NETWORK RECORDERS MC350 & MC350H

- VOLTAGE AND CURRENT AUTO RANGE MEASUREMENTS UP TO **600 V_{L-N}, 12.5 A**.
- ACTIVE ENERGY **ACCURACY CLASS 0.5S.**
- UP TO **FOUR I/O MODULES** (ANALOGUE OUTPUT, PULSE OUTPUT, ALARM OUTPUT, TARIFF INPUT).
- **4 ENERGY COUNTERS WITH TARIFF CLOCK OR TARIFF INPUT.**
- **INTERNAL RECORDER 8 MB** *(MC350).*
- **MODBUS, DNP3, M-BUS**.
- CERTIFIED SHIP VERSION.

Iskra®

PROPERTIES

- Measurements of instantaneous values of more than 60 quantities (U, I, P, Q, S, PF, PA, f, ϕ, THD, MD …)
- Harmonics measurements up to 31st harmonic
- Measurements of minimum and maximum values
- 8 MB flash memory for recorder
- 4 Energy counters
- Accuracy class U, I, P … 0.5
- Active energy Class 0.5S
- Frequency range from 16 Hz to 400 Hz
- Up to 4 I/O (two modules with 2 I/O):
  2 tariff inputs, 2 digital inputs, 2 digital outputs (SO or relay) or 2 analogue outputs
- AC or Universal (option) power supply
- Graphical LCD; 128 x 64 dots with illumination
- Automatic range of nominal current (max. 12.5 A) and voltage (600 V_{L-N})
- User-adjustable display of measurements
- Multilingual support
- Isolated communication RS485 or RS232 up to 115.200 bit/s, USB 2.0
- MODBUS, DNP3, M-Bus communication protocol supported
- Tropical version according to DIN EN 40040
- Certified ship version
- MiQen – user-friendly PC software for setting via communication

APPLICATION

The meter is intended for monitoring and measuring electrical quantities of single and three-phase electric energy system. It measures true TRMS value according to the principle of fast sampling of voltage and current signals. A built-in microprocessor calculates measurands (voltage, current, frequency, energy, power, power factor, phase angles, etc.) from the measured signals.
It records energy like the electricity meter in all four quadrants in up to four tariffs.
Since it also measures active and reactive power in all directions it can provide data about power direction (like ANSI code 32).
By using input/output modules it is possible to use meter for process control. Meter supports 2 optional I/O slots ready for use with double input or output modules. Available options are analogue output, digital output (open collector (SO) or mechanical relay) or tariff input. Digital output can be used as pulse or alarm output.
Alarms are useful tool for fast detection of exceeded parameters, monitoring proper magnitude level and notification in combination with alarm (relay) outputs. Thus function can be used for secondary over/under voltage/frequency protection, overload protection switch...
Internal memory (8MB) is used for recording of real time measurements and alarms, all equipped with a time stamp.

Various types of communication modules are available. Serial RS485, M-Bus can be used for connecting device in to the network, standard USB and serial RS232 for connection of device to computer or controller and service USB communication (not galvanic separated) that can be used for a fast set-up without need for auxiliary power supply.

Available combinations, supported functions and types can be seen in options table.

Special “ship version” is available, certified by Bureau Veritas.

PROGRAMING

Complete programming of a meter and downloading and analysing of stored data can be done via communication with user friendly MiQen software (free download from Iskra d.o.o. web page).
Setting of basic functions and navigation through illuminated LCD can easily be done via 5 buttons placed on the meter front panel.

DESCTRIPTION OF PROPERTIES

Measurands

- True TRMS values of currents and voltages
- Active, reactive, apparent power and power factor
- Energy in all 4 quadrants
- THD values of current and voltage
- Harmonics up to 31st on current and voltage (MC350H only)
- Minimum and maximum values (MC350H only)

Memory (MC350, MC350H only)

A built-in recorder (8Mb) enables storing of up to 32 measurements (two partitions) and detected alarms all equipped with a time stamp.
Sampling time of measurements recorder can be set from 1 to 60 min. Minimum, maximum, average or actual value of selected quantity can be stored.

Alarms

The meter supports setting of up to 16 alarms that are divided in to two alarm groups. Alarms can be set for any of measured parameters by setting condition and a limit value. A time constant of maximum demand values in a thermal mode, a delay time and switch-off hysteresis are defined for each group of alarms. To each of two alarm groups an alarm output (solid-state or electromechanical relay) can be dedicated.

Communication

Meter can be equipped with communication module. Different options are possible:

- Serial RS485
- Serial RS232
- USB 2.0
- M-Bus (MC350, MC350H only)
- Service USB (MC330 only)

Service USB communication uses USB Mini-B type connector that is not galvanic separated. Advantage is that in this case meter do not need a power supply to communicate. Communication via service USB communication is time limited.
When using service USB communication, power supply and measuring voltages needs to be disconnected.

Input/Output modules

The modules are available with double inputs/outputs. Each module has three terminals.
The meter is available without, with one or with two modules. The following modules are available:

- Pulse (digital) output (S0) 2 outputs
- Relay output 2 outputs
- Analogue output (MC350, MC350H only) 2 outputs
- Tariff input 2 inputs
- Digital input 2 inputs

Pulse (digital) output module is available as:
Pulse output according EN 62053-31 (27 V, 27 mA)

Aux power supply

Standard AC power supply enables connection of the meter to a specific AC voltage (57.7 / 63.5 ... V).
There are also two options with a universal power supply:

- Full range - DC (20–300 V) or AC (48–276 V / 40-65 Hz) voltage
- High range - DC (100–265 V) or AC (85–265 V / 40-65 Hz) voltage (MC350, MC350H only)

Data display

Data are displayed on 128 x 64 dot graphic LCD with illumination (37 x 69 mm). An indication symbols on the front side are optical LED for energy flow and active alarm.

Miqen

User friendly MiQen software is intended for supervision of the meter on PC. It enables easy parameterisation of the network and the meter, displaying and recording of real time values, downloading and analysis of stored data via the serial, USB or Ethernet communication. The information and stored measurements can be exported in standard Windows formats. MiQen is multilingual software and it functions on Windows 8, 7, XP, NT, 2000 operating systems. MiQen can be downloaded from *Iskra, d.o.o.* webpage www.iskra.eu.

TECHNICAL DATA

Measurement inputs

VOLTAGE MEASUREMENTS:

Measuring range	10 … 600 V_{LN}
Nominal voltage(U_N)	50 … 500 V_{LN}
Max. measured value (cont.)	600 V_{LN} ; 1000 V_{LL}
Overload	2 × U_N; 10 s
Consumption	< 0.1 VA
Input impedance	3.3 MΩ per phase

CURRENT MEASUREMENTS:

Measuring range	0.01 … 10 A
Nominal current (I_N)	1 / 5 A
Max. measured value	12.5 A sinusoidal
Max. allowed value (thermal)	15 A cont.
Overload	50 × I_N; 1s

FREQUENCY MEASUREMENT

Frequency measuring range (Only for frequency meas.)	16 … 400 Hz (on comm.) f_N ± 30 Hz (on analogue out)
Nominal frequency (f_N)	50/60 Hz
Optional nominal frequencies	16.6, 200, 400 Hz

Basic accuracy under reference conditions

Accuracy is presented as an accuracy class according to EN 61557-12 except when it is stated as an absolute value

Measurand		Accuracy class
Trms current (I1, I2, I3, Iavg, In)		0.5
Voltage Trms P-N and P-P		0.5
Power (P, S)		0.5
Reactive power (Q)		1
Power factor (PF)		0.5
Frequency (f)		10 mHz
P-N and P-P angle		0.5°
THD (U), THD (I) (0 … 400 %)		0.5 %
Active energy	EN 62053-21	Class 1
Active energy	EN 62053-22	Class 0.5S
Reactive energy	EN 62053-23	Class 2
Pulse output	EN 62053-31	Class A & B

Communication

SERIAL COMMUNICATION RS232

Connection type	Direct
Insulation	Protection class II 3.5 kV AC TRMS 1 min
Max. connection length	3 m
Transfer mode	Asynchronous
Protocol	MODBUS RTU / DNP3
Transfer rate	2.4 kBaud to 115.2 kBaud

SERIAL COMMUNICATION RS485

Connection type	Network
Insulation	Protection class II 3.5 kV AC TRMS 1 min
Max. connection length	1000 m
Transfer mode	Asynchronous
Protocol	MODBUS RTU / DNP3
Transfer rate	2.4 kBaud to 115.2 kBaud

M-BUS COMMUNICATION

Connection type	Network
Insulation	Protection class II 2.5 kV AC TRMS 1 min
Max. connection length	1000 m
Transfer mode	Asynchronous
Protocol	M-Bus
Transfer rate	300Baud to 9600Baud

USB COMMUNICATION

Connection type	Direct
Max. connection length	5 m
Insulation	Protection class II 3.5 kV AC TRMS 1 min
Insulation – Service USB communication (see warning below)	Protection class I 2.2 kV AC TRMS 1 min
Transfer mode	Asynchronous
Protocol	MODBUS RTU / DNP3
Transfer rate	USB 2.0

Warning!
Service USB communication is provided with only BASIC insulation and can ONLY be used unconnected to aux. supply AND power inputs.

INPUT / OUTPUT modules

ELECTROMECHANICAL RELAY OUTPUT

Purpose	alarm, pulse, general purpose digital output
Type	Electromechanical Relay switch
Rated voltage AC	250 V AC
Max. switching current AC	1000 mA AC
Rated voltage DC	250 V DC
Max. switching current DC	200 mA DC (valid for resistive load)
Contact resistance	≤ 100 mΩ (100 mA, 24V)
Pulse (if used as pulse output)	Max. No.4000 imp/hour Min. length 100 ms
Insulation voltage	
Between coil and contact	4 kV AC TRMS
Between contacts	1 kV AC TRMS

PULSE (DIGITAL) OUTPUT (SO)

Purpose	pulse, alarm, general purpose digital output
Type	Optocoupler open collector switch
Rated voltage	40 V AC/DC
Max. switching current	30 mA (RONmax = 8Ω)
Pulse length (if used as pulse output)	programmable (2 … 1000 ms)

TARIFF INPUT

Rated voltage	230 V ± 20 % AC/DC 75 … 110 V AC/DC
Max. current	< 0.6 mA
Frequency range	45 … 65 Hz
ON voltage	40 ... 120 % of rated voltage
OFF voltage	0 ... 10 % of rated voltage

DIGITAL INPUT

Rated voltage	230 V ± 20 % AC/DC 75 … 110 V AC/DC 24 V DC
Max. current	< 0.6 mA
Frequency range	45 … 65 Hz
ON voltage	40 ... 120 % of rated voltage
OFF voltage	0 ... 10 % of rated voltage

ANALOGUE OUTPUT (MC350, MC350H)

Note!

Analogue output is available only in combination with High range Universal power supply.

Output range	0 … 20 mA
Accuracy	0.5 % of range
Maximum load	150 Ω
Max. voltage on output (open circuit current output)	5 V
Linearization	Linear, Quadratic
Max. No. of break points	5
Output value limits	120% of nominal output
Response time of analogue output	Depends on set Average interval (8 – 256 periods)
Residual ripple	< 1 % p.p.

All outputs may be either short or open-circuited. They are electrically insulated from all other circuits.
Output range value can be altered subsequently (zoom scale) using the setting software, but a supplementary error results.

INTRINSIC-ERROR (FOR ANALOGUE OUTPUTS)

For intrinsic-error for analogue outputs with bent or linear-zoom characteristic multiply accuracy class with correction factor (c). Correction factor c (the highest value applies):

Linear characteristic

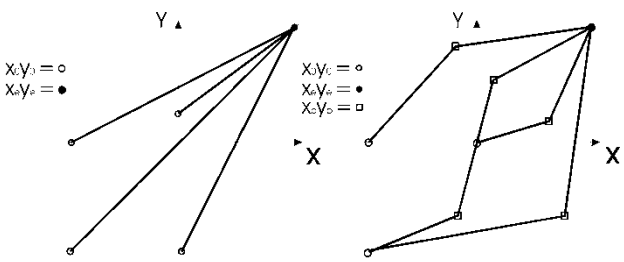
$$c = \frac{1 - \frac{y_0}{y_e}}{1 - \frac{x_0}{x_e}} \quad or \quad c = 1$$

Bent characteristic

$$x_{b-1} \le x \le x_b$$

b – number of break point (1 to 5)

$$c = \frac{y_b - y_{b-1}}{x_b - x_{b-1}} \cdot \frac{x_e}{y_e} \quad or \quad c = 1$$



Limit of the output range

AUX POWER SUPPLY

UNIVERSAL SUPPLY – FULL RANGE

Voltage AC range	48 … 276 V
Frequency range	40 … 65 Hz
Voltage DC range	20 … 300 V
Consumption	< 3.5 VA

UNIVERSAL SUPPLY – HIGH RANGE (MC350, MC350H)

Voltage AC range	85 … 265 V
Frequency range	40 … 65 Hz
Voltage DC range	100 … 265 V
Consumption	< 3.5 VA
Power-on transient current	< 20 A; 3 ms

AC POWER SUPPLY

Nominal voltage AC	57.7 / 63.5 / 100 /110 / 230 / 240 / 400 / 440 / 500 V
Frequency range	40 … 65 Hz
Consumption	< 3.5 VA

SAFETY

Protection	protection class **II** **600 V** trms, installation category **II** **300 V** trms, installation category **III** pollution degree **2** in compliance with **EN 61010-1**
Enclosure material	PC/ABS incombustibility–self-extinguishability complying with **UL 94 V-0**
Enclosure protection	IP 52 front side IP 00 for terminals (IP20 with protection cower) in compliance with **EN 60529**

ENVIRONMENTAL CONDITIONS

Ambient temperature	usage group **III**
Operating temperature	- 10 to +60 °C
Storage temperature	- 40 to +70 °C
Maximum humidity	≤ 95% r.h. non-condensing
Altitude	≤ 2000 m

EU DIRECTIVES

Directive 2014/35/EU on low voltage.
Directive 2014/30/EU on electromagnetic compatibility.
Directive on RoHS 2011/65/EU.

TERMINALS

Connection	Max. conductor cross-sections
Voltage inputs (4)	2.5 mm² with pin terminal 4 mm² solid wire
Current inputs (3)	≤ Ø 6 mm; one conductor with insulation
Power supply (2)	≤ 2.5 mm²; one conductor
Modules (3 each)	≤ 2.5 mm²; one conductor

MECHANICAL

Vibration withstand	0.7g, 3 … 100 Hz
Mounting	Pannel mounting
Cutting for installation:	$92^{+0,8}$ mm acc. to DIN EN 50 022
Weight (max)	500 g

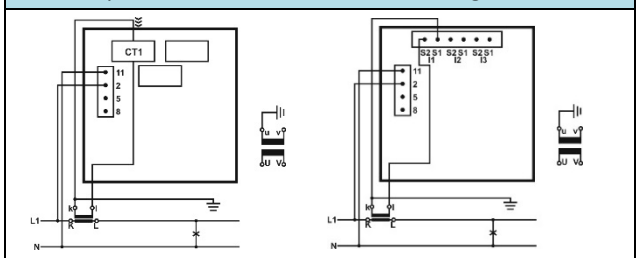
CONNECTION

System:

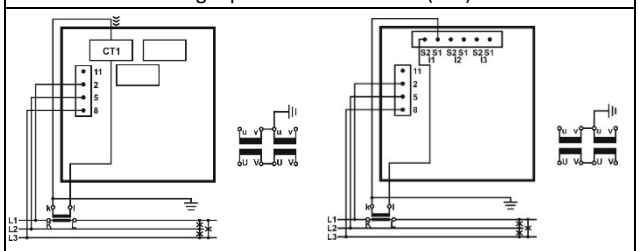
Voltage inputs can be connected either directly to low-voltage network or via a high-voltage transformer to high-voltage network.

Current inputs can be connected either directly to low-voltage network or shall be connected to network via a corresponding current transformer (with standard 1 A or 5 A outputs).

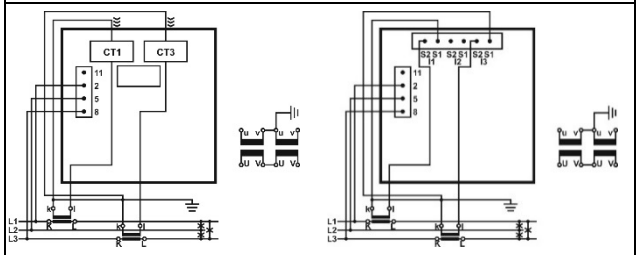
System/ connection with Terminal assignment



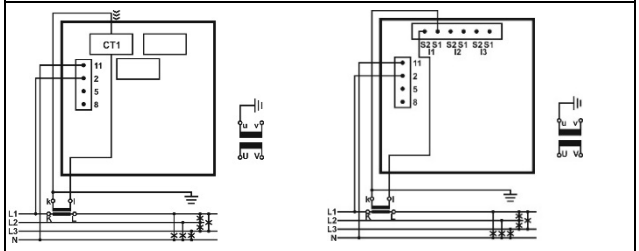
Single-phase connection 1b (1W)



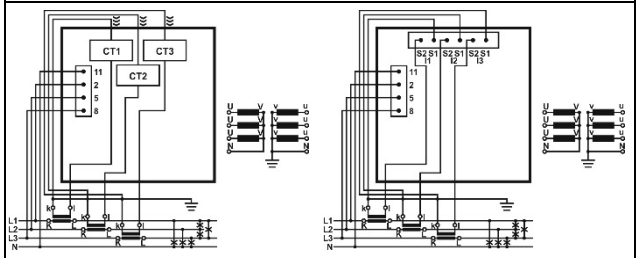
Three-phase three-wire connection with balanced load 3b (1W3)



Three-phase three-wire connection with unbalanced load 3u (2W3)

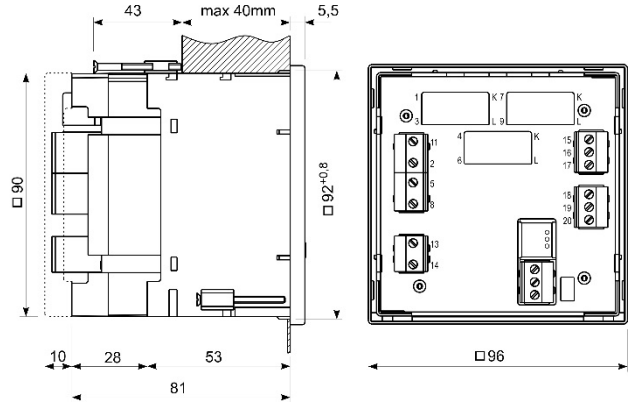


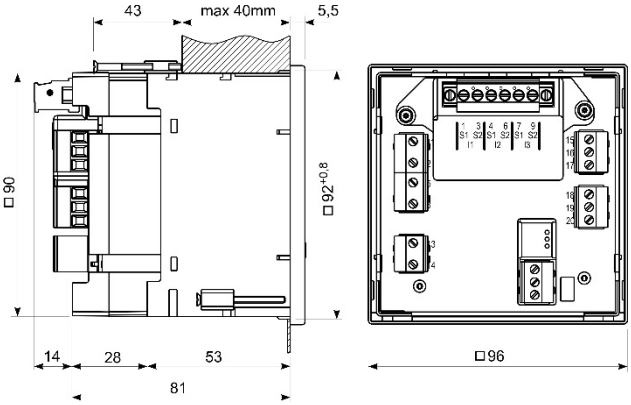
Three-phase four wire connection with balanced load 4b (1W4)



Three-phase four wire connection with unbalanced load 4u (3W4)

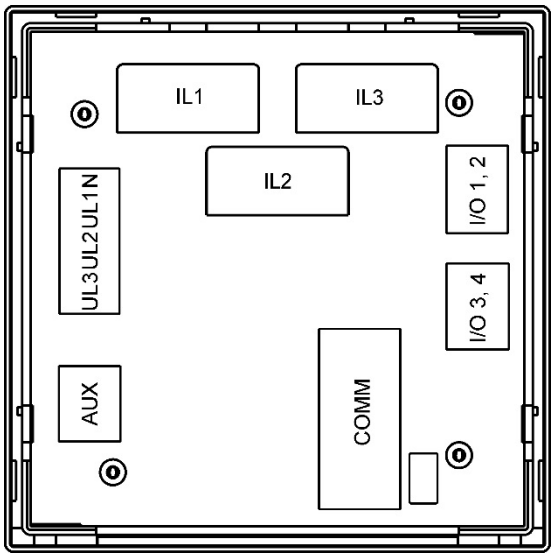
DIMENSIONAL DRAWING

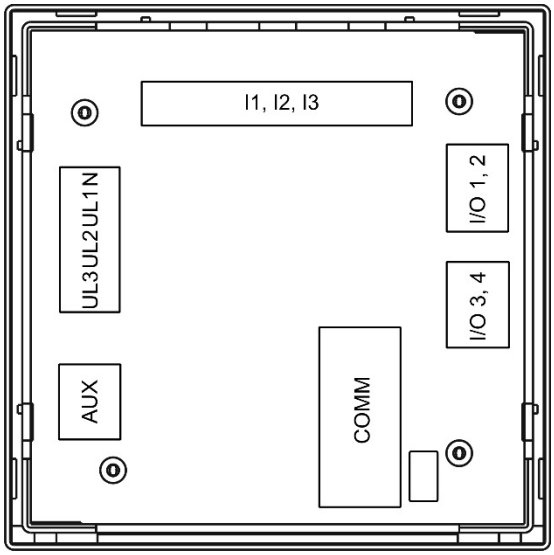




CONNECTION TERMINALS AND MARKINGS

Function		Connection	
Measuring input	AC current	IL1	CT1
		IL2	CT2
		IL3	CT3
	AC voltage	UL1	2
		UL2	5
		UL3	8
		N	11
Inputs / outputs	I/O 1, 2	I/O – 1	15
		Common (1, 2)	16
		I/O – 2	17
	I/O 3, 4	I/O – 3	18
		Common (3, 4)	19
		I/O – 4	20
Auxiliary power supply		+ / AC (L)	13
		– / AC (N)	14
Communication	RS232/RS485 /M-Bus	Rx / A / M+	21
		GND / C / NC	22
		Tx / B / M-	23
	USB	USB type B	
	Service USB	Mini USB	





COMPLIANCE WITH STANDARDS

Standard EN	Description
61557-12	Electrical safety in low voltage distribution systems up to 1000 V a.c. and 1500 V d.c. - Equipment for testing, measuring or monitoring of protective measures
61010-1	Safety requirements for electrical equipment for measurement, control and laboratory use
62053−21*	Electricity metering equipment (a.c.) Particular requirements
62053−22*	Electricity metering equipment (a.c.) Particular requirements
62053−23*	Electricity metering equipment (a.c.) Particular requirements
62053−31*	Electricity metering equipment (a.c.) Particular requirements
61326-1	EMC requirements for electrical equipment for measurement, control and laboratory use Part 1: General requirements
60529	Degrees of protection provided by enclosures (IP code)
UL 94	Tests for flammability of plastic materials for parts in devices and appliances
IEC 61158	Industrial communication networks – Fieldbus specifications (Type 3)
13757	Communication system for and remote reading of meters

* - Partial compliance

DATA FOR ORDERING

When ordering the meter, all required specifications shall be stated in compliance with the ordering code. Also additional information could be stated if needed. Most typical options are shown as an example.

EXAMPLE OF ORDERING

The MC350 meter is connected to secondary phase voltage up to 500 V_{L-N} and 5 A secondary current. There are no special requirements for energy accuracy. A universal supply and two modules are built-in the meter. The first module is a relay output and the second one is a tariff input (230 V AC). Meter has USB communication, it is calibrated to frequency 50, 60 Hz, finish is standard.

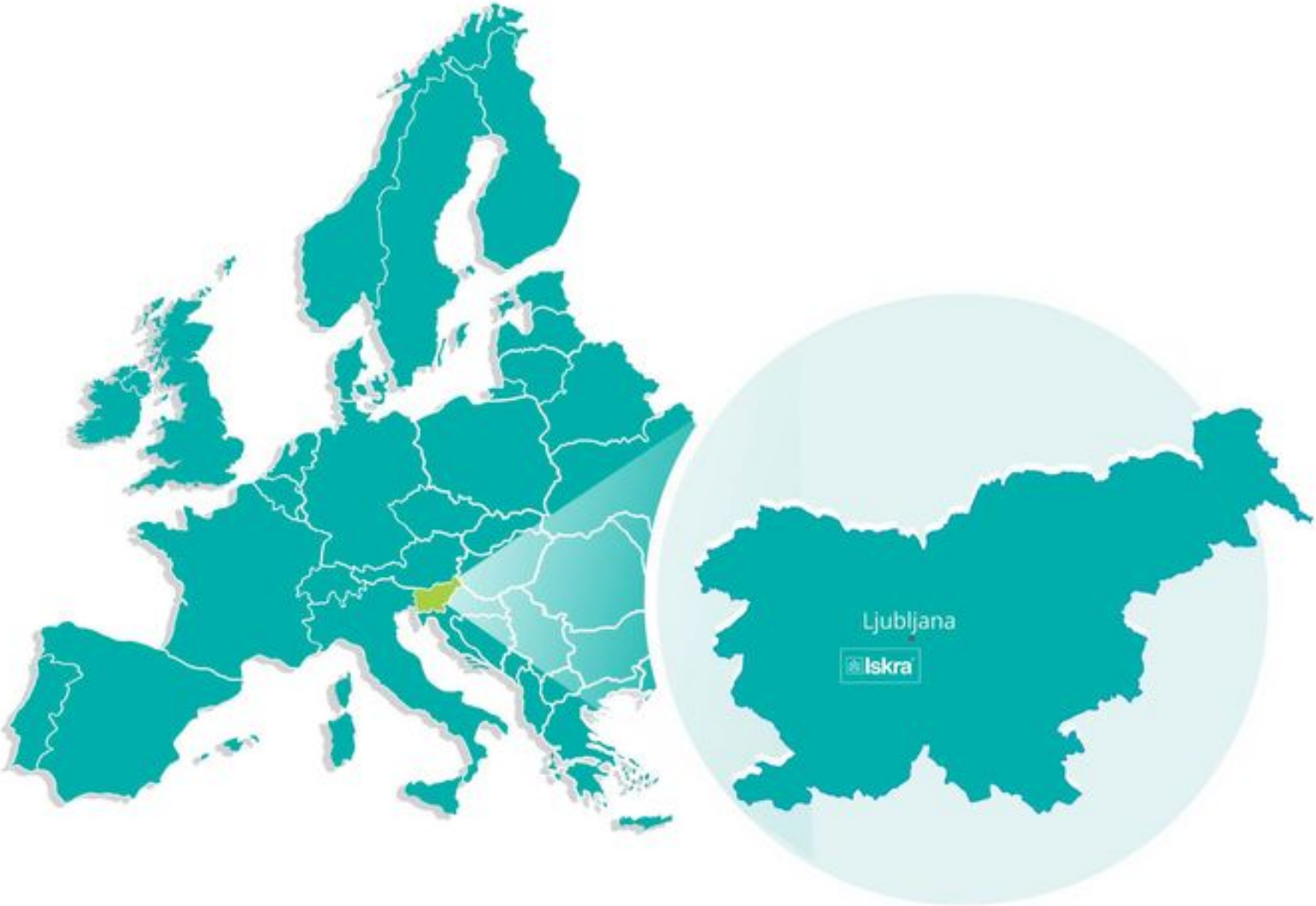
Ordering code example:

MC350 S ARNG S U U M T A T

Type	Energy Accuracy Class	Voltage Input	Calibration Frequency	Aux Power Supply	Communication (COM1)	Input/Output 1&2	Input/Output 3&4	Finish	Current Connection		
MC3x0x	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**		
									T	Through Hole Transformer *	
									C	Screw Terminal Connector	
								A		Standard *	
								P		IP54	
								H		HVE (Tropical Seal)	
								S		Ship Version	(
							D			2x Digital input 230 V	
							E			2x Digital input 75 ... 110 V	
							F			2x Digital input 24 V DC	
							T			2x Tariff input 230 V	
							Z			2x Tariff input 75 ... 110 V	
							N			Without *	
							A			2x Analogue output	*(MC350, MC350H with aux. power supply type H only)*
						S				2x Pulse output	
						M				2x Relay output	
						N				Without *	
					S					RS232	
					D					RS485	
					L					M-Bus + Service USB	*(MC350, MC350H only)*
					U					USB	
					N					Without *	*(MC330 only)*
				U						20 ... 300 V DC, 48 ... 276 V AC (Uni. power supply - Full range) *	
				A						57.7 V AC	
				B						63.5 V AC	
				C						100 V AC	
				D						110 V AC	
				E						230 V AC	
				F						400 V AC	
				G						500 V AC	
				I						240 V AC	
				J						440 V AC	
				H						100 … 265 V DC, 85 ... 265 V AC (Uni. power supply - High range)	*(MC350, MC350H only)*
			S							50, 60 Hz *	*Calibration frequency is valid only for measuring inputs and not for power supply!*
			A							400 Hz	
			B							16.6 Hz	
			C							200 Hz	
		ARNG								Autorange – 50 … 500 V *	
		63V5								57.7 … 63.5 V	*(MC330 only)*
		110V								100 … 110 V	*(MC330 only)*
		240V								230 … 240 V	*(MC330 only)*
	S									Active cl.1 / Reactive cl.2 *	
	H									Active cl.0.5S / Reactive cl.2	

MC330 Multimeter
MC350 Network recorder
MC350H Network recorder with individual harmonics measurements

* - Default ordering value



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