THREE-PHASE METER MKD-ITF

The electronic three-phase energy meter **MKD-ITF** is capable of measuring energy in consumption and generation (four quadrants): active energy (consumed and generated), inductive reactive energy (consumed and generated) and capacitive reactive energy (consumed and generated), in addition to metering partial energies. The measurement is taken directly in true rms by three current transformers in L1, L2 and L3 incorporated in the unit. The power is supplied by the measurement itself between the phases L1 and L2. The parameters measured and calculated are shown in the table of variables.

This unit has 2 references:

MKD-ITF-C2: Meter with two energy pulse outputs.
MKD-ITF-RS485-I2-C2: Meter with RS485 Modbus RTU communication, 2 pulse outputs and 2 programmable voltage-free inputs (Tariffs/Inputs).

The programmable inputs may be digital inputs (logic condition or pulse receptor inputs), or tariff inputs. If the inputs are configured as tariffs, the meter has 3 tariffs.

> This manual is available in electronic format on **CIRCUTOR**'s website: www.circutor.es

⚠ Before making any maintenance operation, connection modification, repair, etc., you must disconnect the appliance from all power supplies. If you suspect an operational fault in the unit or in its protection system, remove the unit from service.

1.- KEYPAD FUNCTIONS

The button ⬤⇕ enables you to move through the different groups of energies, if relevant: tariff one and partial, or tariff one, two, three and partial. In the configuration menu, it is used to validate the data and skip to following parameterisation screen.

The button ⬤▲ enables you to select the different display options for active or reactive energy. In the configuration menu, it is used to increase the digit if you are introducing or selecting a variable.

The button ⬤► in the active option enables you to select generated or consumed energy, and in the reactive option it enables you to select inductive or capacitive. In the configuration menu, it is used to move the cursor between the figures.

The button ⬤Display enables you to turn on the display if there is no power supply. This function permits local reading of the meters, when the unit is out of service. This option is available provided the meter has an *optional* battery installed inside it (*see price list M3*).

The button ⬤Setup is for quick access to the complete parameterisation menu of the unit. To access this menu, keep it pressed for at least one second.

The button ⬤Clear has two purposes:
a) To erase the partial energies. To do this, keep the button pressed for at least four seconds. Once the message "*donE*" is displayed, it indicates that these meters (active and reactive) have been successfully initialised. The group of energies shown on screen are deleted.

b) To delete the pulse meter. To do this, keep the button ⬤Clear pressed for at least four seconds, on the display where the inputs are displayed. Once the message "*donE*" is displayed, it indicates that these meters (input 1 and input 2) have been successfully initialised.

The main function of the button ⬤⇅ is to start up the meter in one single step, with the minimum configuration for metering. (*See section 2.2.- One-step paramererisation*). This button indicates the direction of the current.

2.- ONE-STEP START-UP (FAST CONNECTION)

2.1.- Prior information

This option is only valid for indicating the direction of the current in an installation. As it is a direct measurement device, it does not have any voltage or current relationship.

2.2.- One-step parameterisation

By holding the button ⬤⇅ down, the unit changes the direction of the current to ascending or descending.

When you see ⊕ on the display, it indicates that the direction of the current is ascending and therefore, the load is in the upper part of the meter. To change the direction of the current of the meter, hold the button ⬤⇅

down; this changes the symbol on the display to ⊕ indicating the change in the current direction to descending.

Using a single button, ⬤⇅ the MKD-ITF energy meter is configured.

3.- COMPLETE PARAMETERISATION OF THE METER

Using the setup button, you can modify all the configuration options.

3.1.- Current direction

"*A dir*" appears on the screen; you must choose between "*UP*" (ascending) or "*dn*" (descending) depending on whether the load is in the upper or lower part of the meter.

3.2.- Metering in 2 or 4 quadrants

"*qUAd*" appears on the screen; you must choose one of the two available options: *2*=consumption or *4*=consumption and generation.

3.3.- Programming the disconnection time for the backlight

"*diSP oFF*" appears on the screen; you must program the time the backlight must stay on in seconds after the last button pressed. If you program *00*, the backlight is kept on permanently.

3.4.- Display or omission of reactive energy

"*rEAct*" appears on the screen; this option allows you to select the display or omission of the reactive energy ("*YES*" or "*nO*").

3.5.- Display or omission of partial energy

"*PArt*" appears on the screen; this option allows you to select the display or omission of the partial reactive and active energy ("*YES*" or "*nO*"). If you choose to omit it, the meter hides and stops the metering of partial energy.

#### 3.6.- Programming energy pulse outputs

The screen shows "*OUt Act*"; you must select which energy you wish to associate with digital output 1: consumed (*imPort*) or generated (*EHPort*) active energy; once you have validated the data with the button ⬤⇕, you must enter the value in *W·h* per pulse.

The screen shows "*OUt rEA*"; you must select which reactive energy you wish to associate with digital output 2: Inductive consumed, capacitive generated, inductive generated, capacitive consumed (*L / C- / L- / C*); once you have validated the data with the button ⬤⇕, you must enter the value in *var·h* per pulse. If you select 2 quadrants (*see section 3.2.- Metering in 2 or 4 quadrants*), only *L* and *C* are available, corresponding to the variables of reactive, inductive or capacitive energy consumed.

3.7.- Programming the digital inputs

The unit's digital inputs can be configured by way of selecting tariffs "*tAr iFFS*" with a maximum of three, or in digital inputs mode "*inPUtS*" whose main function is logging the pulses received "*PULS*", or, detecting the logic status of the input "*StAt*".

Through the indication "*In1 In2*" in the upper part of the display, the digital inputs of the meter are configured. To change the configuration of the inputs, and pass from "*tAr iFFS*" to "*inPUtS*", press the key ⬤▲:

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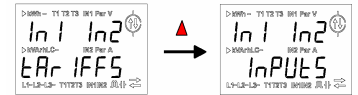
a) Tariffs "*tAr iFFS*"
The inputs convert the meter into a triple tariff meter, selecting each of them through hardware. The unit has one common and two voltage-free inputs to select the type of tariff in which you wish to work (Tariff 1, Tariff 2 or Tariff 3).
- Tariff 1: With no jumpers between terminals
- Tariff 2: Jumper between terminals 7 and 8
- Tariff 3: Jumper between terminals 9 and 8
The lower part of the screen shows "*t*", indicating that the inputs have been configured as tariff inputs.

b) Digital inputs "*inPUtS*"
The lower part of the screen shows "*inPUtS*", indicating that the inputs are configured as digital inputs. Each input must be configured separately; first input 1 "*In1*" and then input 2 "*In2*".
- Input 1: Terminal 7
- Input 2: Terminal 9
- Common for the inputs: Terminal 8
Each of the inputs must be defined between two operating modes:

b.1) Logic status mode "*StAt*".
When programmed as status "*StAt*", this indicates that the input of the meter receives a digital status input. Switch from "*StAt*" to "*PUL*" by pressing the key ⬤▲.
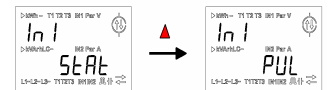
b.2) Pulse receptor mode "*PUL*".
When programmed as pulse receptor "*PUL*", this indicates that the signal received is a pulse input, and you must configure the weight of the pulse. Access this screen by pressing the key ⬤►.

Using the buttons ⬤► and ⬤▲ introduce the weight of the pulse. To validate it, press the key ⬤⇕.
Once you have programmed the weight of the pulse, the option "*In1 dEC*" is displayed, indicating the decimals to show of the pulses received.

4.- DEFAULT CONFIGURATION

The MKD-ITF electronic three-phase meter is supplied with the following default configuration:

VARIABLE	VALUE
Metering in 2 or 4 quadrants	2
Backlight disconnection	10
Reactive energy display	no
Partial energy display	no
Energy pulses	
- Active energy	Import
- W·h / Pulse	1000
- Reactive energy	L
- VAr·h / Pulse	1000

5.- COMMUNICATION (TYPE MKD-ITF-RS485-C2-IN)

5.1.- Programming configuration parameters

Parameters that can be configured in the parameterisation menu:

- "*NPER*": Peripheral number 001 to 255
- "*BAUD*": Speed 1200-2400-4800-9600-19200
- "*BITS*": Length 8 bits
- "*PARI*": No , Even, Odd
- "*STOP*": Stop bits 1 or 2
Default configuration: *001 / 9600 / 8 / N / 1*

5.2.- Communication protocol

The **MKD-ITF** meter uses the MODBUS RTU© communication protocol and the RS485 network protocol. The formulated as follows:

COMMAND: NPFTAAAANNNN CRC

PN:	1 Byte	Peripheral number
FT:	1 Byte	Function 04 Reading of n Words
AAAA:	2 Byte	Address of the 1st record
NNNN:	2 Byte	Number of records to request
CRC:	1 Byte	Cyclic Redundancy Checking

In the Modbus records, the energy is accumulated in kW·h x 100 (to 2 decimal places) with a length of 2 Words.

To read the status of the inputs, make the following Modbus request:

Rx: NP0100140002CRC
Tx: NP0101XXCRC
XX is the response byte.

Inputs activated	Response byte (XX)
None	03
Input 1	02
Input 2	01
All	00

5.3.- Map of MODBUS RTU© memory

VALUE	REC.
Active energy +	00-01
Active energy -	02-03
Inductive reactive energy +	04-05
Capacitive reactive energy -	06-07
Inductive reactive energy -	08-09
Capacitive reactive energy +	0A-0B
Tariff 1	
Active energy +	0C-0D
Active energy -	0E-0F
Inductive reactive energy +	10-11
Capacitive reactive energy -	12-13
Inductive reactive energy -	14-15
Capacitive reactive energy +	16-17
Tariff 2	
Active energy +	18-19
Active energy -	1A-1B
Inductive reactive energy +	1C-1D
Capacitive reactive energy -	1E-1F
Inductive reactive energy -	20-21
Capacitive reactive energy +	22-23
Tariff 3	
Active energy +	24-25
Active energy -	26-27
Inductive reactive energy +	28-29
Capacitive reactive energy -	2A-2B
Inductive reactive energy -	2C-2D
Capacitive reactive energy +	2E-2F
Partial	
Partial active energy +	30-31
Partial active energy -	32-33
Partial inductive reactive energy +	34-35
Partial inductive capacitive energy -	36-37
Partial inductive reactive energy -	38-39
Partial inductive capacitive energy +	3A-3B
Inputs	
Meter IN1	3C-3D
Meter IN2	3E-3F

5.4.- Description of communications

One or more MKD-ITF meters can be connected to a computer or PLC. This system makes it possible to centralise the data in one single record point, in addition to the normal running of each of them.

The **MKD-ITF** has an RS-485 type serial communication output. When you connect more than one analyser to an RS-485 communication bus, you need to assign a peripheral address (from 01 to 255) to each of them, so that the master (computer or PLC) can send the requests of the different records measured or calculated to these addresses.

The RS-485 connection is made with twisted pair communication cable with mesh shield, a minimum of three wires and a maximum distance between the master and the last unit of 1,200 metres. Up to 32 units can be connected in this RS485 series bus.

5.5.- Connections with network converters

Description of how to connect the RS485 bus, for communication through Intelligent Converter (RS485-RS232) or through Ethernet Converter (Transparent/Modbus/TCP).

MKD-ITF-RS485-I2-C2 M33011	Intelligent Converter M54020	Ethernet Converter M54031 / M54032
TERMINALS RS485	TERMINALS RS485	TERMINALS RS485/RS232
Terminal 6 A (+)	1 / A	A
Terminal 4 B (-)	2 / B	B
Terminal 5 (GND)	5 / GND	S

6.- DISPLAY

The display of the **MKD-ITF** energy meter is divided into two display areas: the first (in the upper part) shows the value of the active energy meters and the second (in the lower part) shows the inductive or capacitive reactive energy measurement. These meters show the partial energy of each of the energies when the code (PArt) appears on the display.

7.- DESCRIPTION OF DISPLAY ICONS

- L1-L2-L3 shows that the unit has rated voltage in each of the phases; if in one of them there is no rated voltage, the identification corresponding to this phase disappears.
- T1 T2 T3 identification only available in the type **MKD-ITF-RS485-I2-C2:**; this shows the tariff selected at that exact moment, independently of the tariff displayed in the upper part.
- The symbol ⌒ indicates that the nature of the load is inductive; the symbol ⊣⊢ indicates that the nature of the load is capacitive.
- The symbol ➡ indicates that the meter is in the first and fourth quadrant (consumption); the symbol ◀ indicates that the meter is in the second and third quadrant (generation).

8.- TECHNICAL SPECIFICATIONS

Power circuit:	Type AC
- Biphase (L1-L2):	90V – 500Vac (through the measurement itself)
- Frequency:	45…65 Hz
- Maximum consumption:	
Voltage V f-f <300V	2W – 3VA
Voltage V f-f ≥300V	2W – 20VA
- Working temperature:	-20ºC ….+ 60ºC
- Humidity (non-condensing):	5% .. 95%

Metering circuit:	
- Nominal voltage:	289Vac f-n / 500Vac f-f
- Frequency:	45…65 Hz
- Nominal current:	40 A
- Permanent overload:	120 A
- Minimum current:	160 mA
Energy meter upper limit	9,999,999 kWh

Class/Accuracy:	
- Active energy:	Class 1 – 62053-21
- Reactive energy:	Class 2 – 62053-22

Specifications of pulse outputs transistors:	
- Type: Transistor opto-insulated (collector open):	NPN
- Maximum switching voltage:	24 Vdc,
- Maximum switching current:	50 mA
- Maximum frequency:	5 pulses/second
- Pulse duration:	100 ms
Connections	Terminal 1: output 1
	Terminal 2: Common
	Terminal 3: output 2

Inputs specifications (type of input):	Voltage-free

Mechanical characteristics:	
Box material:	V0 self-extinguishing plastic
- Fitted unit protection (frontal):	IP 51
- Non-fitted unit protection (sides and rear cover):	IP 31
- Dimensions (mm) / weight (g):	105x90x73 mm / 410 g
- Maximum diameter of cable entrance (mm):	11

Standards: EN62052-11, EN62053-21, EN62053-23, EN61010-1
Safety: Class II / EN61010-1 Double-insulated electric shock protection class II

9.- TECHNICAL SERVICE

If you have any doubts about the running of the unit or any faults, contact our service staff at CIRCUTOR S.A.

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