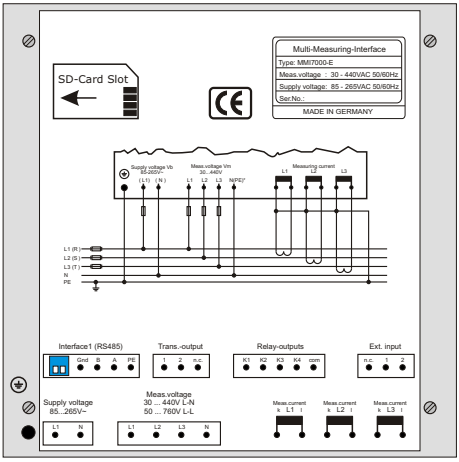
Reduce selected parameter

Escape previous page/value in the display

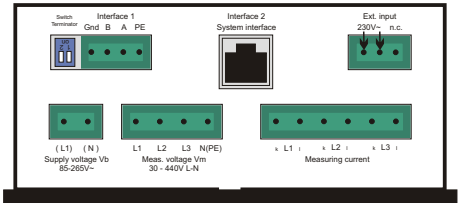
MMI7000/S - rear view

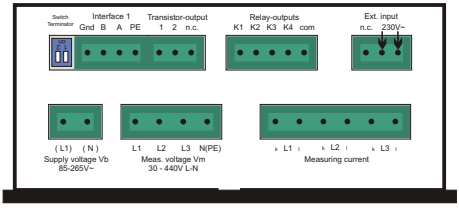


MMI7000/E - rear view

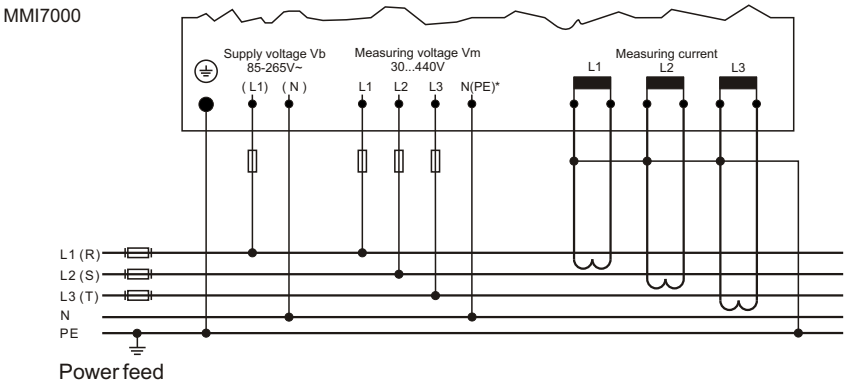


Connectors (from the bottom)





Section 4: CONNECTION



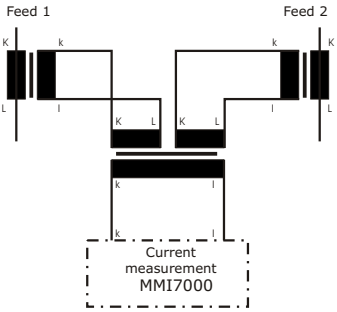
When measuring in grids without neutral conductor, connection N (PE socket) has to be connected with the protective earth (PE) conductor.

Current measurement

When installing the current converter, care should be taken to ensure that the load current flows through it. If the MMI7000 is connected up via sum-current converters, the overall conversion ratio is entered.

Current converter clamps should be grounded on one side!

Measurement via sum current converter



Advices for installation:

The wiring connections that are used have to be suitable for the particular voltages. Feed lines have to be protected by an over-voltage-protection device. The supply voltage has to be protected by a fuse and it must be ensured that it can be switched off by a separating device.
All connection clamps may only be plugged in a zero-voltage state!

The MMI7000 must not be operated without protective earth conductor connected!

Before the device is connected up, all leads and cables must be checked to ensure that no current is flowing through them and the current converter must be short-circuited. Care should be taken to ensure that the measuring voltage and current are in the correct phase position. The measuring-current circuit must be wired with copper leads of 2.5mm^2.

Attention!
Connection to over voltage may result in the destruction of the device!

Section 5: MENU FUNCTIONS / DISPLAY-MODE

Repeated pressing of the button activates the various menus in sequence:

DisplayMode - ProgramMode - IN/OUT-MODE - RecordMode - Service - ExpertMode - Osci-Mode - Display-Editer and back.

DisplayMode: (Main-mode of the device)

Variant 1:
Shows the display variants programmed in Display Editor (invoking and switching by ↑/↓-button)
It is possible to display 3 different pictures with 3 measuring values each as large letters and 3 pictures with 6 measuring values as small letters (Display 1...6).
Display 7: Display of TDH-V/TDH-I (not editable)
Display 8: Indication of actual status of in- and outputs (MMI7000-E only)

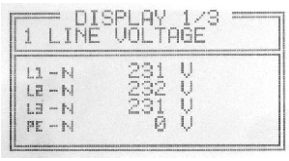
Variant 2:
Shows the standard grid parameters (invoking and switching with ENTER-button). The following fixed pre-set parameters can consecutively be selected:

Action	Display	Unit	in%	Large display possible	Bargraph diagramm	3-phase
ENTER	1 LINE VOLTAGE	V		x		x
ENTER	2 APPARENT CURRENT	A	x	x		x
ENTER	3 COS PHI ind/cap			x		x
ENTER	4 REACTIVE POWER	kvar		x		x
ENTER	5 ACTIVE POWER	kW		x		x
ENTER	6 APPARENT POWER	kVA		x		x
ENTER	7 FREQUENCY	Hz		x		x
ENTER	8 TEMPERATURE	°C		x		
ENTER	9 3.-51. HARMONICS		x		x	x
ENTER	10 HARMONICS THD-V/I		x		x	x
ENTER	11 ENERGY	kvarh(+),kvarh(-), kWh(+),kWh(-)				x
ENTER	12 TIME / DATE	↑ / ↓ changes date-format				
ENTER	13 Softwareversion					
ENTER	return to: 1					

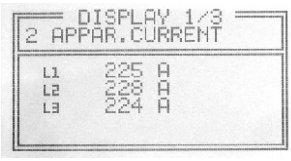
Buttons ↑ / ↓ change the display format:
The values can be displayed with unit, in %, or as large display resp. bar diagram.

=== DISPLAY ===

Examples of different displays:

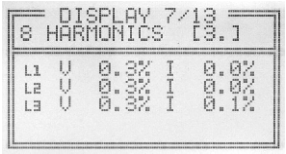


VOLTAGE 3-phas.



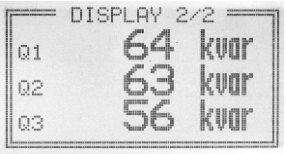
CURRENT 3-phas.

REACTIVE PWR 3-phas.

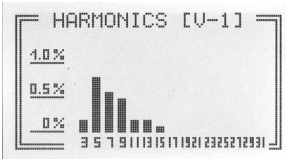


HARMONICS in %

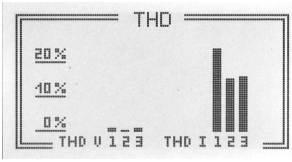
POWER FACTOR
LARGE LETTERS



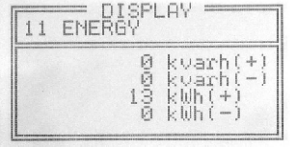
REACTIVE PWR
LARGE LETTERS



HARMONICS diagram



THD V/I as bar diagram



ENERGY

Section 6: HELP-FUNCTIONS

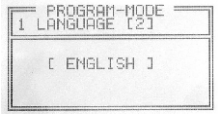
The MMI7000 features a context related help function.

For each menu item one or more help pages are available which can be accessed directly by the HELP-button. Scrolling is done with ↑ / ↓ buttons, back/retrace with ESCape.

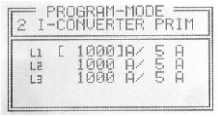
Section 7: PROGRAM-MODE

Pressing the button one time switches from automatic operation to the programming mode.
The upper part of the display always shows the parameter; the adjustable values are shown in the lower part. Editable values are generally given in square brackets. Changes of these values can be done by the buttons ↑ / ↓. By pressing the "ENTER-button" the value is stored. Pressing the "ESC"-button allows to go one step back (without storing).

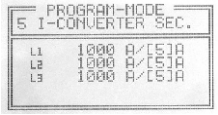
1 LANGUAGE This selects the language of the operating menu [GERMAN, ENGLISH, SPANISH, RUSSIAN, TURKISH]



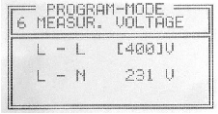
2 - 4 I-CONVERTER PRIM [1000] A / X (5 ... 13000) A
Selects the primary current of the current converters.
Sequential adjustment of L1...L3
via keys ↑ / ↓. Save and continue with ENTER



5 I-CONVERTER SEC 1000 A /[5]A (1 / 5 A)
This sets the secondary current of the current converter.
Selection via ↑ / ↓. Save and continue with ENTER

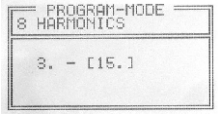


6 MEASURING VOLTAGE L-L [400]V (50...760) V
Programming of measuring voltage.
The values programmed here always refer to the L-L voltage in the system!

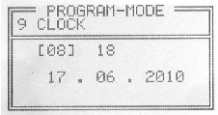


7 V-CONVERTER [NO] (300V-77kV/440V)
When a measuring-voltage converter (e.g. for HV-measurement) is used, its conversion ratio is to be programmed here.
Selection via ↑ / ↓. Save / continue with ENTER

8 HARMONICS 3. - [15.] (possible up to 51.)
Setting of maximum order of harmonics up to which the calculations shall be done.
Remark: The more calculations are to be performed, the slower the indication of harmonics in the display is updated!

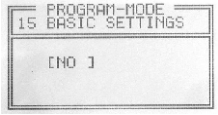


9 -13 CLOCK [HH:MM], **DATE** [DD.MM.YY]
Set system-time and date
(Due to an internal battery the time will be kept even in case of power loss)
Selection with ↑ / ↓. Save/continue with ENTER



14 CONTRAST [6] (0...10)
Adjustment of display contrast for best readability.
Selection with ↑ / ↓. Save/continue with ENTER

15 Basic settings [NO] (YES/NO)
All parameters are set back to the factory settings.



ATTENTION: All user settings get lost !

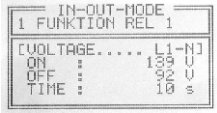
Section 8: IN/OUT MODE *

Pressing the button leads to the **IN/OUT MODE** where the programming of in- and outputs of the device is done.

Version MMI7000-E features a switching input (230 V~), and 4 potential free relay outputs (250 V, 1000 W) as well as a transistor output (60 V, 40 mA).
Functions of in- and outputs can be freely programmed in this mode.

1 FUNCTION REL 1 (in total 38 functions possible)

One of the following functions can be programmed here for relay 1:
(Threshold values are set under menu point 2-4).



- ▣ OFF
- ▣ Voltage L1-N, Voltage L2-N, Voltage L3-N
- ▣ Voltage asymmetry
- ▣ Current L1, Current L2, Current L3
- ▣ Current asymmetry
- ▣ cos-Phi L1, cos-Phi L2, cos-Phi L3, cos-Phi Σ
- ▣ Reactive power L1, Reactive power L2, Reactive power L3, Reactive power Σ
- ▣ Active power L1, Active power L2, Active power L3, Active power Σ
- ▣ Apparent power L1, Apparent power L2, Apparent power L3, Apparent power Σ
- ▣ Frequency L1, Frequency L2, Frequency L3
- ▣ Temperature
- ▣ THD-V L1, THD-V L2, THD-V L3, THD-V L1...L3 max
- ▣ THD-I L1, THD-I L2, THD-I L3, THD-I L1...L3 max
- ▣ ON

2 THRESHOLD ON REL 1
Programming of switch-on threshold for the function programmed under 1.
Input via ↑ / ↓. Save / continue with ENTER

3 THRESHOLD OFF REL 1
Programming of switch-off threshold for the function programmed under 1.
Input via ↑ / ↓. Save / continue with ENTER

4 DELAY TIME REL 1 [0] sec. (0...255)sec.
Programming of a time delay for relay 1 when the programmed event occurs.
Input via ↑ / ↓. Save / continue with ENTER

* MMI7000/E only

Programming of relay 2-4 is done according relay 1:

5 FUNCTION REL 2
6 VALUE ON REL 2
7 VALUE OFF REL 2
8 DELAY TIME REL 2

9 FUNCTION REL 3
10 VALUE ON REL 3
11 VALUE OFF REL 3
12 DELAY TIME REL 3

13 FUNCTION REL 4
14 VALUE ON REL 4
15 VALUE OFF REL 4
16 DELAY TIME REL 4

17 TRANSISTOR-OUTPUT 1

One of the following counter functions can be programmed here for the transistor-output:

- ▣ OFF
- ▣ REACTIVE ENERGY IND (kvarh+)
- ▣ REACTIVE ENERGY CAP (kvarh -)
- ▣ ACTIVE ENERGY (+) kWh(+)
- ▣ ACTIVE ENERGY (-) kWh(-)
- ▣ ON (permanent)

18 ENERGY-IMPULS (only if transistor-output is active)

Equivalence of an impulse is defined here:

- ▣ 1 Imp/ 1kvarh
- ▣ 1 Imp/ 10kvarh
- ▣ 1 Imp/ 100kvarh

19 EXTERNAL INPUT 1

Programming of function of the input.
Following functions are possible:

- ▣ OPERATING HOURS (counter)
  Cumulative time measurement when signal is applied, value is stored.
  Reset possible in Service-Menu.

- ▣ 2. ENERGY COUNTER
  If this option is chosen, two separated energy counters are activated in the device (see display-mode: energy).
  1. counter active, when no signal at external input (2. counter inactive)
  2. counter active, when signal at external input (1. counter inactive)

- ▣ WITHOUT FUNCTION

Section 9: RECORD-MODE * * MMI7000-E only

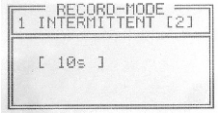
The RECORD-MODE is the main mode of the device. Here the recording of grid parameters is started or stopped (direct start or via timer) and the status of the recording is indicated in the display.

The storage of parameters is done on a standard SD-card (for example 1 GB). The card slot is placed on the right side of the device.
Up to 50 data files can be stored on a 1-GB-card.
In one data file the following maximum recording times are available, depending on the recording interval:

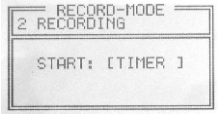
Interval 1 sec:	max. recording time:	approx. 18 hours
Interval 10 sec:	max. recording time:	approx. 7 days
Interval 60 sec:	max. recording time:	approx. 48 days
Interval 15 min:	max. recording time:	approx. 720 days

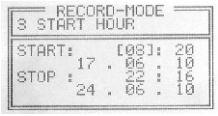
Generally, all grid parameters are recorded. The processing of the recorded data is done using a PC with the software included in the delivery which also allows the selection of customer-relevant data.

1 INTERMITTENT [10s] (1 / 10 / 60sec / 15min)
Recording interval for recording of grid values to the SD-card. By selecting a smaller interval a more precise evaluation is possible, but the available total recording time is reduced.



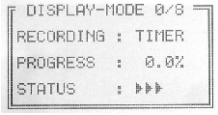
2 RECORDING (NO / YES / TIMER / SERIE)
YES: Recording starts immediately.
Time of start and stop is indicated in the display (according to the maximum possible recording time).
TIMER: Enables the selection menu for programming of start and stop time of the recording.
SERIE: Recording starts immediately.
Recording is done until the SD-card is full
(several data files are created consecutively).





3-12 Programming of start and stop time of a recording
(Only if " TIMER" has been selected in: 2 Recording)

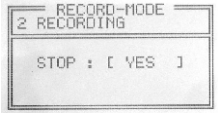
3 START HOUR	8 STOP HOUR
4 START MINUTE	9 STOP MINUTE
5 START DAY	10 STOP DAY
6 START MONTH	11 STOP MONTH
7 START YEAR	12 STOP YEAR



After direct start / after programming of the timer the display changes over to the DISPLAY-MODE and indicates the progress / the status of the recording.

9.1 INTERRUPTION OF RECORDING

The recording can be interrupted or finished at any time under:
RECORD-MODE: 2 RECORDING STOP:[YES]



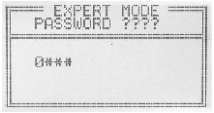
Section 10: SERVICE-MENU

This service menu can be reached by the button.
The stored min. and max. values of the grid parameters and the operating time can be displayed here.

Action	Display	Unit	3-phase
ENTER ↑/↓	1 min. VOLTAGE with time-stamp	V	L1 ... L3
ENTER ↑/↓	2 min. CURRENT with time-stamp	A	L1 ... L3
ENTER ↑/↓	3 min. REACTIVE PWR with time-stamp	kvar	L1 ... L3
ENTER ↑/↓	4 min. ACTIVE POWER with time-stamp	kW	L1 ... L3
ENTER ↑/↓	5 min. APPARENT PWR with time-stamp	kVA	L1 ... L3
ENTER ↑/↓	6 min. FREQUENCY with time-stamp	Hz	L1 ... L3
ENTER ↑/↓	7 min. TEMPERATURE with time-stamp	°C / °F	
ENTER ↑/↓	8 min. THD-V / THD-I with time-stamp	% / Bargraph	L1 ... L3
ENTER ↑/↓	9 max. VOLTAGE with time-stamp	V	L1 ... L3
ENTER ↑/↓	10 max. CURRENT with time-stamp	A	L1 ... L3
ENTER ↑/↓	11 max. REACTIVE PWR with time-stamp	kvar	L1 ... L3
ENTER ↑/↓	12 max. ACTIVE POWER with time-stamp	kW	L1 ... L3
ENTER ↑/↓	13 max. APPARENT PWR with time-stamp	kVA	L1 ... L3
ENTER ↑/↓	14 max. FREQUENCY with time-stamp	Hz	L1 ... L3
ENTER ↑/↓	15 max. TEMPERATURE with time-stamp	°C / °F	
ENTER ↑/↓	16 max. THD-V / THD-I with time-stamp	in % / Bargraph	L1 ... L3
ENTER	17 OPERATING TIME	h / min.	
ENTER	18 MIN. VALUES RESET		
ENTER	19 MAX. VALUES RESET		
ENTER	20 ENERGY RESET		
ENTER	21 OPERATING TIME RESET		
ENTER	back to 1		

Section 11: EXPERT-MODE

The expert mode has an access code:



1 PASSWORD: "6343"

2 OPERATING LOCK [NO] (NO / YES)

As a protection against unauthorized changes of the system parameters, the device is equipped with a programming lock. This can be activated in the EXPERT MODE. When the lock is active, all parameters can be checked but not changed.

3 PROTOCOL COM1* **[MODBUS RTU]**
(ASCII OUT, MODBUS RTU, MODBUS KTR, ---)

4 BAUDRATE COM1* **[9600] (4800 ... 38400)** * **MMI7000-S and**

5 BUS-ADRESS COM1* **[1] (1...128)** **MMI7000-E**

The ASCII-transmission protocol can here be adjusted according to the requirements:

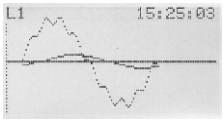
- ASCII transm. time		[10] sec.	(5...255) sec.
- VOLTAGE	COM1	[YES]	(YES/NO)
- CURRENT	COM1	[YES]	(YES/NO)
- COS-PHI	COM1	[YES]	(YES/NO)
- REACTIVE POWER	COM1	[YES]	(YES/NO)
- ACTIVE POWER	COM1	[YES]	(YES/NO)
- APPARENT POWER	COM1	[YES]	(YES/NO)
- SEPARATOR 1	COM1	[YES]	(YES/NO)
- SEPARATOR 2	COM1	[YES]	(YES/NO)
- START SIGNAL	COM1	[YES]	(YES/NO)

6 PROTOCOL COM2** **[MODBUS RTU]**
(ASCII OUT, MODBUS RTU, MODBUS KTR, ---)

7 BAUDRATE COM2** **38400 - not changeable**

8 BUS-ADRESS COM2** **[1] (1...128)** ** **MMI7000-S only**
Settings compare with Bus-Adress COM1

Section 12: OSCI-MODE



Access via operation mode button in main menu.
In the osci-mode the actual form of a period of voltage and current is graphically displayed. This allows gathering of information about phase shift and wave form.
Assignment of current / voltage to same phase can be checked here.
Indication consecutively possible for L1...L3 (ENTER-button) Updating is done via button ↓.

Section 13: DISPLAY-EDITOR / SCAN-MODE

Access via operation mode button in main menu.
In the DISPLAY EDITOR the parameters that shall be permanently displayed in the display mode can be selected.

6 different display settings with 3 measuring values in large letters (display 1-3) or 6 measuring values in small letters (display 4-6) can be programmed.

The recorded displays can be shown one after the other with the ↑ button in the DISPLAY-MODE or a consecutive automatic display is possible in SCAN-MODE. The settings for the SCAN-MODE (selection of pages, display time) are also performed in the DISPLAY-EDITOR.

After switching on of the device or after a voltage breakdown, the last display variant will be recovered.

Programming of display is performed consecutively line wise:

1.-3. Display 1 - Line 1...3
4.-6. Display 2 - Line 1...3
7.-9. Display 3 - Line 1...3
10.-15. Display 4 - Line 1...6
16.-21. Display 5 - Line 1...6
22.-27. Display 6 - Line 1...6

Following display values can freely be assigned to each of the a.m. lines:

Meas. voltage L1-L3,	Meas. current L1-L3,	
Reactive power L1-L3, Σ	Active power L1-L3, Σ	Apparent power L1-L3, Σ
Frequency L1-L3,	COS-PHI L1-L3, Σ	System temperature
THD-V L1-L3	THD-I L1-L3	(Space)

Programming SCAN-MODE:

28. SCAN-MODE		[NO]	(NO/YES)
29. SCAN-MODE	START-PAGE	[xx]	
30. SCAN-MODE	STOP - PAGE	[xx]	
31. SCAN-MODE	DISPLAY-TIME	[xx] sec.	(1-250sec.)
32. BASIC SETTINGS		[NO]	(NO/YES)

All parameters are set back to the factory settings.

Section 14: INTERFACE*

The MMI7000-S is equipped with two, the MMI7000-E with one isolated RS485-interface. Connection according to the drawing page 5.

The following functions can be realized via the interfaces:

- ☑ Parameterization of the device via PC with enclosed software
- ☑ Remote read out of grid parameters, display with enclosed PC-software during online-operation
- ☑ Usage as system interface for connection of accessories
- ☑ Usage for customer specific applications (facility master control system, SPC etc.)
- ☑ MODBUS-Protocol (s. Annex) or
- ☑ ASCII-Protocol (s.table below)

Interface 1 mainly designed for customer specific applications, whilst
Interface 2 intended for coupling with accessories.

Coupling with a PC for the usage of Windows-Software can be done from both interfaces with accessory "USB-adapter".

RS485- Bus structure
All devices are connected to one line in parallel. (Example connection of several devices to a PC.) This requires a direct connection of the bus lines to the plug connection of the device (no junction box).

Cable
For connection a twisted and shielded cable has to be used. The shielding has to be connected with casing or cabinet parts at both ends.
Max. cable length in the bus is 1,200 m (depending on cable and baud rate).
At the first and at the last device of the bus the cable has to be terminated with resistors. Activation (termination) on the controller side is done with the switch "Termination" next to the clamp "Interface1" (both white switches on "ON").

14.1 Design of ASCII-transmission protocol

The following data is sent one after the other:

DATE	TIME	
V1 = 223 V	V2 = 223 V	V3 = 223 V
I1 = 100 A	I2 = 100 A	I3 = 100 A
PF1 = 1.00	PF2 = 1.00	PF3 = 1.00
Q1 = 100 kvar	Q2 = 100 kvar	Q3 = 100 kvar
P1 = 100 kW	P2 = 100 kW	P3 = 100 kW
S1 = 100 kVA	S2 = 100 kVA	S3 = 100 kVA

The ASCII- transmission protocol can be adjusted to the requirements:
(Expert-Mode / Menu item 5 ff.)

* MMI7000-S and -E only

Section 15 Windows-Software für PC

(enclosed with delivery of version -S/-E)

PC-Software on CD
The following features are included in the software:

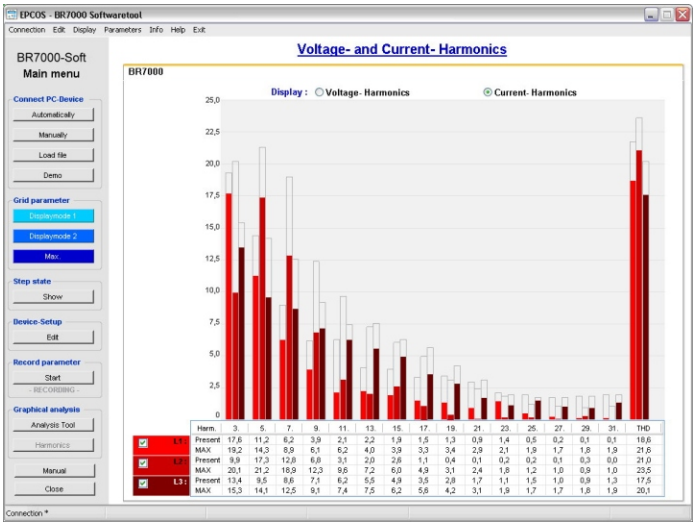
Visualization and evaluation of the grid parameters recorded on the SD-card:

- ☑ various pre-configured graphical displays of measured values
- ☑ graphic display of selected grid values
- ☑ comfortable editing of parameters and time interval
- ☑ simultaneous display in several diagrams with same time reference
- ☑ display of harmonic spectrum
- ☑ display as line- or bar diagram, zoom-function
- ☑ copy to clipboard, print function included

Online-operation of MMI7000 on PC:

- ☑ remote programming of MMI7000
- ☑ real time display of measured grid parameter and display on the PC

A detailed description of all software functions can be found in the online-help-function of the software.



Annex 1: Troubleshooting

Fault	Reasons / Solution
Indication of negative power in the display	- Check connection/direction of current for the current transformer - Check direction of energy of the system (delivery?)
Wrong grid cos-phi indicated	- see above - check phase shift - check phase position (voltage/current in same phase) - see Osci-Mode
Display of measuring current: ">" (over-current)	- Measurement current range exceeded Check settings of current transformer!
Display of measuring voltage: ">" (over-voltage)	- Measuring voltage range exceeded Voltage transformer programmed?
After switching on, the display indicates "SYSTEM-TEST"	The system-test is performed to check the device when starting. If this page shows up, at least one internal test is not OK. The error can be read out here, but cannot be solved. Depending on the error (e.g. internal battery empty) it might be possible to continue working for the time being. Quit with "ESC".
No voltage indication at measuring device	- Check fuses for the measuring voltage in the system (L1-L3). - Has voltage been applied at the inputs? - Is the device connected to the protective conductor?
No connection in the network (MMI 7000-S and MMI 7000-E only)	- Check network connections; maybe exchange connection A and B - In case an interface adapter (RS485 to RS 232 or RS485 to USB) is used: not all brands are compatible!
Recording does not start or display "SD-card not ready" (MMI 7000-E only)	- Has a compatible SD-card been plugged?

Annex 2: Technical Data

Type series	MMI 7000
Operating voltage	110...230 V~, +/-15% - 50/60Hz
Measuring voltage (3-phase)	3x 30...440 V~ (L-N) - 50/60Hz
	3x 50...760 V~ (L-L) - 50/60Hz
Measuring current (3-phase)	3x X:5A / X:1A
Power consumption	< 5 VA
Operation and display	
Menu Languages	D / E / ES / RU / TR
Display	Illuminated full-graphic display 128x64 Pixel
Displayfunktionen	
Display of grid-parameters As real value / in% / as bar graph Large display of 3 grid parameters	3-phase Cos-Phi, V, I, f, Q, P, S, THD-V, THD-I, W Selection via display-editor
Harmonics	3. - 51. harmonics of voltage and current also as bar diagram
Osci-mode	1 period V/I in oscilloscope mode
Temperature meas. range	-30°...100°C
Precision	Current / voltage: 1% Reactive-, active-, apparent power: 2%
Integrated help-function / HELP button	Context depending, plain text
Storage function*	
Storage of all grid-parameters with SD-Card according selected measuring Interval	3-phase Cos-Phi, V, I, f, Q, P, S, THD-V, THD-I Individual harmonics of V and I, energy
Memory	Standard SD-Card 1GB (enclosed with delivery)
Measuring interval	1sec. / 10sec. / 60 sec. /15min.
Max. storage capacity / file at meas. interval 1 / 10 / 60 sec./15 min.	18 hrs. / 7 days / 48 days / 720 days
Additional storage of minimum- and maximum values in internal memory (3-phase with time stamp)	Voltage, current, reactive-, active-, apparent-power, THD-V, THD-I, frequency, temperature
Interface (MMI7000/S and /E only)	
Isolated Interfaces RS485 MODBUS RTU, system interface	MMI7000/S: 2 independent interfaces MMI7000/E: 1 interface
External input (MMI7000/E only)	110...230V~ isolated
Switching outputs (MMI7000/E only)	
4 Relays-outputs	Isolated, Switching power: max. 250V/1000W Function individual programmable
1 Transistor-output	Isolated via opto-coupler Switching power: max. 40mA /60V Function programmable
* MMI7000/E only	

Annex 2: Technical Data (2)

Others	
Dimension	144x144x60mm
Weight	ca. 1 kg
Operating ambient temperature	-10 ... +50°C
Storage temperature	-20 ... +60°C
Degree of pollution	2
Protection class according to IEC60529	IP 40
Protection class	I
Safety standards	IEC 61010-1:2001; EN 61010-1:2001
EMV-resistance	IEC 61000-4-2:8kV; IEC 61000-4-4:4kV

Accessories in delivery:	**Type series:**	
Measuring device MMI7000 Manual Software-CD* SD-memory card 1GB* * MMI7000/E only	MMI7000-B MMI7000-S MMI7000-E	Basic version Additional 2x RS485 interface 1x Interface RS485, 1x External input 4x Relay-outputs 1x Transistor-output 1x Socket SD-Memory Card

Section 15: MAINTENANCE AND WARRANTY

No maintenance of the MMI7000 is required when operation conditions are obeyed. Nevertheless a rotating functional check of the device is recommended.

The measuring accuracy indicated is only guaranteed in case the device is tested / calibrated once a year by the supplier.

The typical life expectancy of the internal Li-battery is 8...10 years. It is firmly connected to the circuit board and should only be exchanged by the manufacturer.

In the event of any interventions in the controller during the warranty period, all warranty claims lapse.

Appendix 3: MODBUS-Protocol: read-only registers (Functioncode 3)

F	Modbus No.	Register / Function	Range	Unit / Digit	Note
3	3001	Power multiplier	16 Bit	1, 10, 100, 1000	to multiply with readed power
	3002..3005	L1..L3, Sum: Reactive power	16 Bit	1 var	to get real values s. No. 3001
	3006..3009	L1..L3, Sum: Active power	16 Bit	1 W	to get real values s. No. 3001
	3010..3013	L1..L3, Sum: Apparent power	16 Bit	1 VA	to get real values s. No. 3001
	3014..3017	L1..L3, Sum: Diff. Reactive power	16 Bit	1 var	to get real values s. No. 3001
	3018..3020	L1..L3: Voltage	16 Bit	1 V	
	3021..3023	L1..L3: Current	16 Bit	1 A	
	3024	cos-Phi L1	16 Bit		(0hFCE0) -800 = 0,800cap
	3025	cos-Phi L2	16 Bit		(0h03E8) 1000 = 1,000
	3026	cos-Phi L3	16 Bit		(0h0320) 800 = 0,800ind
	3027	cos-Phi Sum	16 Bit		
	3028..3030	L1..L3: Frequency	8 Bit	1 Hz	
	3031	Temperature (cabinet)	16 Bit	1 °C	0h0A= 10°C / 0hFFF6= -10°C
	3035	Output (relay) K1..4	4 x 1 Bit	0 = OFF / 1=ON	Bit1 . .4
	3037	Error register L1 / L2	2 x 8 Bit		High= L1 / Low= L2
	3038	Error register L3 / Sum	2 x 8 Bit		High= L3 / Low= Sum
	3043	Time	16 Bit		High= Minute / Low= Second
	3044	Date / Time	16 Bit		High= Day / Low= Hour
	3045	Date	16 Bit		High= Month / Low= Year
	3073..3087	3. - 31. Voltage harmonics L1	16 Bit	0,1 %	
	3088..3102	3. - 31. Voltage harmonics L2	16 Bit	0,1 %	
	3103..3117	3. - 31. Voltage harmonics L3	16 Bit	0,1 %	
	3118..3132	3. - 31. Current harmonics L1	16 Bit	0,1 %	
	3133..3147	3. - 31. Current harmonics L2	16 Bit	0,1 %	
	3148..3162	3. - 31. Current harmonics L3	16 Bit	0,1 %	
	3163..3165	L1..L3: Voltage-THD	16 Bit	0,1 %	
	3166..3168	L1..L3: Current-THD	16 Bit	0,1 %	
	3281	Max. ordinal number of harmonics	8 Bit		Value * 2 +1 = ordinal number
	3226..3231	L1..L3: Timestamp max. voltage	32 Bit		
	3232..3237	L1..L3: Timestamp max. current	32 Bit		
	3238..3243	L1..L3: Time. max. reactive power	32 Bit		Bit0 ..16 Time in Seconds
	3244..3249	L1..L3: Time. max. active power	32 Bit		Bit17..21 Day (1..31)
	3250..3255	L1..L3: Time. max. apparent power	32 Bit		Bit22..25 Month (1..12)
	3262	Timestamp max. temperature	32 Bit		Bit26..31 Year + 2000
	3264..3269	L1..L3: Time. max. voltage-THD	32 Bit		
	3270..3275	L1..L3: Time. max. current-THD	32 Bit		
	3276..3278	L1..L3: min. voltage	16 Bit	1 V	
	3279..3281	L1..L3: max. voltage	16 Bit	1 V	
	3282..3284	L1..L3: max. current	16 Bit	1 A	
	3285	Max. power multiplier	16 Bit	1, 10, 100, 1000	multiply with read.max. power
	3286..3289	L1..L3, Sum: max. reactive power	16 Bit	1 var	to get real values s. No. 3285
	3290..3293	L1..L3, Sum: max. active power	16 Bit	1 W	to get real values s. No. 3285
	3294..3297	L1..L3, Sum: max. apparent power	16 Bit	1 VA	to get real values s. No. 3285
	3298	Max. Temperature (cabinet)	16 Bit	1 °C	0h0A= 10°C / 0hFFF6= -10°C
	3299..3301	L1..L3: max. voltage-THD	16 Bit	0,1%	
	3302..3304	L1..L3: max. current-THD	16 Bit	0,1%	
	3305, 3306	Reactive energy (inductive)	32 Bit	kvarh	High-, Low- Word
	3307, 3308	Reactive energy (capacitive)	32 Bit	kvarh	High-, Low- Word
	3309, 3310	Work (+)	32 Bit	kWh	High-, Low- Word
	3311, 3312	Work (-)	32 Bit	kWh	High-, Low- Word
	3841..3850	33.-51. Voltage harmonics L1	16 Bit	0,1 %	
	3851..3860	33.-51. Voltage harmonics L2	16 Bit	0,1 %	
	3861..3870	33.-51. Voltage harmonics L3	16 Bit	0,1 %	
	3871..3880	33.-51. Current harmonics L1	16 Bit	0,1 %	
	3881..3890	33.-51. Current harmonics L2	16 Bit	0,1 %	
	3891..3900	33.-51. Current harmonics L3	16 Bit	0,1 %	

Modbus Function-Code 3 (read-only), Example: Read register 3018 (Voltage L1). Result = 233V

Byte	Master	dec	hex	Response	dec	hex	Resp.Exception	dec	hex
1	Slave Address	1	0h01	Slave Addr.	1	0h01	Slave Addr.	1	0h01
2	Functioncode	3	0h03	Functionc.	3	0h03	Functionc.	131	0h83
3	Starting register 'H'	11	0h0B	Quantity	2	0h02	Exception code	1	0h01
4	Starting register 'L'	202	0hCA	Data 'H'	0	0h00	CRC 'L'	128	0h80
5	Quantity 'H'	0	0h00	Data 'L'	233	0hE9	CRC 'H'	240	0hF0
6	Quantity 'L'	1	0h01	CRC 'L'	121	0hD4			
7	CRC-Checksum 'L'	144	0h90	CRC 'H'	202	0hCA			
8	CRC-Checksum 'H'	122	0h7A						

Appendix 3: MODBUS-Protocol: write-only registers

for next versions

Display complies with last recorded “DISPLAY-MODE”

PROGRAM-MODE

IN/OUT-MODE

to the display configurations programmed in the “Display-Editor”

Display of Standard-grid parameters

= DISPLAY-MODE 0 =

RECORDING: OFF
PROGRESS : 5%
STATUS: >>>>>>>

DISPLAY-MODE 1/8

L1 230 V
L2 230 V
L3 230 V

DISPLAY-MODE 2

L1 123 A
L2 239 A
L3 167 A

DISPLAY-MODE 3

PF L1 1.00
PF L2 0.98 IND
PF L3 0.97 IND

DISPLAY-MODE 4

Q1 88.23 kvar
Q2 89.50 kvar
Q3 90.20 kvar
cos φ L1 1.00
cos φ L2 0.98 IND
cos φ L3 0.97 IND

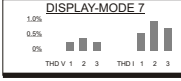
DISPLAY-MODE 5

QΣ 88.23 kvar
PΣ 89.50 kW
SΣ 90.20 kVA
cos φ Σ 0.98 IND

DISPLAY-MODE 6

f1 50 Hz
f2 50 Hz
f3 50 Hz
QΣ 88.23 kvar
PΣ 89.50 kW
SΣ 90.20 kVA

DISPLAY-MODE 7



DISPLAY-MODE 8

REL1: 0 INP1 - 0
REL2: 1
REL3: -
REL4: -
OPTO: A

1 LINE VOLTAGE

L1-N 230 V
L2-N 230 V
L3-N 230 V
PE-N 0 V

2 APPAR. CURRENT

L1 123 A
L2 239 A
L3 167 A

3 COS φ

cosφ L1 1.00
cosφ L2 0.98 IND
cosφ L3 0.97 IND
cosφ Σ 0.99 IND

4 REACTIVE POWER

L1 88 kvar
L2 88 kvar
L3 88 kvar
Σ 264 kvar

5 ACTIVE POWER

L1 88 kW
L2 88 kW
L3 88 kW
Σ 264 kW

6 APPARENT POWER

L1 88 kVA
L2 88 kVA
L3 88 kVA
Σ 264 kVA

7 FREQUENCY

L1 50 Hz
L2 50 Hz
L3 50 Hz

8 TEMPERATURE

26 °C

9 HARMONICS [3.]

L1 V 0.5% I 1.0%
L2 V 0.8% I 1.0%
L3 V 0.5% I 1.0%

10 HARMONICS THD

L1 V 0.3% I 0.2%
L2 V 0.3% I 0.2%
L3 V 0.3% I 0.2%

11 ENERGY

xxx kvarh (+)
xxx kvarh (-)
xxx kWh (+)
xxx kWh

12 TIME / DATE

12:56:07
25.02.2010
(FORMAT-CHANGE)

13 SOFTWAREVERSION

MMI 7000
VERSION V1.0

BACK TO 1

1 LANGUAGE [2]

[ENGLISH]

2-4 I-CONVERTER PRIM

L1 [1000] A / 5 A
L2 1000 A / 5 A
L3 1000 A / 5 A

5 I-CONVERTER SEC.

L1 1000 A / [5] A
L2 1000 A / [5] A
L3 1000 A / [5] A

6 MEASUR. VOLTAGE

L - L [400] V
L - N 230 V

7 V - CONVERTER

[NEIN]

8 HARMONICS

3. - [15.]

9 CLOCK

[10] : 40
12 . 02 . 2010

10 CLOCK

10 : [40]
12 . 02 . 2010

11 DATE

10 : 40
[12] . 02 . 2010

12 DATE

10 : 40
12 . [02] . 2010

13 DATE

10 : 40
12 . 02 . [2010]

14 CONTRAST

****** [6] ******

15 BASIC SETTINGS

[NO]

BACK TO 1

1 FUNCTION REL 1

[VOLTAGE…L1-N]
(38 different functions possible refer description on page 10)

2 THRESHOLD ON REL1

[ON: xxxx]

3 THRESHOLD OFF REL1

[OFF: xxxx]

4 DELAY REL 1

[TIME: xxxx]

5 FUNCTION REL 2

[OFF]
(38 different functions possible refer description on page 10)

6 - 8 as 2 - 4

9 FUNCTION REL 3

[OFF]
(38 different functions possible refer description on page 10)

10 - 12 as 2 - 4

13 FUNCTION REL 4

[OFF]
(38 different functions possible refer description on page 10)

14 - 16 as 2 - 4

17 TRANS.-OUTPUT 1

[OFF]
(5 different functions possible refer description on page 11)

18 ENERGY/IMPULSE 1

[1Imp./ xxx kWh]
(equivalency of the impulse)

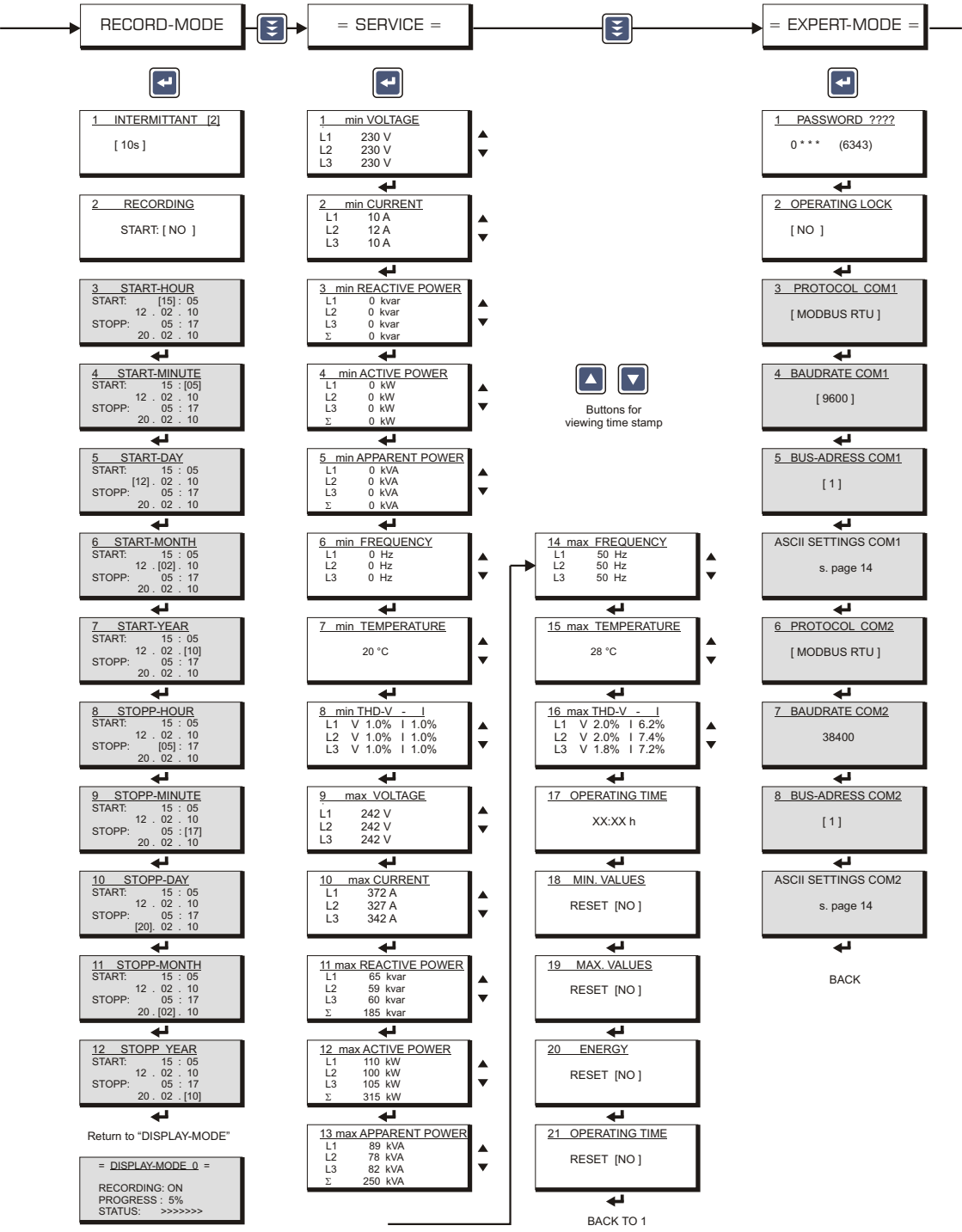
19 EXTERN-INPUT 1

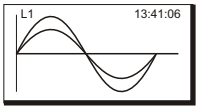
[without function]
Functions refer page 11

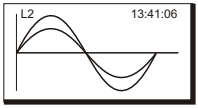
BACK TO 1

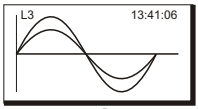
Settings shown with grey background colour are active only in case of certain other settings. If not needed they are not displayed.

Operating diagram (fast programming)
MMI 7000


RECORD-MODE
= SERVICE =
= EXPERT-MODE =
1 INTERMITTANT [2]
[10s]
2 RECORDING
START: [NO]
3 START-HOUR
START: [15] : 05
12 . 02 . 10
STOPP: 05 : 17
20 . 02 . 10
4 START-MINUTE
START: 15 : [05]
12 . 02 . 10
STOPP: 05 : 17
20 . 02 . 10
5 START-DAY
START: 15 : 05
[12] . 02 . 10
STOPP: 05 : 17
20 . 02 . 10
6 START-MONTH
START: 15 : 05
12 . [02] . 10
STOPP: 05 : 17
20 . 02 . 10
7 START-YEAR
START: 15 : 05
12 . 02 . [10]
STOPP: 05 : 17
20 . 02 . 10
8 STOPP-HOUR
START: 15 : 05
12 . 02 . 10
STOPP: [05] : 17
20 . 02 . 10
9 STOPP-MINUTE
START: 15 : 05
12 . 02 . 10
STOPP: 05 : [17]
20 . 02 . 10
10 STOPP-DAY
START: 15 : 05
12 . 02 . 10
STOPP: 05 : 17
[20]. 02 . 10
11 STOPP-MONTH
START: 15 : 05
12 . 02 . 10
STOPP: 05 : 17
20 . [02] . 10
12 STOPP YEAR
START: 15 : 05
12 . 02 . 10
STOPP: 05 : 17
20 . 02 . [10]
Return to “DISPLAY-MODE”
= DISPLAY-MODE 0 =
RECORDING: ON
PROGRESS : 5%
STATUS: >>>>>>>
1 min VOLTAGE
L1 230 V
L2 230 V
L3 230 V
2 min CURRENT
L1 10 A
L2 12 A
L3 10 A
3 min REACTIVE POWER
L1 0 kvar
L2 0 kvar
L3 0 kvar
Σ 0 kvar
4 min ACTIVE POWER
L1 0 kW
L2 0 kW
L3 0 kW
Σ 0 kW
5 min APPARENT POWER
L1 0 kVA
L2 0 kVA
L3 0 kVA
Σ 0 kVA
6 min FREQUENCY
L1 0 Hz
L2 0 Hz
L3 0 Hz
7 min TEMPERATURE
20 °C
8 min THD-V - I
L1 V 1.0% I 1.0%
L2 V 1.0% I 1.0%
L3 V 1.0% I 1.0%
9 max VOLTAGE
L1 242 V
L2 242 V
L3 242 V
10 max CURRENT
L1 372 A
L2 327 A
L3 342 A
11 max REACTIVE POWER
L1 65 kvar
L2 59 kvar
L3 60 kvar
Σ 185 kvar
12 max ACTIVE POWER
L1 110 kW
L2 100 kW
L3 105 kW
Σ 315 kW
13 max APPARENT POWER
L1 89 kVA
L2 78 kVA
L3 82 kVA
Σ 250 kVA
Buttons for
viewing time stamp
14 max FREQUENCY
L1 50 Hz
L2 50 Hz
L3 50 Hz
15 max TEMPERATURE
28 °C
16 max THD-V - I
L1 V 2.0% I 6.2%
L2 V 2.0% I 7.4%
L3 V 1.8% I 7.2%
17 OPERATING TIME
XX:XX h
18 MIN. VALUES
RESET [NO]
19 MAX. VALUES
RESET [NO]
20 ENERGY
RESET [NO]
21 OPERATING TIME
RESET [NO]
BACK TO 1
1 PASSWORD ????
0 * * * (6343)
2 OPERATING LOCK
[NO]
3 PROTOCOL COM1
[MODBUS RTU]
4 BAUDRATE COM1
[9600]
5 BUS-ADRESS COM1
[1]
ASCII SETTINGS COM1
s. page 14
6 PROTOCOL COM2
[MODBUS RTU]
7 BAUDRATE COM2
38400
8 BUS-ADRESS COM2
[1]
ASCII SETTINGS COM2
s. page 14
BACK







BACK TO L1

= DISPLAY EDITOR =
1 DISPLAY 1 LINE 1

1 [MEAS. VOLTAGE L1]
2 MEAS. VOLTAGE L2
3 MEAS: VOLTAGE L3

= DISPLAY EDITOR =
2 DISPLAY 1 LINE 2

1 MEAS. VOLTAGE L1
2 [MEAS. VOLTAGE L2]
3 MEAS. VOLTAGE L3

= DISPLAY EDITOR =
3 DSPLAY 1 LINE 3

1 MEAS. VOLTAGE L1
2 MEAS. VOLTAGE L2
3 [MEAS. VOLTAGE L3]

4 DISPLAY 2 LINE 1
5 DISPLAY 2 LINE 2
6 DISPLAY 2 LINE 3
7 DISPLAY 3 LINE 1
8 DISPLAY 3 LINE 2
9 DISPLAY 3 LINE 3
10 DISPLAY 4 LINE 1
11 DISPLAY 4 LINE 2
12 DISPLAY 4 LINE 3
13 DISPLAY 4 LINE 4
14 DISPLAY 4 LINE 5
15 DISPLAY 4 LINE 6
16 DISPLAY 5 LINE 1
17 DISPLAY 5 LINE 2
18 DISPLAY 5 LINE 3
19 DISPLAY 5 LINE 4
20 DISPLAY 5 LINE 5
21 DISPLAY 5 LINE 6
22 DISPLAY 6 LINE 1
23 DISPLAY 6 LINE 2
24 DISPLAY 6 LINE 3
25 DISPLAY 6 LINE 4
26 DISPLAY 6 LINE 5
27 DISPLAY 6 LINE 6

28 SCAN-MODE

[NO]

29 / 30 SCAN-MODE
START- PAGE: [1]
STOPP-PAGE: 3
SCAN - TIME : 5 s

31 SCAN-MODE
START- PAGE: 1
STOPP-PAGE: 3
SCAN - TIME : [5] s

= DISPLAY EDITOR =
32 BASIC SETTINGS

[NO]

BACK TO 1