Electricity Measurement, Compensation, Power Control and Tracking Systems

MAKEL

Meters

Makel has the broadest portfolio in the field of electronic electricity meter in Turkey. With its lowest return rates, high quality products, innovative unique rich features, superior customer service, Makel is the leader of the Turkish market in the field of electronic electricity meter.

Broad product portfolio

▸ Monophase meters for residential and low consuming users,

▸ Threephase, direct and current transformer connected meters for medium-power commercial companies, offices, street lightings, big apartments and skyscrapers and such consumers

▸ Single or Bidirectional, class 0.5 or class 1, direct connected or current transformer and/or voltage transformer connected active and reactive industrial meters for high consuming industries, hotels, Shopping malls, electricity production plants, Medium Voltage subscribers

100% test and verification

▸ All our products, from production to packaging are tested and verified 100% in 0.01 accuracy zera test system.

Compatibility to MID

▸ All Makel meters conform European Union Measurement Instruments Directive (MID). Conformity of our meters are certified by notified bodies.

Wide LCD Screen with backlight

▸ All our meters have large LCD screens. With backlight feature, even in dark environments our meters can easily be read from long distances.

Excess operating conditions

▸ All our meters has protections over conformed standards. As an example, although surge tests defined as 4 kV in EN 50470-1 standards, Makel meters are applied to surge tests at 4.4 kV. Our meters are tested in 8 kV instead of 6 kV for isolation test. In regarding to EMI, Our meters are also tested under 30V/m EM field with current flowing through them. All our meters have IP54 protection class. Our meters also work between 40 and 60 Hz and operating voltage are far more than the ranges specified in standards.

▸ All makel meters can accurately measure between -40 and 85 degree Celsius. With this feature, they are unique in the market

Low time drift

▸ Our meters are calibrated to compensate crystal frequency ppm error in production and continuously make temperature compensation while they are running.

Wide Load Profile

▸ Some Electrical parameters are recorded in load profiles. For Monophase meters 720 records (30 days data with one hour interval), for Threephase meters 4000 - 8000 records (with variable intervals, 90- 180 days for 30 minutes interval) and for industrial meters 4300 - 8730 records with five channels (with variable intervals, 90- 180 days for 30 minutes interval) can be stored and retrieved.

Ready for AMI/AMR systems

▸ All meters equipped with RS232 or RS485 interfaces which provide necessary communication interfaces for AMI/AMR applications. Using Makel Wport GSM/GPRS modems, meters can be easily integrated to MAKEL USOBİM AMR system.

General View

Rich content, ergonomic LCD
screen with backlight

High temperature coefficient
polycarbonate body and terminal

Compliant to EU MID directive

High-accuracy meters
including class 0.5

Ten years battery life

Widest operating temperature
range in its field (-40 °C ile +85 °C)

Improved high voltage
protection over standards

You are one step ahead, with its backlighted wide screen, load profile capability, very low time drift by temperature and crystal calibration

General Specifications

▸ Class B (1%) accuracy (TS EN 50470-1, TS EN 50470-3) when measuring active energy.

▸ Splits day into 8 time slices; measuring consumed energy in 4 different tariffs; weekdays, Saturday and Sunday can be programmed separately.

▸ Keeps information on permanent memory without the need for energy.

▸ Wide LCD screen showing consumed energy according to tariffs and error notices.

▸ Battery weakening, real time clock corruption, main cover and terminal cover intervention can be seen on LCD as flashing symbols and with their code numbers.

▸ 10 year lifetime lithium battery protects clock and the other information against power cut.

▸ Supports TS EN 62056-21 protocol on optic port for communication and programming needs.

▸ The information can also be read in power cut condition from LCD screen using button and via communication on optic port thanks to a secondary 10 year lifetime lithium battery.

▸ Keeps energy values of actual and previous 12 periods in memory.

▸ Has 30 days of loading profile (optional 360 days) 1 hour interval.

▸ Calculates demand in every 15 minutes.

▸ 150V-300V wide operating voltage range.

▸ The real time clock has 0,5sec/day precision. Temperature and crystal compensation is done to prevent real time clock's time drifts.

▸ Actual current and voltage can be seen on the screen.

▸ It is easy to read metering information even in the dark, thanks to the backlight of the LCD screen.

▸ An optional RS485 communication port is available for AMI/AMR applications.

▸ All single phase meters are MID compliant.

▸ Operating temperature range is between -40°C to 85°C.

▸ Optional Circuit Breaker Relay

▸ Communication icons indicates on the screen

Outline Dimensions

187.5

152.5

10

109.3

93.5

55
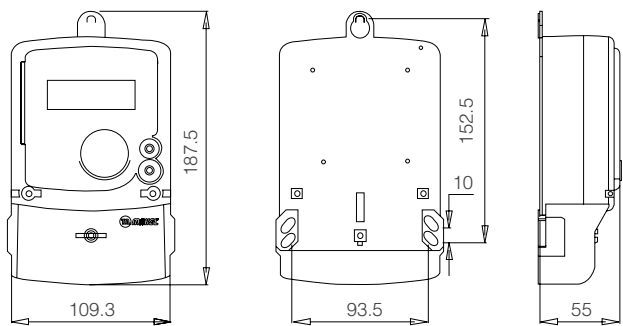
LCD Screen
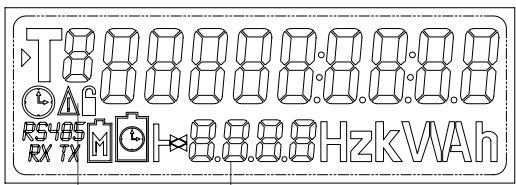
Tariff codes
T, T1, T2, T3, T4

Obis codes

Explanation of LCD Icons:

Icon	Description
	Battery low alarm
	Real time clock error alarm
	Terminal cover opened alarm
	Main cover opened alarm
▷	Current tariff indicator
	Maximum demand indicator

Connection diagram for monophase meters (M550)
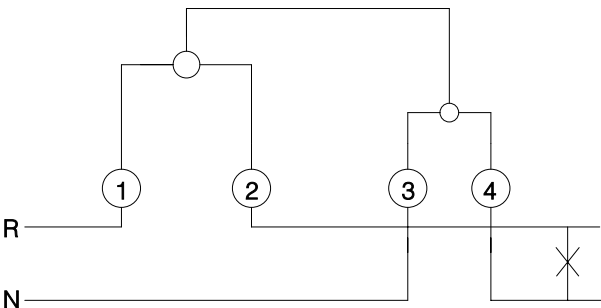
1   2   3   4

R

N

Technical Specifications

| Specifications		Model No.
		M550.2251
Nominal Voltage		220 V or 230 V
Operating Voltage Range		150 V~300 V
Nominal (Base) Current		5 A
Maximum Current		100 A
Minimum Current		250 mA
Starting Current		20 mA
Meter Constant	Active	3000 imp/kWh
	Reactive	-
Accuracy (Class)	Active	B (Class 1)
	Reactive	-
Frequency		50 Hz ± 10%
IP Protection Class		IP54
Protection Class		II
EMC Class		E2
Mechanical Class		M1
Humidity Ratio		<95%
Operating Temperature Range		-40˚C~+85˚C
Storage Temperature Range		-40˚C~+85˚C
Power Consumption in Voltage Circuit		< 2W 10 VA
Power Consumption in Current Circuit		< 4 VA
Real Time Clock Battery (Lithium)		3,6 V/1.2 Ah
Battery Lifetime		10 Years /4 Years (Storage)
Real Time Clock	Sensibility	0,5 sec./day
	Temperature and Frequency Calibration	Yes
Meters Voltage Battery	Voltage	3 V
	Capacity	195 mAh
Communication		-/RS485 ops
Optical Communication		EN 62056- 21
Load Profile	Total Record Duration	30 days (optional 360 days)
	Channel Count	1
	Record Interval	1 hour
Current Line Connection		Direct
LCD Display	Digit Count	9 (6+3) digit
	Lifetime	10 Year
	Backlight	Yes
	Menu	Constant
	Current and Voltage Display	Yes
	for each Phase	Yes
Tariff	Count	4
Number of Time Slices		8
Circuit Breaker		100 A optional
Log Record		Yes

MAKEL

Beyond your expectations with wide load profile features, backlight and communication options

T510

Outline Dimensions (T510)
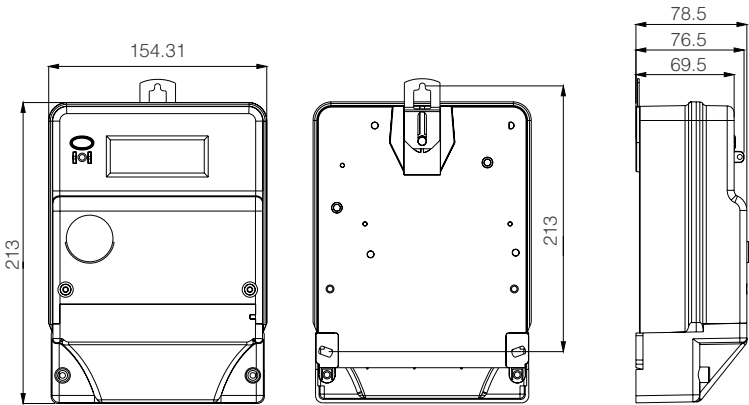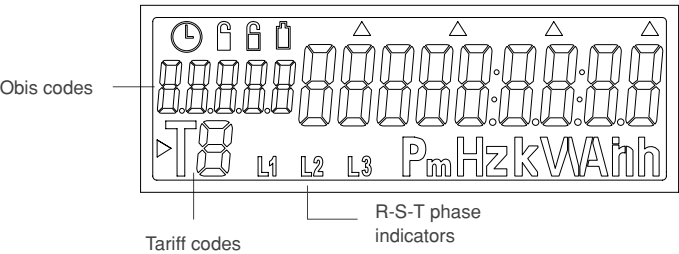
154.31

213

213

78.5
76.5
69.5

T510 LCD Screen

Obis codes

Tariff codes

R-S-T phase indicators

Coding Explanations

🔋	Battery low alarm
🕐	Real time clock error alarm
🔒	Main cover opened alarm
🔓	Terminal cover opened alarm
P	Maximum demand indicator

C500. KOY- C500. KOT

Outline Dimensions (C500.K0Y - C500.KOT)
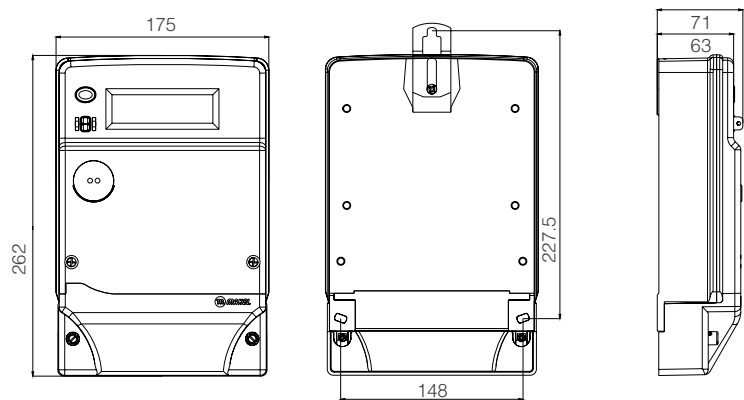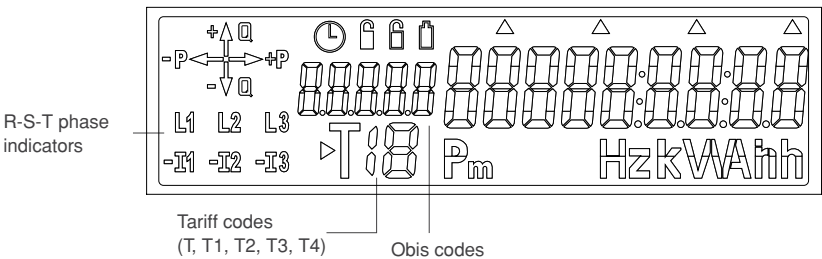
175

262

227.5

148

71

63

C500. KOY - C500. KOT

R-S-T phase indicators

Tariff codes
(T, T1, T2, T3, T4)

Obis codes

Coding Explanations

|	
	Battery low alarm
	Real time clock error alarm
	Main cover opened alarm
	Terminal cover opened alarm
P	Maximum demand indicator

General Specifications

▸ Class B (1%) accuracy (TS EN 50470-1, TS EN 50470-3) when measuring active 3 phase energy.

▸ Splits day into 8 time slices; measuring consumed energy in 4 different tariffs; weekdays, Saturday and Sunday can be programmed separately.

▸ 10 year lifetime lithium battery protects time and date information against power cut.

▸ Keeps information on permanent memory for 100 years without the need for energy.

▸ LCD screen showing consumed energy according to tariffs and error notices.

▸ Battery weakening, real time clock corruption, absence of one of the phases, wrong phase sequence, reverse current direction main cover and terminal cover intervention can be seen on LCD as flashing symbols and with their code numbers.

▸ Supports TS EN 62056-21 protocol on optic port for communication and programming needs.

▸ An optional RS485 communication port is available for AMI/AMR applications.

▸ Daylight saving time (DST) configuration is supported.

▸ The information can also be read in power cut condition from LCD screen using button and via communication on optic port thanks to a secondary 10 year lifetime lithium battery.

▸ Keeps energy values of actual and previous 12 periods in memory.

▸ Maximum demand is calculated by its demand meter. Demand calculation period can be adjusted to 5, 10, 15, 30, 45 or 60 minutes.

▸ From 1 minute to 60 minute intermittently, up to 90 days long, 3 or 5 channels load profile.

▸ The meter has current transformers inside. These current transformers have lifetime accuracy guarantee and advantages like very low energy consumption and isolation from the mains

▸ Meters with X/5 current transformer models are available.

▸ Easy to read metering information even in the dark, thanks to the backlight of the LCD screen.

▸ All three phase meters are MID compliant.

▸ From 150V to 300V (3x220/380V) accurate metering.

▸ Operating temperature range is from -40°C to 85°C.

▸ Bidirectional models available.

Direct Connected Meters

5002

Current Transformer Connected Meters

5010
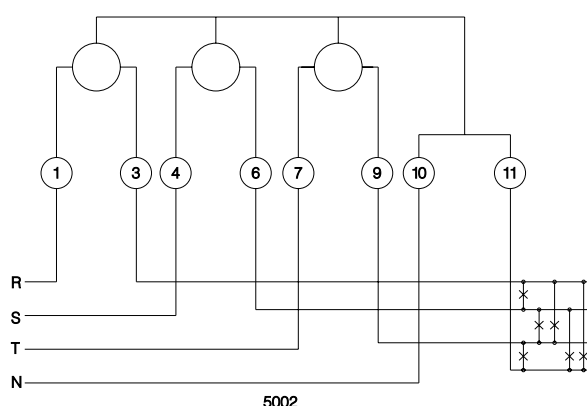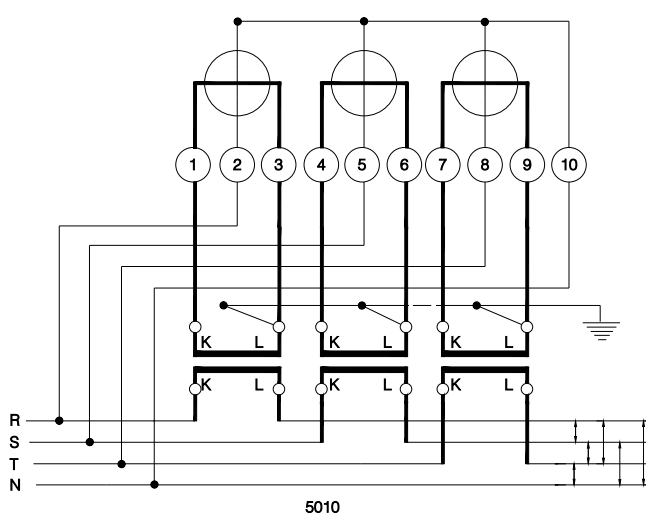
Direct or Transformer connected Threephase meters for street lighting, commercial companies with middle consumption, offices and housings

Technical Specifications

Specifications		Model No.		
		T510.2256	T510.2251	T510.2510
Nominal Voltage		3x220/380 V	3x220/380 V or 3x230/400V	3x220 / 380 V
Operating Voltage Range		150 V~300 V	150V~300V	150V~300V
Nominal (Base) Current		5 A	5A	X / 5 A
Maximum Current		60 A	100 A	10A
Minimum Current		250 mA	250 mA	50 mA
Starting Current		20 mA	20 mA / 20mA	10 mA
Meter Constant	Active	1000 imp/kWh	1000 imp/kWh	5000 imp/kWh
Accuracy (Class)	Active	B (Class 1)	B (Class 1)	B (Class 1)
Frequency		50 Hz ± 10%	50 Hz ± 20%	50 Hz ± 20%
IP Protection Class		IP54	IP54	IP54
Protection Class		II	II	II
EMC Class		E2	E2	E2
Mechanical Class		M1	M1	M1
Humidity Ratio		<95%	<95%	<95%
Operating Temperature Range		-40˚C~+85˚C	-40˚C ~ +85˚C	-40˚C ~ +85˚C
Storage Temperature Range		-40˚C~+85˚C	-40˚C ~ +85˚C	-40˚C ~ +85˚C
Power Consumption in Voltage Circuit		< 2W 10 VA	< 2W 10 VA	< 2W 10 VA
Power Consumption in Current Circuit		< 4 VA	< 4 VA	< 4 VA
Real Time Clock Battery (Lithium)		3,6 V/1.2 Ah	3,6 V/ 1.2 Ah	3,6 V/ 1.2 Ah
Battery Lifetime		10 Years /4 Years (Storage)	10 Years /4 Years (Storage)	10 Years /4 Years (Storage)
Real Time Clock	Accuracy	TS EN 61038	TS EN 61038	TS EN 61038
	Temperature and Frequency			
	Calibration	Yes	Yes	Yes
DST Application		Yes	Yes	Yes
Communication	EN 62056-21	RS485 ops	RS485 (opt)	RS485 (opt)
Optical Communication		EN 62056- 21	EN 62056-21	EN 62056-21
Load Profile	Total Record Duration	60/240 days	60/240 days	60/240 days
	Channel Count	3	3	3
	Record Interval	30 min	30 min	30 min
Current Line Connection		Direct	Direct	Current Transformer
LCD Display	Digit Count	9 (6+3) digit	9 (6+3) digit	9 (6+3) digit
	Lifetime	10 Year	10 Year	10 Year
	Backlight	-	Optional	Optional
	Menu	Constant	Constant	Constant
	Quadrant Display			
	VDEW 2.0	-	-	-
	Current and Voltage Display	Yes		
	for each Phase	Yes	-/Yes	-/Yes
Tariff	Count	4	4	4
	Holidays	Optional	-	-
Number of Time Slices		8	8	8
Season Structure		Optional	-	-
Alarm Relay		-	-	-
Magnetic Field Sensor		-	-	-
Harmonic Analysis		-	-	-
Circuit Breaker		Optional	Yes	-
Log Record		-	-	-

All Makel products are 100% tested and verified from production to packaging. All Makel meters are subjected to accuracy and periodic tests with highly accurate Zera test systems.
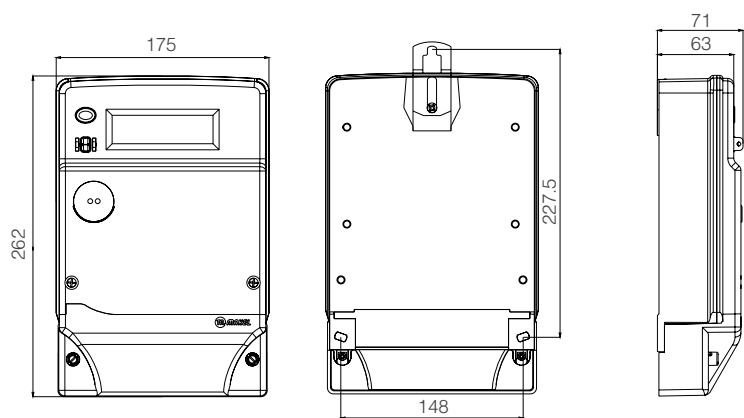
Technical Specifications

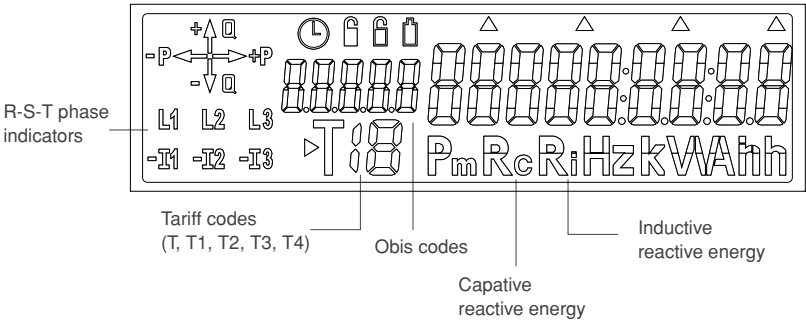| Specifications		Model No.		
		C500.KOY.2251 C500.KOT.2251	C500.K0Y.2256	C500.K0Y.2211
Nominal Voltage		3x220/380 V, 3x230/400 V	3x220/380V, 3x230/400V	3x220/380 V
Operating Voltage Range		150V~300V	150 V~300 V	150 V~300 V
Nominal (Base) Current		5 A	5 A	10 A
Maximum Current		100A	10 A	100 A
Minimum Current		50 mA	50 mA	500 mA
Starting Current		10 mA	10 mA	10 mA
Meter Constant	Active	1000 imp/kWh	5000 imp/kWh	1000 imp/kWh
Accuracy (Class)	Active	B (Class 1)	B (Class 1)	B (Class 1)
Frequency		50 Hz ± 10%	50 Hz ± 10%	50 Hz ± 10%
IP Protection Class		IP54	IP54	IP54
Protection Class		II	II	II
EMC Class		E2	E2	E2
Mechanical Class		M1	M1	M1
Humidity Ratio		<95%	<95%	<95%
Operating Temperature Range		-40˚C ~ +85˚C	-40˚C~+85˚C	-40˚C~+85˚C
Storage Temperature Range		-40˚C ~ +85˚C	-40˚C~+85˚C	-40˚C~+85˚C
Power Consumption in Voltage Circuit		< 2W 10 VA	< 2W 10 VA	< 2W 10 VA
Power Consumption in Current Circuit		< 4 VA	< 4 VA	< 4 VA
Real Time Clock Battery (Lithium)		3,6 V/ 1.2 Ah	3,6 V/1.2 Ah	3,6 V/1.2 Ah
Battery Lifetime		10 Years /4 Years (Storage)	10 Years /4 Years (Storage)	10 Years /4 Years (Storage)
Real Time Clock	Accuracy	TS EN 61038	TS EN 61038	TS EN 61038
	Temperature and Frequency			
	Calibration	Yes	Yes	Yes
DST Application		Configurable	Configurable	Configurable
Communication	EN 62056-21	RS485/RS232 (opt)	RS485/RS232 ops	RS485/RS232 ops
Optical Communication		EN 62056-21	EN 62056-21	EN 62056-21
Load Profile	Total Record Duration	91 days	91 days	91 days
	Channel Count	3/4	3	3
	Record Interval			
		1,5,10,15,20,30,60 min	1,5,10,15,20,30,60 dk.	1,5,10,15,20,30,60 dk.
Current Line Connection		Direct	Current Transformer	Direct
LCD Display	Digit Count	9 (6+3) digit	9 (6+3) digit	9 (6+3) digit
	Lifetime	10 Year	10 Year	10 Year
	Backlight	Optional	Opsiyonel	Opsiyonel
	Menu	Constant /	Constant /	Constant /
		Dynamically Configurable	Dynamically Configurable	Dynamically Configurable
	Quadrant Display			
	VDEW 2.0	- / VDEW 2.0	-	-
	Current and Voltage Display			
	for each Phase	Yes	Yes	Yes
Tariff	Count	4/4 (Optional 16)	4/4 (Optional 16)	4/4 (Optional 16)
	Holidays	Yes	-/Yes	-/Yes
Number of Time Slices		8/8 (Optional 32)	8/8 (Optional 32)	8/8 (Optional 32)
Season Structure		-/Optional	-/Optional	-/Optional
Alarm Relay		-/Optional	-/Optional	-/Optional
Magnetic Field Sensor		-/Optional	-/Optional	-/Optional
Harmonic Analysis		-/Optional	-/Optional	-/Optional
Directionality		Unidirectional / Bidirectional	Unidirectional	Unidirectional

All Makel meters have exceeded protections over conformed standards. 4.4 kV for surge tests instead of 4 kV, 8 kV isolation tests instead of 6kV, 30V/m instead of 10V/m regarding EMI. All our meters have IP54 protection class. Meters operate over standards definitions such as they operate between 40Hz and 60 Hz frequencies, 150V and 300V supply voltages, -40 to +85 °C temperatures

C500-C510

Outline Dimensions (C500-C510)

175

262

71
63

227.5

148

C500 - C510 LCD Screen

R-S-T phase indicators

Tariff codes
(T, T1, T2, T3, T4)

Obis codes

Capative
reactive energy

Inductive
reactive energy

Coding Explanations

|	
🔋	Battery low alarm
🕐	Real time clock error alarm
🔓	Main cover opened alarm
🔒	Terminal cover opened alarm
▷	Current tariff indicator
P	Maximum demand indicator

Single or bidirectional, CT or Direct connected, class 0.5 or class 1 Industrial Meters for Industries, hotels, shopping malls, power plants, MV subscribers, etc.
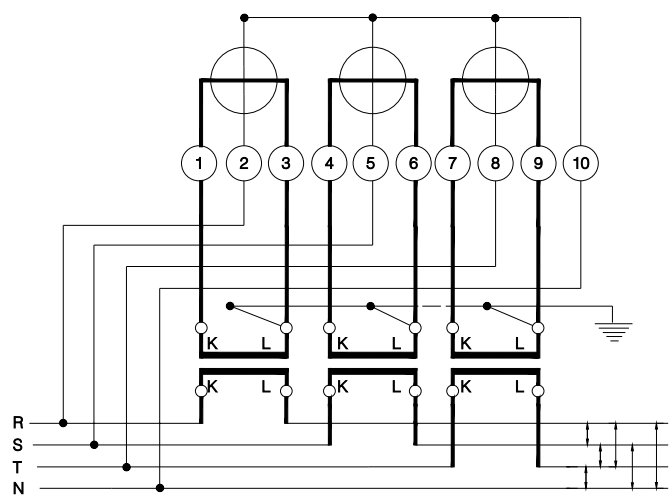
General Specifications

- Industrial (Combi) Electronic Electricity Metering Products, measures consumed active energy according to class B (%1) or class C (%0.5) (TS EN 50470-1, TS EN 50470-3) and reactive energy according to class 2 (TS EN 62053-23) in all 3 phases.
- Have ability to divide a week into 3 parts called "Week, Saturday,Sunday" and divide each part into 8 locals and calculate consumed energy in 4 different tariffs. (Some types have 16 tariffs, special tariff days and seasons).
- Date and time are prevented from electricity failures by lithium cell which has minimum 10 year battery life.
- Have a non-volatile memory that data remains over 100 years without energy.
- Have a wide lcd that displays consumed energy in each tariffs and fault notifications. (Some types of meters have dynamic menu.)
- Have the ability to display low battery, real time clock failure, power line failure, wrong ordered line, reversed current, main cover and terminal cover tampering.
- Have optical port interface that supports TS EN 62056-21 standard.
- Have RS485/RS232 ports to support AMI/AMR systems.
- Have the ability to make DST (Daylight saving time) automatically. It can be enabled/disabled dynamically by user.
- Have ability to read data from lcd by pressing button or communication interface on electricity breaks.
- Current and past 12 month period data are saved into non-volatile memory.
- Have the ability to measure maximum demands that can be programmed as 5, 10, 15, 30, 45, 60 minutes dynamically.
- Have 3 or 5 channels wide range load profile that supports up to 90 days with programmable period between 1-60 minutes.
- Current transformators, used as metering component, have guaranteed to save metering sensivity in all time.
- Additionally they have no power consumption and provide isolation from power line.
- Current "Voltage, current, frequency and $\cos\varphi$ " values of each phases are shown on lcd displays.
- Have types that include "X/5 Current" and "voltage" transformators.
- With an lcd backlight, it's easy to read data from meters in dark places.
- Have types that support magnetic tamper detection.
- Have types that support WDEV 2.0 quadrant indication and harmonic analysis.
- %0.5 class products support bidirectional and high accuracy metering.
- Operates between 150V - 300V (3x220/380V) and 40V -75V (3x58/100V) voltages.
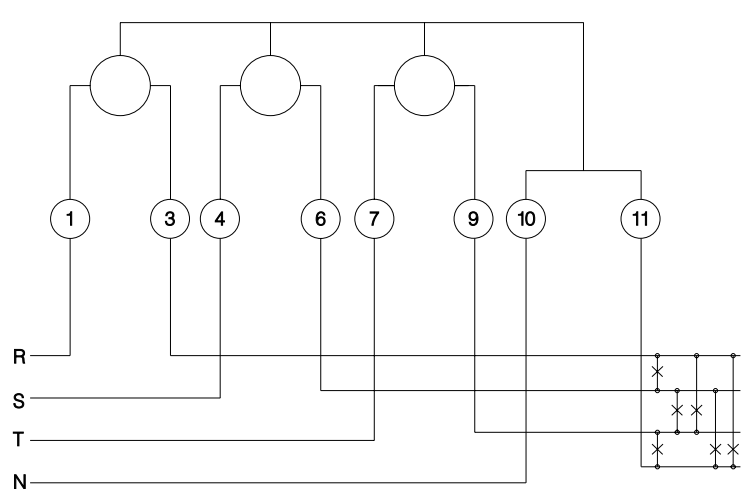- Operates between temperatures -40 and 85 °C.

Current And Voltage Transformer Connected Meters
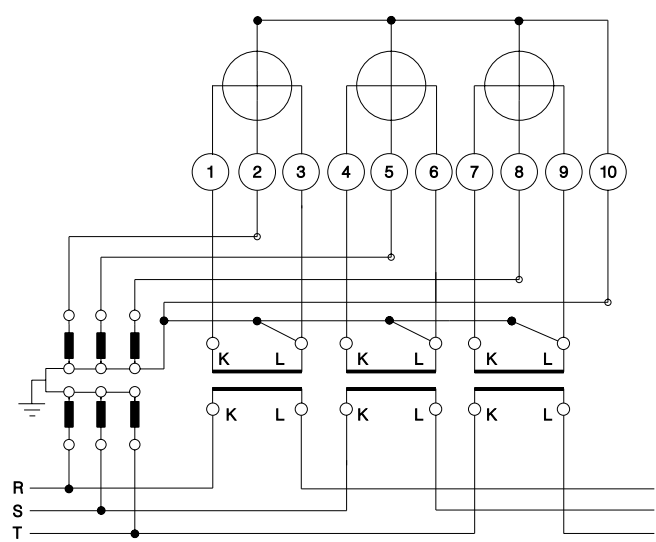
Current Transformer Connected Meters

Direct Connected Meters

Technical Specifications

Specifications		C500.KMT.2251	C500.KMY.2251 C510.AMY.2251	C500.KMY.2211 C510.AMY.2211
Nominal Voltage		3x220/380 V	3x220/380 V	3x220/380 V
Operating Voltage Range		150 V~300 V	150 V~300 V	150 V~300 V
Reference Current		5 A	5 A	10 A
Maximum Current		100 A	100 A	100 A
Minimum Current		250 mA	250 mA/150 mA	500 mA/300 mA
Starting Current		10 mA	10 mA/10mA	10 mA/10 mA
Meter pulse constant	Active	1000 imp/kWh	1000 imp/kWh	1000 imp/kWh
	Reactive	1000 imp/kVArh	1000 imp/kVArh	1000 imp/kVArh
Accuracy Class	Active	B (Class 1)	B (Class 1)/C (Class 0.5)	B (Class 1)/C (Class 0.5)
	Reactive	Class 2	Class 2	Class 2
Frequency		50 Hz ± 10%	50 Hz ± 10%	50 Hz ± 10%
Measuring Direction		Bidirectional	Unidirectional	Unidirectional
IP protection class		IP54	IP54	IP54
Protection Class (Body)		II	II	II
Electromagnetic Environment Class		E2	E2	E2
Mechanic Environment Class		M1	M1	M1
Relative Humidity		<95%	<95%	<95%
Operating Temperature Range		-40˚C ~ +85˚C	-40˚C~+85˚C	-40˚C~+85˚C
Storage Temperature Range		-40˚C ~ +85˚C	-40˚C~+85˚C	-40˚C~+85˚C
Voltage circuit power consumption		< 2W 10 VA	< 2W 10 VA	< 2W 10 VA
Current circuit power consumption		< 4 VA	< 4 VA	< 4 VA
RTC battery (Lithium)	Voltage/Capacity	3,6 V/1,2 Ah	3,6 V/1,2 Ah	3,6 V/1,2 Ah
Battery Life		10 Years /4 Years (Storage)	10 Years /4 Years (Storage)	10 Years /4 Years (Storage)
RTC measurement	Sensitivity	TS EN 61038	TS EN 61038	TS EN 61038
	Temp./ Frequency Calibration	Available	Available	Available
DST		Adjustable	Adjustable	Adjustable
Communication		RS 232/RS 485	RS 232/RS 485	RS 232/RS 485
Optical Interface		EN 62056-21	EN 62056-21	EN 62056-21
Load Profile	Total record time	91 days	91 days	91 days
	Number of Channel	8	5	5
	Record interval	1,5,10,15,20,30,60 dk.	1,5,10,15,20,30,60 dk.	1,5,10,15,20,30,60 dk.
Connection Type		Direct	Direct	Direct
LCD Screen	Number of digits	9 (6+3) digit	9 (6+3) digit	9 (6+3) digit
	Life	10 Years	10 Years	10 Years
	Backlight	Yes	Yes	Yes
	Menu's	Dynamically Configurable	Dynamically Configurable	Dynamically Configurable
	Quadrant Display	VDEW 2.0	VDEW 2.0	VDEW 2.0
	Parameters shown	Yes	Yes	Yes
	Current, Voltage, f frequency, Cosφ			
Tariff	Number	4	4	4
		Optional 16	Optional 16	Optional 16
	Holidays	Optional 8	Optional 8	Optional 8
Number of time slice		Optional 32	Optional 32	Optional 32
Season structure		Yes	Yes	Yes
Alarm Relay		Optional	Optional	Optional
Magnetic Field sensor		Optional	Optional	Optional
Harmonic Analysis		Yes	Yes	Yes
Logging		Yes	Yes	Yes

Technical Specifications

Specifications		C500.KMY.2256 C510.AMY.2256 C510.AMT.2256	C500.KMY.5851 C510.AMY.5851 C510.AMT.5851	C500.KMY.2556
			Model No.	
Nominal Voltage		3x220/380 V	3x58/100 V	3x58/100 V or 3x220/380 V
Operating Voltage Range		150 V~300 V	40 V~80 V	40 V-300 V
Reference Current		x / 5 A	x / 5 A	x / 5 A
Maximum Current		10 A	10 A	10 A
Minimum Current		50 mA	50 mA	50 mA
Starting Current		10 mA/5 mA/5 mA	10 mA/5mA/5 mA	10 mA
Meter pulse constant	Active	5000 imp/kWh	20.000 imp/kWh	20.000 imp/kWh
	Reactive	5000 imp/kVArh	20.000 imp/kVArh	20.000 imp/kVArh
Accuracy Class	Active	B (Class 1)/ C (Class 0.5)/ C (Class 0.5)	B (Class 1)/ C (Class 0.5)/ C (Class 0.5)	B (Class 1)
	Reactive	Class 2	Class 2	Class 2
Frequency		50 Hz ± 10%	50 Hz ± 10%	50 Hz ± 10%
Measuring Direction		Unidirectional / Unidirectional / Bidirectional	Unidirectional / Unidirectional / Bidirectional	Unidirectional
IP protection class		IP54	IP54	IP54
Protection Class (Body)		II	II	II
Electromagnetic Environment Class		E2	E2	E2
Mechanic Environment Class		M1	M1	M1
Relative Humidity		<95%	<95%	<95%
Operating Temperature Range		-40˚C ~ +85˚C	-40˚C ~ +85˚C	-40˚C ~ +85˚C
Storage Temperature Range		-40˚C ~ +85˚C	-40˚C ~ +85˚C	-40˚C ~ +85˚C
Voltage circuit power consumption		< 2W 10 VA	< 2W 10 VA	< 2W 10 VA
Current circuit power consumption		< 4 VA	< 4 VA	< 4 VA
RTC battery (Lithium) Voltage/Capacity		3,6 V/1,2 Ah	3,6 V/1,2 Ah	3,6 V/1,2 Ah
Battery Life		10 Years /4 Years (Storage)	10 Years /4 Years (Storage)	10 Years /4 Years (Storage)
RTC measurement	Sensitivity	TS EN 61038	TS EN 61038	TS EN 61038
	Temp./ Frequency Calibration	Available	Available	Available
DST		Adjustable	Adjustable	Adjustable
Communication		RS 232/RS 485	RS 232/RS 485	RS 232/RS 485
Optical Interface		EN 62056-21	EN 62056-21	EN 62056-21
Load Profile	Total record time	91/91/61days	91/91/61 days	91 days
	Number of Channel	5/5/8	5/5/8	5
	Record interval	1, 5, 10, 15, 20, 30, 60 dk.	1,5,10,15,20,30,60 dk.	1,5,10,15,20,30,60 dk.
Connection Type		Current Transformer	Current Voltage Transformer	Current Transformer, Current Voltage Transformer
LCD Screen	Number of digits	9 (6+3) digit	9 (6+3) digit	9 (6+3) digit
	Life	10 Years	10 Years	10 Years
	Backlight	Yes	Yes	Yes
	Menu's	Dynamically Configurable	Dynamically Configurable	Dynamically Configurable
	Quadrant Display	VDEW 2.0	VDEW 2.0	VDEW 2.0
	Parameters shown Current, Voltage, f frequency, Cosφ	Yes	Yes	Yes
Tariff	Number	4	4	4
		Optional 16	Optional 16	Optional 16
	Holidays	Optional	Optional	Optional
Number of time slice		8	8	8
		Optional 32	Optional 32	Optional 32
Season structure		Yes	Yes	Yes
Alarm Relay		Optional	Optional	Optional
Magnetic Field sensor		Optional	Optional	Optional
Harmonic Analysis		Yes	Yes	Yes
Logging		Yes	Yes	Yes

100% web based architecture provides seamless interface to its users for accessing all data over internet

MAKEL USOBIM, is a 100% web based OSOS(Automatic Meter Reading System) system that is designed for the AMI/AMR needs of the electricity distribution and industrial companies. Meters started to become a part of data communication system first by remote reading of the electricity meter data(AMR - Automatic Meter Reading) and this process is evolved to a Smart Grid: A distribution data management system enabling us to manage energy generation, usage and distribution.

Remote meter reading systems enables us to use the electricity infrastructure efficiently, to make correct estimations for investments, correct grid analysis and planning, reduce tampering and losses, in time billing, real time multi pricing in a multi tariff system, distribution web automation, remote closing and opening, to reduce meter reading cost and to increase customer satisfaction. These features give distribution companies an ease in management and reduce costs. Makel automatic meter reading system, is designed to collect energy usage, state and notifications from customers into a central control station. Meters can also be controlled remotely by the help of the two-way communication. The system can be programmed to read metering data periodically or at the determined time. Also the central station can make immediate reading in cases of a new customer arrival, customer departure, customer objection, tamper or loss suspicion. Makel USOBIM system consists of 3 parts; communication software, application software and database.

Communications software which runs as background service in communication server at data center provides all necessary communication activities between meters and data center using TCP/IP protocols. Communications software and web interface uses database to communicate with each other. Application software is the backbone for web interface and services. It provides a web server for web users. Number of connected users is only limited by the capacity of the server and internet throughput. Database is based on SQL server 2008 and can hold millions of data for years safely and produces faster and sophisticated reports.

General Specifications

- GSM/GPRS technology and TCP/IP protocol gives us a wide range of coverage in a secure, fast and cost effective way.
- The system is independent of the underlying hardware infrastructure, with the help of the web based multi layer modular software architecture; it easy to add and remove a meter. You can start from 1 meter to a hundreds of thousands of meters.
- Provides data communication interfaces to exchange necessary data between external systems (Geographical information systems, subscriber information management systems, Billing systems, CRM, ERP software) using web services in xml language or in other formats. It also provides methods for processing of retrieved data for hand held terminals.
- Has a customer tracking aimed at periodic reading (hourly, daily, weekly, etc.), which can collect energy usage, state and notification information and also load profile data.
- Using universal standards the system is independent of mobile network operators.
- The analysis module working on top of the SQL database server can make flexible queries, analysis, create graphical views, and creates needed work commands.
- With the help of the flexible module in the multilayered software new meter communication protocols can be added easily (EN 62056-21, DLMS-COSEM, etc.). The system can read many different brands of meters
- The security is ensured by using an encrypted communication between the central station and the meter.
- Database security is ensured by the encrypted communication in the database access layer, authorization mechanism and firewall. Also the database is backed up periodically.
- With the easily usable GUI, error prone and efficient usage is ensured.
- Street lightening meters can be controlled automatically or manually by using the reed available in the Wport.
- Users can be informed through e-mail or SMS for cases like when the Reactive/Active energy ratio goes below or above the determined value, number of failed communication attempts.
- Different authentication levels enable to create users with different qualifications
- Virtual metering points can be constructed by using some of the metering points connected to the system.
- Using Wport modem, Partial (user specified or default packets with user defined or default contents) or complete readout data in meters can be read from data center.
- Up to 10 different packets with user specified contents can be defined in Makel USOBİM system.
- All reports created by the system can be exported to Excel, pdf, csv, text, rtf. Also the graphics can be saved in image formats. System can create OSF formats.
- System is designed to work 7/24.

Makel Usobim General Architecture
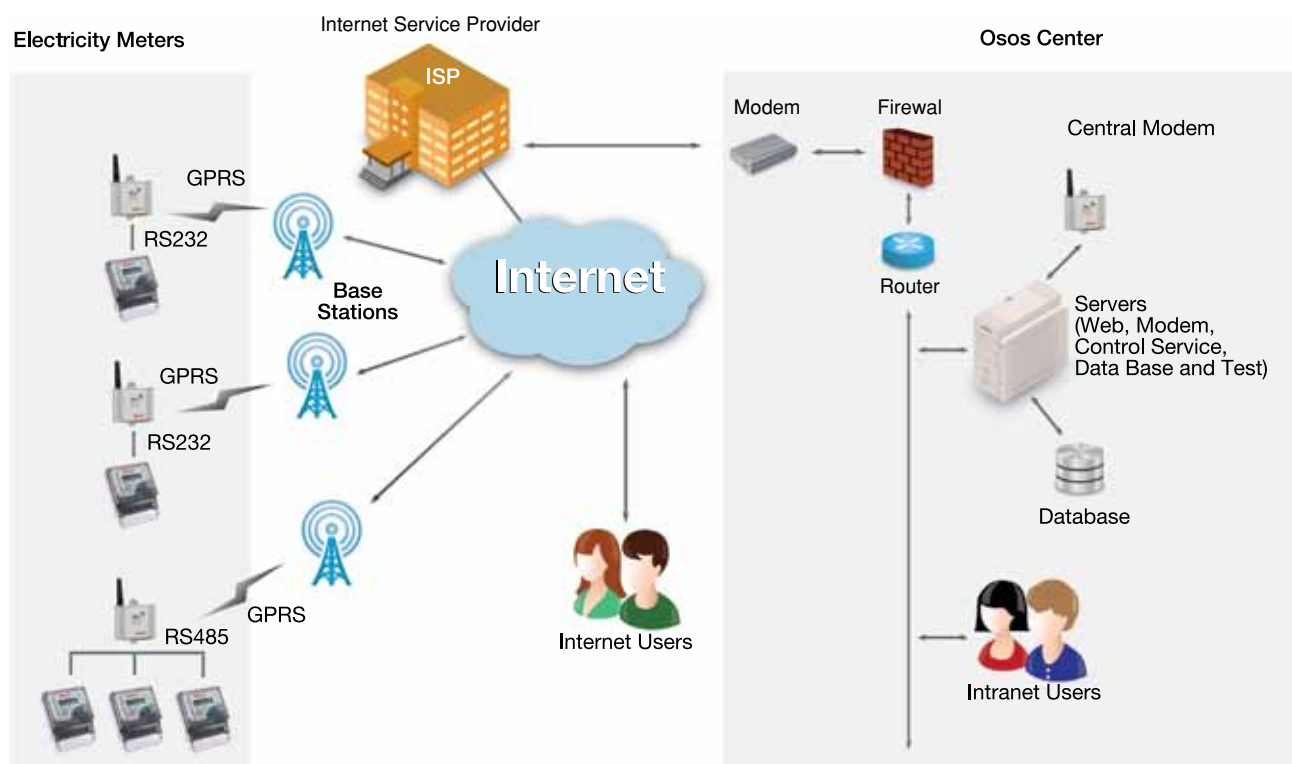
- OSOS center is the installed data center of AMR. Data management, collection and storage are coordinated in this center.
- Commands from OSOS data center passing through the routers and broadband modems reach to modems via ISPs and GSM/GPSR mobile internet infrastructure.
- Modems doing all necessary communications with meters or bypassing commands to meters, behave as a gateway between meters and OSOS data center. Communications are encrypted. If desired, modems can do all the necessary communications with meters in determined times to pick-up and store all required data in standalone fashion and when OSOS data center asks for data, they transfer all stored meter data to data center.
- Data obtained from meters are stored in a strong database in OSOS Center. So, one can easily and safely reach millions of data in a short time.
- When desired, internet and intranet users using a web browser which is available in their computers and by entering their user name and password can query all stored data, have desired reports or give new orders for new data reading action.

Outline Dimensions

93.5000±0.0100

62.0000±0.0100

96.5000±0.0100

75.5000±0.0100

30.70

SIM CARD
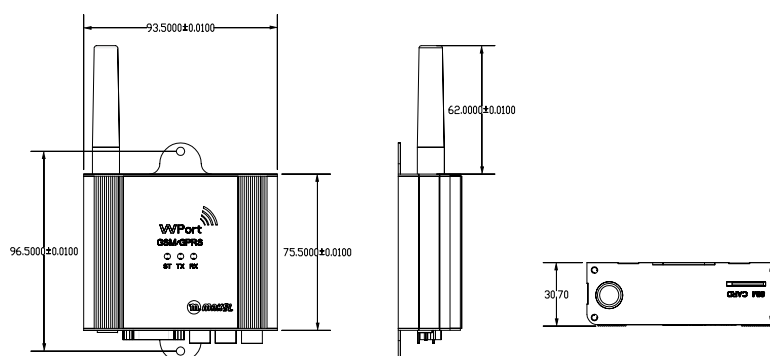
With its easy usage and installation, Compact and high quality design , Wport is a data collection and supervision device intended to read and control of electronic electricity meters and such devices which build an AMI/AMR system.

General Specifications

▶ Supports simultaneous multiple port TCP/IP protocols on GPRS/EDGE
▶ Operator independent
▶ Provides secure communication with its powerful DES algorithm
▶ Supports software upgrade through air.
▶ RTC and other parameters can be modified locally or by SMS. RTC can also be updated using time data from GSM Network.
▶ Supports IEC 62056-21 mod C and DLMS-COSEM protocols for meter communication with variable speeds.
▶ Wport, Logs many events up to 1000 records such as, Local or remote firmware upgrades, parameters, Access trials from unauthorized users, poor signal levels, some errors related to network with all time stamped fashion
▶ Periodic and a-periodic work instructions with variable contents can be defined According to these work instructions, Wport automatically communicates with meters and collects requested data and stores them in to its 256 KB memory and realizes requested control operations.
▶ Wport has one digital input to detect various events.
▶ Wport has 220V /5A contact capacity relay to activate external devices.
▶ Supports GSM/GPRS/EDGE, 900/1800/1900 Class B communication.
▶ External antenna can be connected in case of poor signal conditions.
▶ Wport has signal led's for indications GSM connection status and communication activities.
▶ Sim card can be inserted and removed with its push/push type sim card connector without opening the device case.
▶ Wport has simultaneously working RS232 and RS485 communication interfaces. RS485 interface supports up to 255 meters connected simultaneously.
▶ All connections terminals are sealable
▶ Variable interval automatic reset feature provides a failsafe mechanism to recover from locks.
▶ 100% compatible to web based Makel Usobim AMI/AMR system.

Technical Specifications

Model	GM1
Communication type	GSM/GPRS/EDGE
Frequency Band	850/900/1800/1900
GPRS Class	Class 10
TCP/IP Support	Available
RS232 Communications	Exist
RS485 Communications	Exist
Digital Alarm Input	Max 12 V
Relay Capacity	250V/5A
DC Power Supply	12V DC
Sim Card	1.8 – 3V
External Antenna	50 Ohm, SMA
RTC	Available
Operating Temperature	-30 , +70
Operating Voltage	220 V/ 100 V
Dimensions	105.5 x 30.7 x 93.5
Weight	210 gr
Remote SW upload	Exist
Data Security	DES

E Port Ethernet Gateway

Outline Dimensions
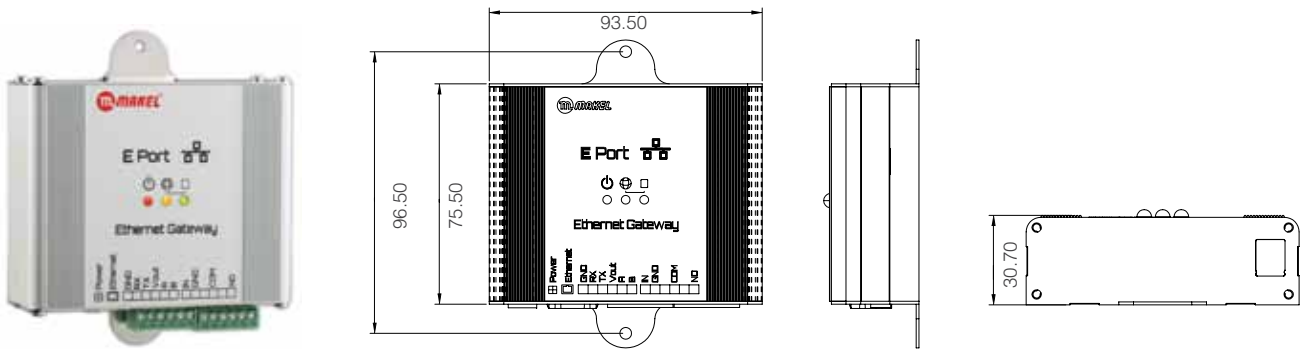
The EPort is a remote control and data collection device developed to enable remote reading of measurement values and control of the electrical meters on electronic and similar devices. Since communication is provided over the internet no extra costs are required. By connecting to the network via the RJ-45 Ethernet socket on the device remote reading is made possible by simply connecting with the RS232, RS485 or Optic Port to the meter.
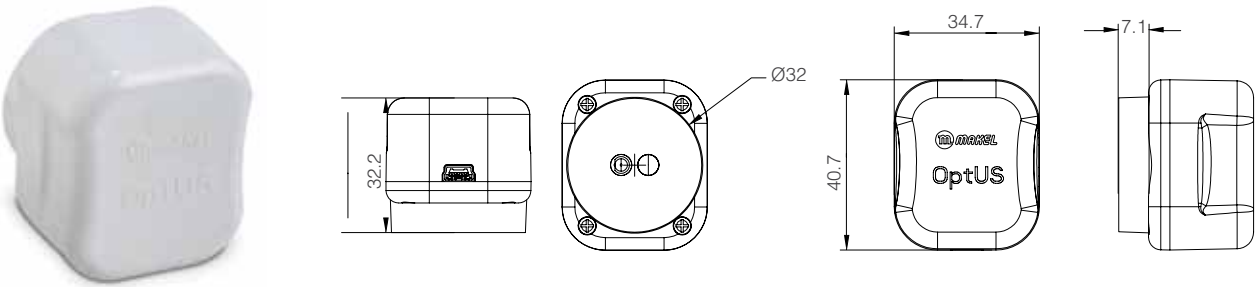
General Specifications

▶ TCP/IP support

▶ 10BASE-T and 100BASE-TX Ethernet connection

▶ RS232 and RS485 ports can be used at the same time. The RS485 port supports up to 255 connections.

▶ It supports optic port connection to the meter

▶ Numerical alarm entry: compatible to dry contact or 0-24 V input.

▶ 220V/5 A capacity relay output.

▶ Compatible with IEC 62056-21 Mod C and DLMS meters.

▶ Supports all brands and models of meters.

▶ 100% Compatible with the Makel USOBİM (OSOS- automatic meter reading system).

▶ The MAC, IP, gateway, sub network mask and port numbers can be adjusted with the E Port configuration software.

▶ Has input/output with ESD protection

Technical Specifications

Model	
Communication Protocol	TCP/IP
Network connection	10BASE-T ve 100BASE-TX Ethernet
Network connection	RJ-45
RS232 port	1 item, 300-115200 bps
RS485 port	1 item, 300-115200 bps, max 255 device
Numerical input	1 item
Relay output	1 item, 250V/5A NO
Adaptor input	12V DC
Operation temperature	-40˚C / +85˚C
Dimensions	77 x 30.7 x 93.5 mm
Weight	180gr

Optus is a device that can use the computer's USB port to read the meter over the Optic Port.

Outline Dimensions

34.7

7.1

Ø32

32.2

40.7

OptUS

Technical Specifications

Mechanical Properties	
Dimensions	40.5mm x 34.5mm x 32.5mm
Body Material	ABS
Weight	~150gr

Electrical Properties	
Standard	IEC 62056-21
Cable Length	1.5m
Operation voltage	obtains power from the USB port
Electrical Interface	USB 2.0

Software

The driver needs to be loaded in order for Optus to be operated on this computer. The address where the driver can be downloaded http://www.makelamr.com/Setup/OptusSetup.exe

Single Phase

Product Name	Code No.	Piece in Box	Piece in Package	Gross Weight (kg)	Size of Package (mm)
M550.2251	152011013	1	12	5,80	405 x 220 x 263
M550.2251 R5485	152011016	1	12	5,80	405 x 220 x 263

Three Phase

Product Name	Code No.	Piece in Box	Piece in Package	Gross Weight (kg)	Size of Package (mm)
T510.2256	152013025	1	6	6,92	280 x 335 x 240
T510.2256 RS485	152013026	1	6	6,92	280 x 335 x 240
T510.2251	152013029	1	6	6,92	280 x 335 x 240
T510.2251.RS485	152013030	1	6	6,92	280 x 335 x 240
T510.2510	152013031	1	6	6,92	280 x 335 x 240
T510.2510.RS485	152013032	1	6	6,92	280 x 335 x 240
C500.K0Y.2256	152013024	1	6	6,92	280 x 335 x 240
C500.K0T.2251.RS485	152013043	1	6	6,92	280 x 335 x 240

Industrial

Product Name	Code No.	Piece in Box	Piece in Package	Gross Weight (kg)	Size of Package (mm)
C500.KMY.2251.RS232	152012023	1	6	6,97	380 x 335 x 240
C500.KMY.2251.RS485	152012025	1	6	6,97	380 x 335 x 240
C500.KMY.2256.RS232	152012026	1	6	6,97	380 x 335 x 240
C500.KMY.2256.RS485	152012024	1	6	6,97	380 x 335 x 240
C500.KMY.5851.RS232	152012027	1	6	6,97	380 x 335 x 240
C500.KMY.5851.RS485	152012028	1	6	6,97	380 x 335 x 240
C510.AMY.2256.RS485	152012036	1	6	6,97	380 x 335 x 240
C510.AMY.5851.RS485	152012035	1	6	6,97	380 x 335 x 240
C510.AMT.2256.RS485	152012032	1	6	6,97	380 x 335 x 240
C510.AMT.5851.RS485	152012034	1	6	6,97	380 x 335 x 240
C500.KMT.2251.RS485	152012043	1	6	6,97	380 x 335 x 240

Wport - E Port - Optus

Product Name	Code No.	Piece in Box	Piece in Package	Gross Weight (kg)	Size of Package (mm)
Wport Gsm-Gprs Modem/Gateway	152040001	1	10	6,18	293 x 386 x 257
E Port Ethernet Gateway	152040002	1	10	6,18	293 x 386 x 257
Optus Usb Optic Reader	152060001	1	-	-	-

Outline Dimensions

144±0
144±0
230
64±0
110±0
43±0
138 ±0
138 ±0
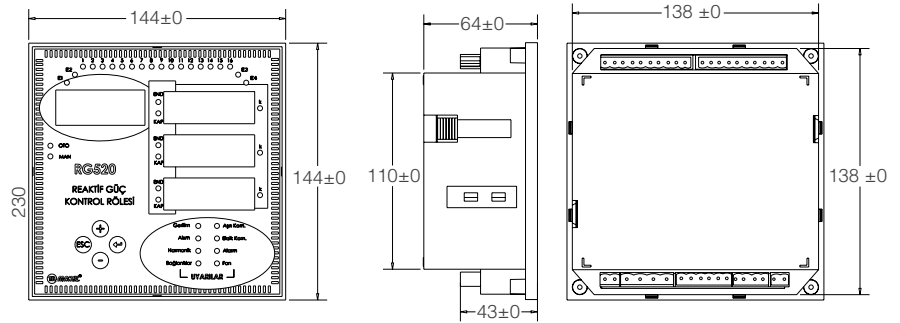
Makel RG500 series Reactive Power Compensation Relay offers professional solutions for companies reactive power compensation needs, with its superior features such as wide current operating ranges starting from very low currents, ability and the ability to make inductive and capacitive compensation in 20 steps and other features

General Specifications

‣ It has 16 Capacitor ranges and 4 (2 alarm and fan choice) inductance ranges. These ranges can be established as mono phase, three phases or between phases connection. Due to the ability to compensate separately for each phase, especially in systems with unbalanced loads produces successful solutions.

‣ Two-way compensation can be made. This means that both capacitors and inductors can be used. With this feature places where have capacitive loads (air conditioning, SMPS, PC, Fluorescent and CFL-based lighting) such as banks, hotels, shopping centers, service sector companies, successful compensation can be done.

‣ Displays voltage, powers, cosφ, frequencies, total energies for all three phases and time and temperature.

‣ Harmonic measurement is available up to 21. harmonic and provides current and voltage harmonics protection.

‣ Overvoltage, undervoltage, overcurrent, ratio error, harmonic error, compensation error, and such as overtemperature error can be detected and alarm relay output for each one, or compensation control can be set.

‣ Keeps error log records. The times at which errors occur, and recovery time with the error types are recorded.

‣ Total active, inductive and capacitive energies are fixed and 3 phase x 3 channels load profile recording are optional. User replaceable 3 channels optional parts. For example; such as cosφ, currents, voltages. In addition, the period of recording is left to the user's needs.

‣ Using Fan output, a fan can be started and stopped between the desired temperatures Thus, temperature control for compensation panel doesn't need another temperature measurement system.

‣ Automatic test are available for the finding the reactive loads in ranges. In this way, the range powers are perceived automatically without the need to manually entering the capacitor or inductor powers. Additionally, daily control is available for the power values whether or not defective. User can disable or enable this control.

‣ If the current flow direction is false, it corrects reversed phase automatically in the Test mode. If phase sequence error is detected, system will continue compensation and will give corresponding error warning.

‣ Password protection is available also left to the user's request. When the password protection is active, all programming menu will protected. Thus, the compensation settings and alarm operations will be protected from accidental accesses and system will run properly as set before.

‣ It supports modbus protocol on RS485 communication. A Special PC software are available for reading or manipulating relay settings remotely.

‣ Enables easy usage with four separate screen.

‣ With its improved compensation algorithm decreases the number of switching. Thus, life of the capacitors and contactors will be longer.

‣ Ranges ON, OFF and discharge time settings are adjustable.

Reactive Power Compensation Relay

Model No.	Code No.	Max. Number of Ranges	Measurement devices with RS485 VL1, VL2, VL3 IL1, IL2, IL3, Hz P1, P2, P3, Q1,Q2, Q3, S1, S2, S3 CosΦ1, CosΦ2, CosΦ3, ΣkWh ΣkVARh(ind) %ind ve %kap Load Profile Error Record	3 Phase	V (Voltage)	I (Current)	CosΦ	Single Phase Capacitor	Three-Phase Capacitor	Support for balanced and unbalanced loads	Active power (W)	Reactive Power (Var)	Apparent power (VA)	kWh	kVARh	% THD-I	% THD-V	1-21. Harmonics (for current and voltage)	Shunt reactor	Generator detection	RS-485 Modbus	Temperature measurement and fan output relay	Alarm functions	Real time-clock	Equal aging	Load profile	Error record	Password protection	Led Display	144x144
New RG 520 EC	152033007	20	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
New RG 520 E	152033008	20	–	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	–	•	•	•	–	–	•	•
New RG 518C	152033009	16	•	•	•	•	•	•	•	•	•	•	•	•	•	•	–	•	•	•	•	•	•	•	•	•	•	•	•	•
New RG 518	152033010	16	–	•	•	•	•	•	•	•	•	•	•	•	•	•	–	•	–	•	•	•	•	–	–	•	•	•	•

Technical Specifications

RG520 - EC

Operating Voltage (Un)	220V AC
Operating Measuring Range	3mA – 6A
Operating Voltage Range	(0,68 – 1,36)xUn (150-300V)
Operating Current Range	0,015 – 6A
Operating Frequency	50Hz
Operating Temperature Range	-30 to +85 degree
Number of Ranges	16 capacitors, 2+2 inductors (+2 alarm and fan out change)
Range Powers	Mono phase, three phase and between phases able to connecting
	Capacitors or Inductors,automatic steps power sense
Power Consumption	<4VA
Relay Contact capacity	5A
Screen	1 line 4 digits alpha numeric and 3 line 4 digits 7 segment led display
Wire Diameter	2,5 mm
Safety Class	IP20 and IP40
Connection Type	Terminal connection
Displayed Parameters	CosΦ, Current, Voltage, frequency, Total active, inductive, capacitive energies
	Apparent power, active power, reactive power Harmonic measuring (include 21. harmonic)
	Temperature measuring, real time calendar and hour
Measuring Accuracy	Voltage, current and CosΦ = 1%
	Active, reactive and apparent power = 1%
	Temperature between 25 to 85 degree = +/- 5 degree
Setting Limits	Target CosΦ = 0.8 inductive to 0.8 capacitive
	Current transformer ratio = 5/5 to 5000/5
	Voltage transformer ratio = 220 /220
	Step On, Off and discharge times = 1to 180 second
RS 485 Communication ModBus	Address range = 1 to 247
	Baud rate = 1200, 2400, 4800, 9600, 19200 and 38400 bps
Load Profile	Record period = 1, 5, 10, 15, 30, 60 minute
	Record type = Energies and 3 phase x 3 channel change
	Max record time = 19 hours to 48 days
Error Log Records	Max record number = 192 number
Alarm Functions	Low and over voltage
	Over current, over temperature
	Harmonic protection
	Poor or over compensation
	Rate error
Fan Function	On board temperature control relay
Password Protection	Exist

Product Name	Code No.	Piece in Box	Piece in Package	Gross Weight (kg)	Size of Package (mm)
New RG 520 -EC	152033007	1	6	10,26	285 x 475 x 275
New RG 520 -E	152033008	1	6	10,26	285 x 475 x 275
New RG 518 -C	152033009	1	6	10,26	285 x 475 x 275
New RG 518	152033010	1	6	10,26	285 x 475 x 275

Industries can keep their energy supply healthy, by monitoring and supervising their power system with the help of Makel Panelmeter solutions. Makel panelmeter products with reactive power control relay offer complete product portfolio to its customers.

Panelmeter product portfolio includes 3-phase measuring M6T, M3T Multimeters, V3T Voltmeters and 1-phase measuring A1M Ammeter, V1M Voltmeter products. A1M and V1M have single display group, M3T and V3T have 3 display group and M6T has 6 display group.

General Specifications

▸ Voltmeters are three phase devices and can measure line-neutral voltages, line-line voltages and phase frequencies.

▸ Multimeters are multifunctional devices which can measure many electrical parameters of the system. Multimeters can measure phase currents, line-neutral voltages, line-line voltages and phase frequencies. They can also calculate the neutral current and cosφ values.

▸ Panelmeter models can generate alarms via relays if the system parameters like currents and voltages go out of the boundary limits which user configures or if there is a phase sequence error.

▸ Panelmeters have 3 or 6 group of 4 digit seven segment displays. User can see 3 phase data at the same time.

▸ Maximum values of currents, line-neutral voltages, line-line voltages, demands of currents and minimum values of currents, line-neutral voltages, line-line voltages are recorded in its flash memory and can be displayed.

▸ The metering menu of the multimeter can be changed automatically in period of from 1 to 15 seconds.

▸ Maximum demand period can be adjusted.

▸ Current and voltage transformer ratio can be configured.

▸ To prevent unauthorized person to change the configuration, it is possible to activate password control.

▸ Current starting delay can be set for motor applications.

  Instant tripping property can be activated separately for current, voltage and frequency values.

▸ Latch property of relays of the panelmeter can be activated and the default position of the relays can be reversed.

▸ Modbus RTU protocol is supported over RS485 line. So the measured values and configuration values can be read and configuration values can also be changed.
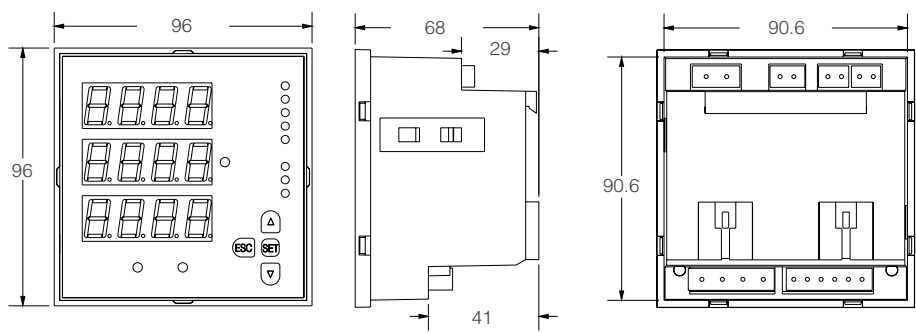
Multimeter

Multimeter M3T

Multimeter M6T

Voltmeter V3T

	Model No.	Code No.	Panel type I1, I2, I3	Voltage Phase-neutral VL1N,VL2N,VL3N	Voltage phase-phase VL12, VL23, VL13	Cosφ	Hz	I Neutral	V, Hz, overflow and underflow protection	IV, Hz, overflow and underflow protection	Demand ((Current))	Phase sequence protection	Contact (Single relay)	(Current)	RS-485 Modbus	...X/5A (Voltage transformer range)	Voltage transformer rate	96X96	Panel type	Rail type	3 Display 4 Digit	6 Display 4 Digit	Password protection
	V3T - 21	152050003	–	●	●	–	●	–	●	–	–	●	●	–	–	–	●	●	●	●	●	–	●
	M3T - 22	152050001	●	●	●	●	●	●	–	●	●	●	–	●	–	●	●	●	●	●	●	–	●
	M6T - 22C	152050004	●	●	●	●	●	●	–	●	●	●	–	●	●	●	●	●	●	–	●	●	●
New	M3T - 22C	152050002	●	●	●	●	●	●	–	●	●	●	–	●	●	●	●	●	●	●	●	–	●
New	M3T - 21	152050006	●	●	●	–	●	●	–	●	●	●	–	●	–	–	●	●	●	●	●	–	●
New	M3T - 20	152050005	●	●	●	–	●	●	–	–	●	●	–	–	–	●	●	●	●	●	●	–	●

Outline Dimensions

96

96

68

29

41

90.6

90.6

Technical Specifications

Specifications	V3T - 21	M3T - 22	M6T - 22C
Operating voltage	24V-300V AC/DC	24V-300V AC/DC	24V-300V AC/DC
Operating frequency	50/60Hz	50/60Hz	50/60Hz
Temperature range	-10 C° / +70 C°	-10 C° / +70 C°	-10 C° / +70 C°
Supply power consumption	< 6 VA	< 6 VA	< 6 VA
Class	%1 ±1 digit	%1 ±1 digit	%1 ±1 digit
Outputs relay	1 piece NO 5A 250V	2 piece NO 5A 250V	2 piece NO 5A 250V
Safety class	IP20	IP20	IP20
Cable thickness for terminal connection	2,5mm²	2,5mm²	2,5mm²
Weight	< 300g	< 300g	< 300g

| Specifications	M3T - 22C	M3T - 21	M3T - 20
Operating voltage	24V-300V AC/DC	24V-300V AC/DC	24V-300V AC/DC
Operating frequency	50/60Hz	50/60Hz	50/60Hz
Temperature range	-10 C° / +70 C°	-10 C° / +70 C°	-10 C° / +70 C°
Supply power consumption	< 6 VA	< 6 VA	< 6 VA
Class	%1 ±1 digit	%1 ±1 digit	%1 ±1 digit
Outputs relay	2 piece NO 5A 250V	1 piece NO 5A 250V	-
Safety class	IP20	IP20	IP20
Cable thickness for terminal connection	2,5mm²	2,5mm²	2,5mm²
Weight	< 300g	< 300g	< 300g

Ampermeter

Ampermeter A1M

Model No	Code No.	Single-phase Current	Demand	Max Demand	Contact Output (single relay)	Over/Low protection	...X/5A (Current transformer ratio)	96X96	Panel Type	Rail Type	1 Display 4 Digit	150-300V AC/DC Feeding
A1M - 10	152070017	▪	▪	▪	–	–	▪	▪	▪	▪	▪	▪
A1M - 11	152070018	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪
A1M - 10T *	152070030	▪	▪	▪	–	–	–	▪	▪	▪	▪	▪

*AT-20 is supplied with current transformer.

Outline Dimensions (Ampermeter A1M)
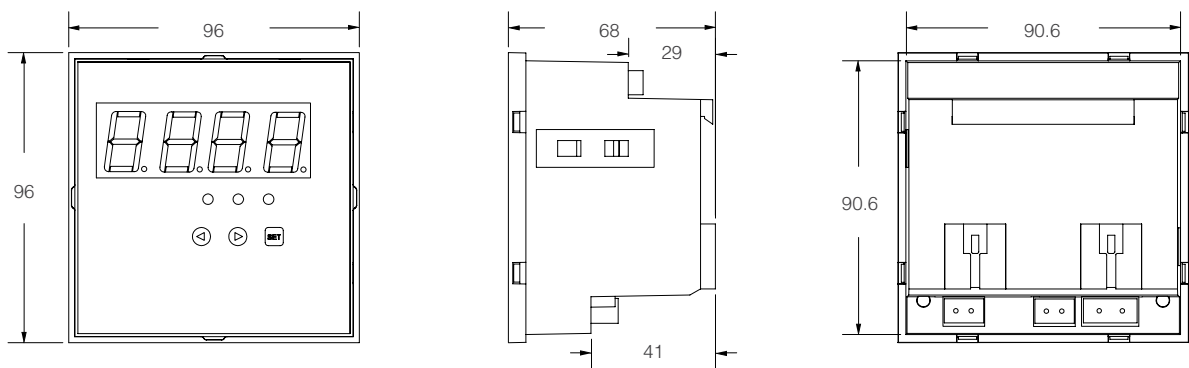
Voltmeter

Voltmeter V1M

Model No	Code No.	Single-phase Voltage	Max Voltage	Min. Voltage	Contact Output (single relay)	Over/Low protection	Voltage Transformer Ratio	96X96	Panel Type	Rail Type	1 Display 4 Digit	150-300V AC/DC Feeding
V1M-10	152070019	▪	▪	▪	–	–	▪	▪	▪	▪	▪	▪
V1M-11	152070027	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪

Outline Dimensions (Voltmeter V1M)
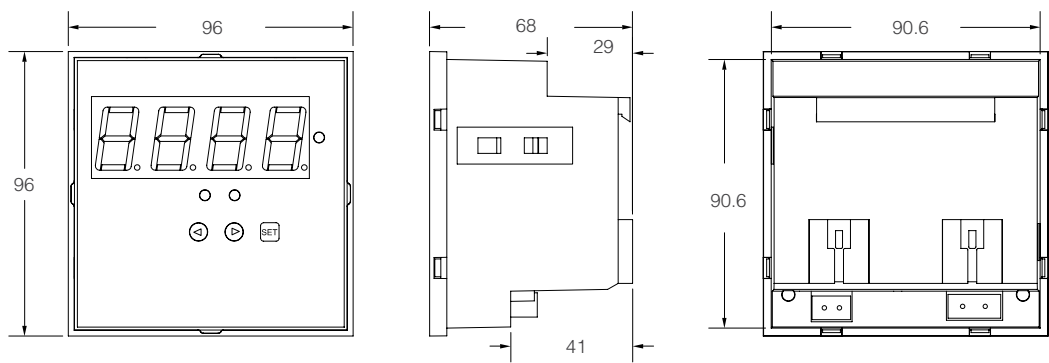
Technical Specifications

Specifications	A1M-10 / A1M-10T	A1M-11	V1M-10	V1M-11
Operating voltage	150-300V AC/DC	150-300V AC/DC	150-300V AC/DC	150-300V AC/DC
Operating frequency	50/60Hz	50/60Hz	50/60Hz	50/60Hz
Temperature range	-20 C° / +70 C°	-20 C° / +70 C°	-20 C° / +70 C°	-20 C° / +70 C°
Supply power consumption	4VA (max)	4VA (max)	4VA (max)	4VA (max)
Class	%1 ±1 digit	%1 ±1 digit	%1 ±1 digit	%1 ±1 digit
Outputs relay	-	1 Pcs NO 5A 250V	-	1 Pcs NO 5A 250 V
Safety class	IP20	IP20	IP20	IP20
Cable thickness for terminal connection	2,5mm²	2,5mm²	2,5mm²	2,5mm²
Weight	220g / 275g	235g	225g	240g

Multimeter / Ampermeter / Voltmeter

	Product Name	Code No.	Piece in Box	Piece in Package	Gross Weight (kg)	Size of Package (mm)
	V3T - 21	152050003	1	12	3,71	250 x 235 x 220
	M3T - 22	152050001	1	12	4,14	250 x 235 x 220
	M6T - 22C	152050004	1	12	4,17	250 x 235 x 220
New	M3T - 22C	152050002	1	12	4,17	250 x 235 x 220
New	M3T - 21	152050006	1	12	4,04	250 x 235 x 220
New	M3T - 20	152050005	1	12	3,88	250 x 235 x 220
	A1M - 10	152070017	1	12	2,96	250 x 235 x 220
	A1M - 11	152070018	1	12	3,12	250 x 235 x 220
	A1M - 10 T	152070030	1	12	3,60	250 x 235 x 220
	V1M - 10	152070019	1	12	3,02	250 x 235 x 220
	V1M - 11	152070027	1	12	3,18	250 x 235 x 220

Outline Dimensions

MKN - 02P

48.7
34.7
90 36
44.6 61.9
36.0
61.0
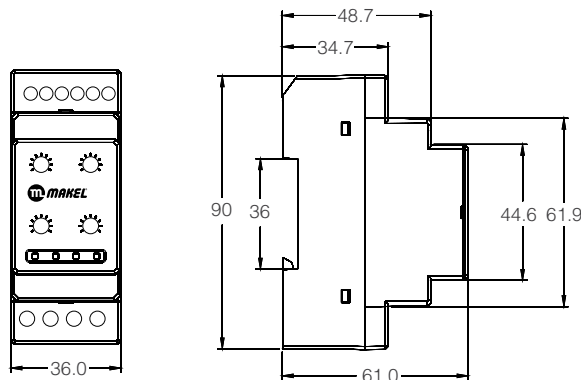
Motor Protection Relays

During the operation of three phase motors if voltage imbalance or voltage outage occurs the motor overheats. This situation can cause damage in the motors. Motor protection relays are designed to cut off the motor's power supply in such situations to prevent any kind of malfunction. Also by doing phase checks it makes sure that motor connections run smoothly.

Control Functions

During Phase Control: Makes sure whether or not the phase connection order is done correctly as L1, L2, L3.

If the connection order is different the relay (out) cannot be made to draw and the motor will not be operated. In this case the "Phs. Seq." on the device will be lit up.

Ptc Control (in MKx02P models): This control is done in order for the motor winding temperature to be measured. If the winding temperature reaches dangerous levels the relay will release without delay and the motor will be stopped. When Ptc error occurs or the Ptc connection is left idle the "Phs.Seq." led flashes.

Insufficient Supply Control: When the 3 phase voltages fall below the margin to the point that the device cannot be supplied with power the relay will release without delay and the motor will be stopped. During this time the "Asm" led flashes.

Absence of Phase Control: When at least one of the 3 phase voltages falls below the set Phs. Abs. setting the relay will release without delay and the motor will be stopped. During this time the "Phs.Abs" led flashes.
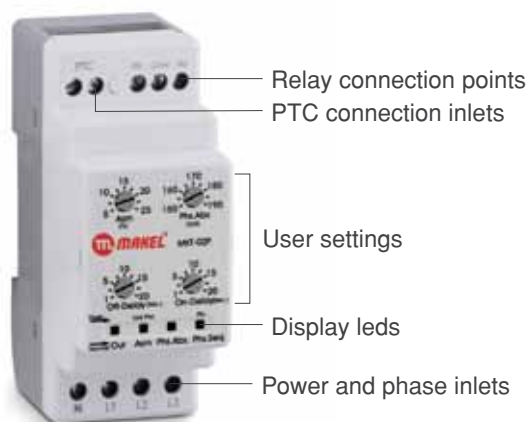
Operating the Device

The necessary connections are made by studying the connection chart. Care must be taken to avoid Phase order and Ptc error (in Ptc models). If Ptc is not to be used the Ptc ends must be made into short circuits. When the system is operated if there is no error the out relay draws and the "out" led lights up. If there is an error the out relay will not extract and the relevant error light will go on.

Asymmetry Error During Normal Operation: If the voltage imbalance is higher than the asymmetry setting in the system a period that is as long as the Off-Delay setting will be waited. If the problem continues after this period the drawn relay is released and the motor is stopped the "Asm" led lights up, the "Out" led turns off, if the error is not continuing the relay remains drawn.

Moving to Normal Operation While an Asymmetry Error is Ongoing: If the voltage imbalance is lower than the asymmetry setting in the system, a period that is as long as the On-Delay setting will be waited out. If there is no asymmetry error at the end of the period the released relay is drawn and the motor is operated, the "Asm" led turns off, the "Out" led turns on, if the error continues the relay remains released.

Note: In the event that a single phase is cut off while the motor is operating, the cut off phase's voltage cannot be zero because the other phase voltages pass over the motor windings and appear in the entry of the cut off phase. Therefore make the asymmetry setting lower.

Relay connection points
PTC connection inlets

User settings

Display leds

Power and phase inlets

Meanings of the display leds	Out	Asm.	Phs. Abs	Phs. Seq
No problem, normal operation, exit relay active	x			
Asm. error occurred (period being counted)	x	x		
Asymmetry error		x		
Phase order error (Phs. Seq)				x
Ptc error (Ptc)				Flash
Insufficient supply (Low Pwr.)	Flash			
Absence of phase error (Phs. Abs)			x	

Wiring Diagrams

MKT-01, MKT-02P

Note: The only difference in the MKT-01 model is that there is no PTC connection.
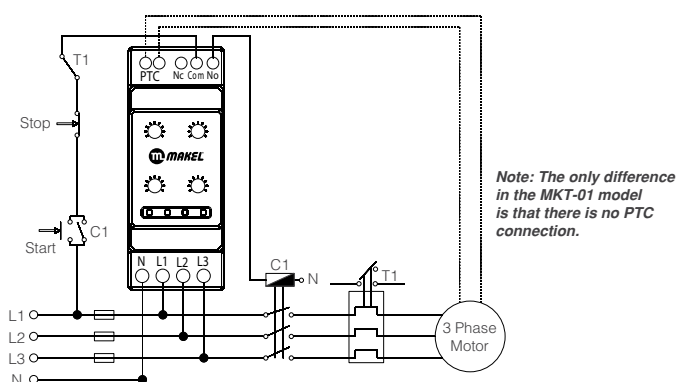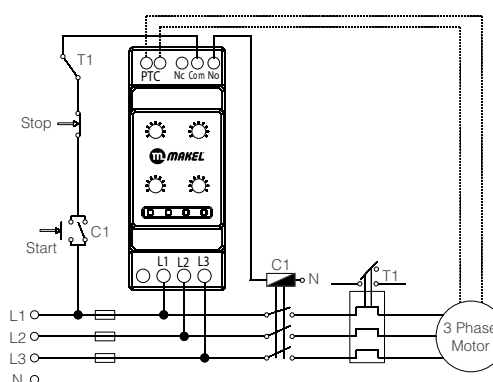
MKN-02P

Technical Specifications

| Specifications	MKT-01 / MKT-01S	MKT-02P	MKN-02P
Operation Voltage (Un)	230 V AC	230 V AC	400 V AC
Operation Voltage Interval (U)	150-300 V AC / 65-300 V AC	150-300 V AC	260-520 V AC
Insufficient Supply Interval	100-120 V AC / 58-60 V AC	100-120V AC	175-210 V AC
Operation Frequency	50 Hz	50 Hz	50 Hz
Power Consumption (Max)	2.5 VA	2.5 VA	2.5 VA
Measurement Method	TrueRMS	TrueRMS	TrueRMS
Asymmetry	%15 Fixed	%5...%25	%5...%25
Phs. Abs. (Absence of Phase)	170 V Fixed	Set at 150…190 V	Set at 260…330 V
Hysteresis	20% of asymmetry value	20% of asymmetry value	20% of asymmetry value
Off-Delay (Release Delay)	1sec	Set at 1…20 sec	Set at 1…20 sec
On-Delay (Draw Delay)	1sec	Set at 1…20 sec	Set at 1…20 sec
Ptc Operation Interval	None	Opening: more than 1600 ohm Closing: less than 1400 ohm	Opening: more than 1600 ohm Closing: less than 1400 ohm
Setting Accuracy	None	+ or - %5	+ or - %5
Exit Relay	5 A 250 V AC	5 A 250 V AC	5 A 250 V AC
Operation Temperature	Between -20°C…50°C	Between -20°C…50°C	Between -20°C…50°C
Relative Humidity	Less than 90% (Without condensation)	Less than 90% (Without condensation)	Less than 90% (Without condensation)
Cable Sections	2.5 mm² multi vessel cable	2.5 mm² multi vessel cable	2.5 mm² multi vessel cable
Assembly Types	Rail type	Rail type	Rail type
Protection Class	IP20 (Terminals), IP40 (Front Panel)	IP20 (Terminals), IP40 (Front Panel)	IP20 (Terminals), IP40 (Front Panel)
Dimensions	36x90x61	36x90x61	36x90x61
Weight	125gr	125gr	125gr
Insulation	400 V insulation voltage 4 KV source impact	400 V insulation voltage 4 KV source impact	400 V insulation voltage 4 KV source impact

Current protection relays have been designed for the purpose of protecting the systems they are attached to from excessive and low voltages.

Outline Dimensions

AKM-01

48.7
34.7
90 36
44.6 61.9
36.0
61.0
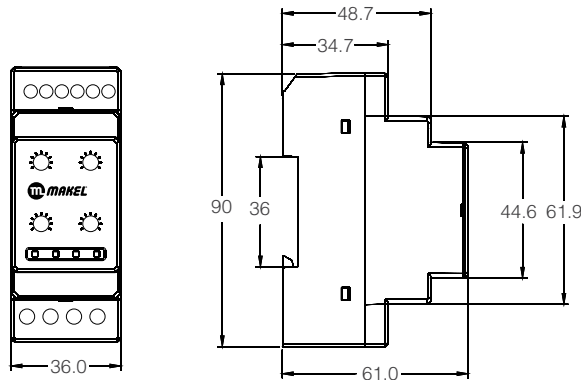
Current Protection Relays

Current protection relays monitor the current in every phase of motors and similar devices and make sure that the devices operate in the desired power intervals. When the devices draw currents at intervals other than what is set the system's power is cut off to prevent the device from malfunctioning.

Current protection relays are designed to protect the systems they are attached to from excessive and low currents. It is possible to enter the operation current interval. The relays can also be used as only "excessive current protection" and "low current protection". The first start currents in motors are high, therefore they have a start delay to prevent incorrect excessive currents that may occur.

Operation of Device

The necessary connections are made according to the connection chart. Imax and Imin current margin values cannot be set close to each other or Imax cannot be smaller than Imin. If they are set as such an error will occur and the "Set.Err." led will light up. This must be checked. When the system is operated if there is no error the out relay will draw and the "Out" led will light up. If there is an error the relay-out will not draw and the relevant led will light up.

Normal Operation and Excessive or Low Current Error: When the system is first started up the period of time that the Star-delay has been set at is waited out. The current levels measured during the wait period are not evaluated. Thus the start-up current of the motor being high will not cause a problem. After the Start-Delay period is finished the system will go back to working normally.

If the system's current value goes above the excessive current level or falls below the low current level, a PERİOD AS LONG AS THE Off-Delay period is waited out. If the error is ongoing after the waiting period the drawn relay is released, the system it is attached to is stopped and the "Imax" or "Imin" led lights up. If the error is not continuing the relay will continue to be drawn.

Important Explanation

• The excessive current margin and low current margin can be set close to each other or
• If the excessive current margin is set lower than the low current margin there will be an error, the current protection device will not work and the "Set.Err." led will light up.

To use as **"excessive current protection"** set Imin current margin to min. ampere,

To use as **"low current protection"** set Imax current margin to max. ampere.

Off-Delay: As soon as an excessive or low current error is detected the Off-Delay waiting period must be waited out.

Start Delay: At the first point that the system operates the Start-Delay period must be waited out. The current levels that are measured at this time are not taken into account and no excessive load error occurs.

Relay connection points
Current connection inlets
User settings
Display leds
Power inlets
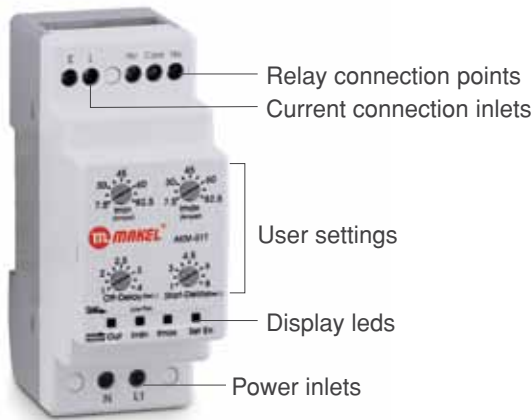
Meaning of the display leds	Out	Imin	Imax	Set.Err.
No problem, normal operation, axit relay active	x			
Excessive error occurred (period being counted)	x		x	
Over current error			x	
Low current occurred (period being counted)	x	x		
Low current error		x		
Outside the boundary of the Imax and Imin settings				x

Wiring Diagrams

AKM-01
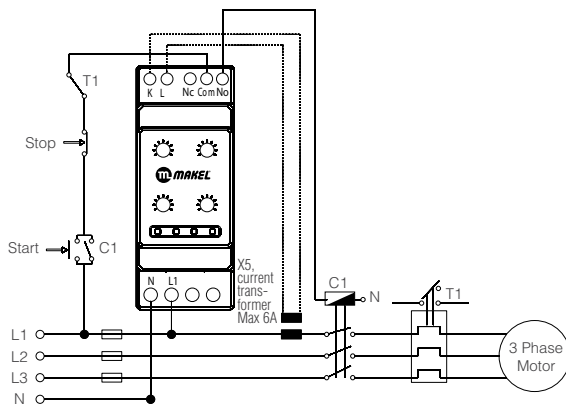
AKM-01T
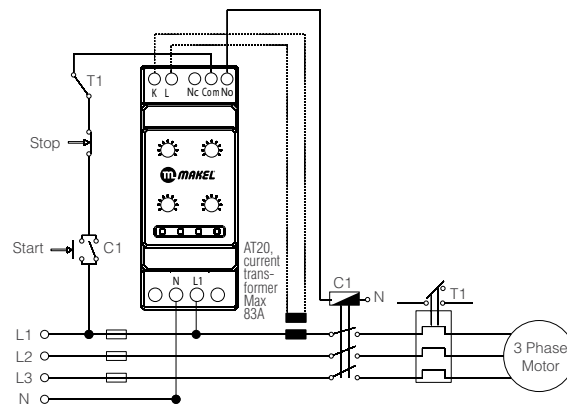
Technical Specifications

Specifications	AKM-01	AKM-01T
Operation Voltage (Un)	230 V AC	230 V AC
Operating Voltage Interval (U)	150-300 V AC	150-300V AC
Operation Frequency	50 Hz	50 Hz
Power Consumption (Max)	2.5 VA	2.5 VA
Measurement Method	TrueRMS	TrueRMS
Imax (Over Current Setting)	0,5...5,5 A	7,5...82,5 A
Imin (Low Current Limit Setting)	0,5...5,5 A	7,5...82,5 A
Hysteresis	200 mA	3 A
Off-Delay (Release Delay)	Set at 1…4 sec	Set at 1…4 sec
Start-Delay (Start-up Delay)	Set at 1…8 sec	Set at 1…8 sec
Setting Accuracy	+ or -%5	+ or -%5
Exit Relay	5 A 250 V AC	5A 250 V AC
Operation Temperature	Between -20°C…50°C	Between -20°C…50°C
Relative Humidity	Less than 90% (Without condensation)	%90'dan küçük (Yoğunlaşma olmadan)
Cable Sections	2.5 mm² multi vessel cable	2.5 mm² multi vessel cable
Assembly Types	Rail type	Rail type
Protection Class	IP20 (Terminals), IP40 (Front Panel)	IP20 (Terminals), IP40 (Front Panel)
Dimensions	36x90x61	36x90x61
Weight	125gr	125gr
Insulation	400 V insulation voltage, 4 KV source impact	400 V insulation voltage, 4 KV source impact

GKT-02P

Outline Dimensions
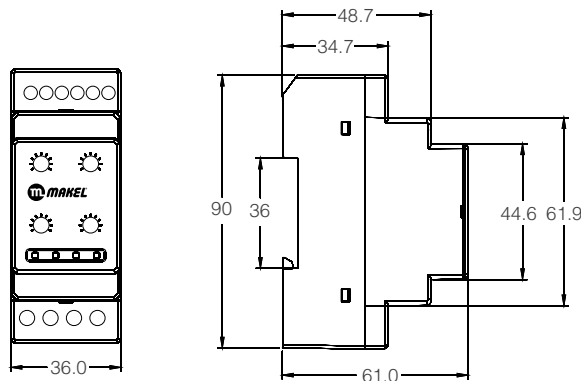
Voltage Protection Relays

Used to protect triphase motors and similar devices from phase interruptions, voltage imbalances, incorrect connections and overheating. In any error situation the system's power is cut off to prevent the device from malfunctioning.

The voltage protection relay has been designed to protect the systems they are connected to from excessive voltage, low voltage and overheating. Also in 3 phase models they control the phase order to make sure that the motor connections work properly.

Control Functions

During Phase Control (in GKx02P models): Makes sure whether or not the phase connection order is done correctly as L1, L2, L3.

If the connection order is different the relay (out) cannot be made to draw and the motor will not be operated. In this case the "Phs. Seq." on the device will be lit up.

Ptc Control (in GKx02P models): This control is done in order for the motor winding temperature to be measured. If the winding temperature reaches dangerous levels the relay will release without delay and the motor will be stopped. When Ptc error occurs or the Ptc connection is left idle and the "Phs.Seq." led flashes.

Insufficient Supply Control (in GKx02P models): When the 3 phase voltages fall below the margin to the point that the device cannot be supplied with power, the relay will release without delay and the motor will be stopped. During this time the "Vmax" led flashes.

Absence of Phase Control (in GKx02P models): When at least one of the 3 phase voltages is cut off the relay releases without delay and the motor is stopped. During this time the "Vmin" led flashes.

Operating the Device

The necessary connections are made by studying the connection chart. Care must be taken to avoid Phase order and Ptc error (in Ptc models). If Ptc is not to be used the Ptc ends must be made into short circuits. When the system is operated if there is no error the out relay draws and the "out" led lights up. If there is an error the out relay will not draw and the relevant error light will go on.

Excessive and/or Low Voltage Occurring During Normal Operation: If any of the system's phase voltages rise above the excessive voltage margin and/or fall below the low voltage margin period that is as long as the Off-Delay setting will be waited. If the problem continues after this period the drawn relay is released, the system it is connected to is stopped and the "Vmin" and/or "Vmax" led lights up and the "Out" led turns off. If the problem continues the relay stay drawn.

Moving to Normal Operation While there is an Excessive and/or Low Voltage Error: If the system's 3 phase voltages are lower than the set Vmax voltage and lower than the set Vmin voltage, a period that is as long as the On-Delay setting will be waited. If there is no error at the end of the period the released relay is drawn and the system is operated. The "Vmax" and "Vmin" led turns off, the "Out" led turns on, if the error is continuing the relay remains released.

Note: In the event that a single phase is cut off while the motor is operating, the cut off phase's voltage cannot be zero because the other phase voltages pass over the motor windings and appear in the entry of the cut off phase. Therefore make the Vmin setting higher.

Relay connection points
Current connection inlets
User settings
Display leds
Power inlets
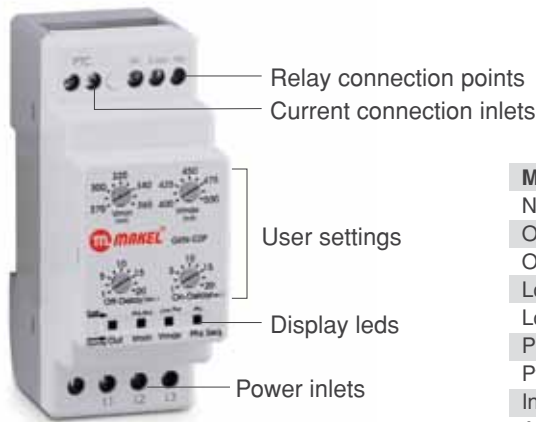
| Meaning of the display leds	Out	Vmin	Vmax	Phs. Seq.
No problem, normal operaion, exit relay active	x			
Overvoltage error occurred(period being counted)	x		x	
Overvoltage error			x	
Low voltage error occurred (period being counted)	x	x		
Low voltage error		x		
Phase order error (Phs. Seq)				x
Ptc error (Ptc)				Flash
Insufficient supply (Low Pwr.)			Flash	
Absence of phase error (Phs. Abs)		Flash		

Wiring Diagrams

GMK-01 / GKT-02P
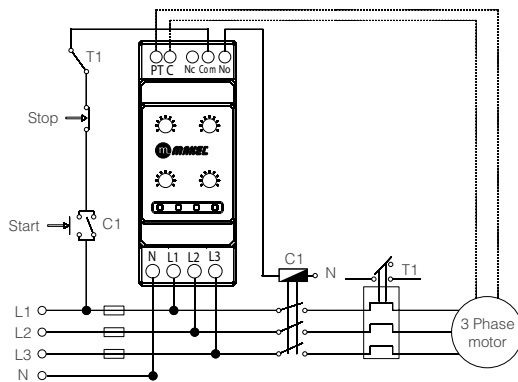
Note: The only difference in the GKM 01 model is that there are no PTC connection and L2, L3.

GKN-02P
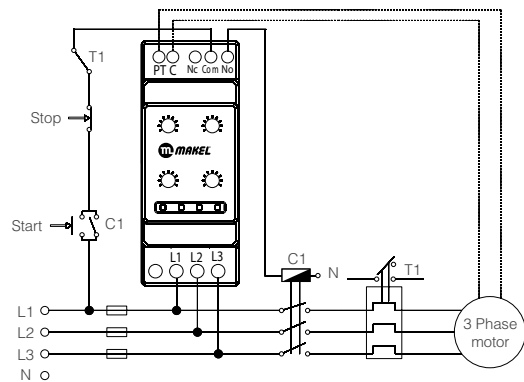
Technical Specifications

Specifications	GKM-01	GKT-02P/ GKT-01S	GKN-02P
Operation Voltage (Un)	230 V AC	230 V AC	400 V AC
Operation Voltage Interval (U)	150-300 V AC	150-300 V AC / 65-300 V AC	260-520 V AC
Insufficient Supply Interval	100-120 AC	100-120V AC / 58-60V AC	175-210 V AC
Operation Frequency	50 Hz	50 Hz	50 Hz
Power Consumption (Max)	2.5VA	2.5 VA	2.5 VA
Measurement Method	TrueRMS	TrueRMS	TrueRMS
Vmax (Over Voltage Setting)	230...290 V AC	230...290 V AC	400..500 V AC
Vmin (Low Voltage Setting)	160...210 V AC	160...210 V AC / Ayar yok	275...365 V AC
Hysteresis	%5 of Vmax Vmin value	Vmax-Vmin değerinin %5'i	Vmax-Vmin değerinin %5'i
Off-Delay (Release Delay) On-Delay (Draw Delay)	Set at 1 ... 20 sec.	Set at 1 ... 20 sec. / 1sec. constant	Set at 1 ... 20 sec.
Ptc Operation Interval	None	Opening: more than 1600 ohm / PCT none Closing: less than 1400 ohm / PCT none	Opening: more than 1600 ohm Closing: less than 1400 ohm
Setting Accuracy	+ or -%5	+ veya -%5	+ or -%5
Exit Relay	5A 250 V AC	5A 250 V AC	5A 250 V AC
Operation Temperature	Between -20°C…50°C	Between -20°C…50°C	Between -20°C…50°C
Relative Humidity	Less than 90% (Without condensation)	Less than 90% (Without condensation)	Less than 90% (Without condensation)
Cable Sections	2.5 mm² multi vessel cable	2.5 mm² multi vessel cable	2.5 mm² multi vessel cable
Assembly Types	Rail type	Rail type	Rail type
Protection Class	IP20 (Terminals), IP40 (Front Panel)	IP20 (Terminals), IP40 (Front Panel)	IP20 (Terminals), IP40 (Front Panel)
Dimensions	36x90x61	36x90x61	36x90x61
Weight	125gr	125gr	125gr
Insulation	400 V insulation voltage, 4 KV source impact	400 V insulation voltage, 4 KV source impact	400 V insulation voltage, 4 KV source impact

The liquid level relay has 3 electrodes

SRM-02A

Outline Dimensions

48.7
34.7
90 36
44.6 61.9
36.0
61.0
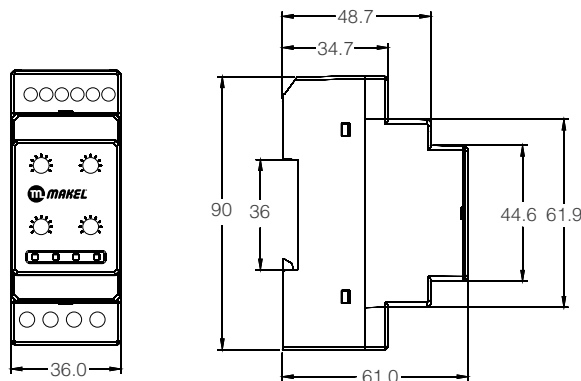
Liquid Level Relays

When liquids with certain conductivity are emptied from storage tanks or while the tanks are being filled these relays prevent the tanks from overflowing and the motors working unnecessarily.

The liquid level relay has 3 electrodes. It is used for emptying liquid reservoirs or water wells. The liquid needs to be conductive in order for the electrodes to be detected. The relay may not be used for flammable or explosive liquids.
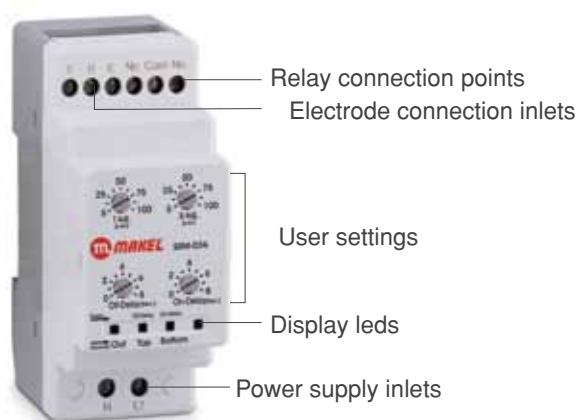
Operation of the Device

The necessary connections are made according to the connection chart. If the liquid reservoir surface is conductive the E connection terminal may be connected to the reservoir surface. If the reservoir is conductive an electrode must be also be connected to the E terminal.

Attention must be paid to the order of the electrodes in the reservoir or well. The E electrode must be placed in the bottom, the T electrode determining the motor operation point must be placed at the very top and the B electrode determining the stopping point of the motor must be placed in between.

The liquid must be conductive. The relay may not be used with flammable or explosive liquids. If the electrodes are not being detected in the SRM-02A model you can change the perception level and enable it to be detected with the Adj. setting.

Operation When the Relay is Passive: When the T and E electrodes are outside of the liquid the "Top" and "Bottom" leds lights up. During this process the out relay is in passive state. The leds of the electrodes that enter the liquid will turn off. When both of the electrodes enter the liquid the On-Delay wait period is counted down. During this period the "Bottom" led will flash. At the end of the period the relay becomes active and the "Out" led goes on.

Operation When the Relay is Active: When the T and E electrodes are inside the liquid the "Top" and "Bottom" leds are off. During this process the out relay is in active state. The leds of the electrodes that come out of the liquid will turn on. When both of the electrodes come out of the liquid the Off-Delay wait period is counted down. During this period the "Top" led will flash. At the end of the period the relay becomes passive and the "Out" led goes off.

Relay connection points

Electrode connection inlets

User settings

Display leds

Power supply inlets

Meanings of the display leds	Out	Top	Bottom
Top and bottom electrodes are outside of the liquid		x	x
Top electrode is outside of the liquid, bottom is inside		x	
Exit active, top and bottom electrodes in liquid	x		
Exit active, top electrode outside liquid	x	x	
The period that exit relay is to be Off is counting down	x	Flash	x
The period that exit relay is to be On is counting down			Flash

Note: *There are no T Adj., B Adj., Off-Delay and On-Delay settings on the SRM-01 model.*

Wiring Diagrams

SRM-01 / SRM-02A
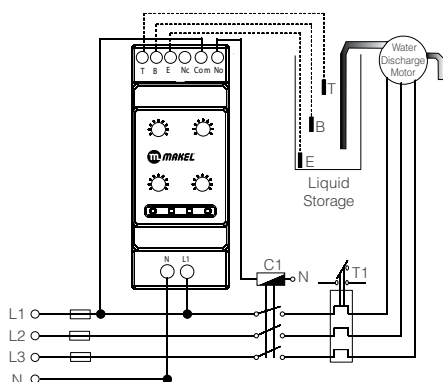
Technical Specifications

Specifications	SRM-01	SRM-02A
Operation Voltage (Un)	230 V AC	230 V AC
Operation Voltage Interval (U)	150-300 V AC	150-300 V AC
Operation Frequency	50 Hz	50 Hz
Power Consumption (Max)	2.5 VA	2.5 VA
T- adj. (Top electrode sensitivity setting)	Fixed between 0-50 kohm	Set between 0-100 kohm
B- adj. (Top electrode sensitivity setting)	Fixed between 0-50 kohm	Set between 0-100 kohm
Off-Delay (Release period)	1 sec fixed	Set at 1-8 sec
On-Delay (Draw period)	1 sec fixed	Set at 1-8 sec
Setting Accuracy	+ or -5%	+ or -5%
Exit Relay	5 A 250 V AC	5 A 250 V AC
Operation Temperature	Between -20°C…50°C	Between -20°C…50°C
Relative Humidity	Less than 90% (Without condensation)	Less than 90% (Without condensation)
Cable Sections	2.5 mm² multi vessel cable	2.5 mm² multi vessel cable
Assembly Types	Rail type	Rail type
Protection Class	IP20 (Terminals), IP40 (Front Panel)	IP20 (Terminals), IP40 (Front Panel)
Dimensions	36x90x61	36x90x61
Weight	125gr	125gr
Insulation	400 V insulation voltage 4 KV source impact	400 V insulation voltage 4 KV source impact

Time Relay TMR-01

TMR-01

Outline Dimensions
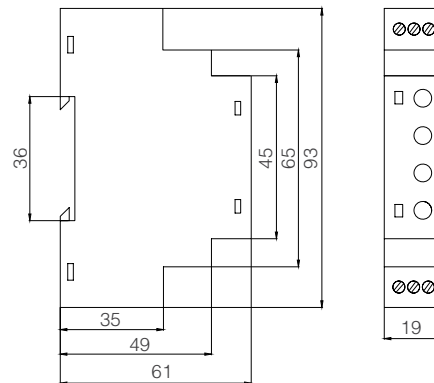
Used especially for process control in industrial automation. They activate or inactivate systems with set delays or start or stop events with a delay.

Draw Delayed Relays: draw contact at the end of the T period after voltage is applied to the time relay.

Release Delayed Relays: draw contact when voltage is applied to the time relay and release contact at the end of the t period.

Note: In order for time settings which have been made when the time relay is with power to be valid, the time relay power supply needs to be provided again.
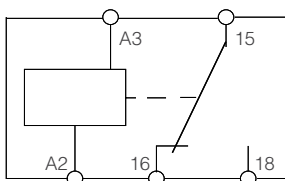
General Specifications

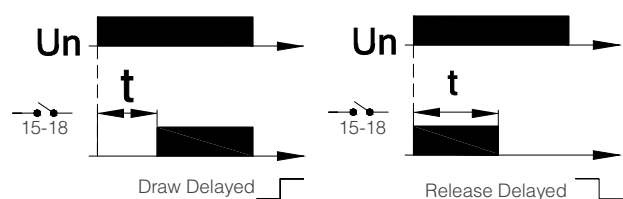Time Relays are used in industry for their following feature.
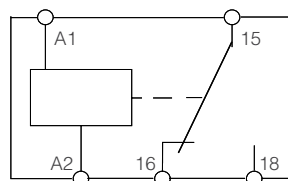
▸ General purpose use

▸ Easily adjustable time interval

▸ Easy attachment to rail

▸ Narrow and small size

Wiring Diagrams

24 V AC / DC ± %10   220 / 230 V AC ± %20

Draw Delayed   Release Delayed

Safety Warnings

▸ The assembly and electrical connections must be done by technical personnel according to the instructions.

▸ While the device is being assembled there should be no power on the connection cables.

▸ Check the cable connections before operating the device.

▸ Do not open the device.

▸ Do not operate the device in dirty, wet or vibrating conditions.

▸ Use a dry cloth to clean the device, never use a solvent or chemical substance.

Time Setting

X10 trimpot value show the tens digit of the desired time, x1 shows the ones digit and x0.1 show the one tenths digit of the desired time.

Example: x10 = 4, x1= 8, x0.1 = 5 and

Mode= if 1s has been set the contact outlets will change position after 48.5 seconds.

x10	x1	x0.1	Mode	Set Time
4	8	5	1s	48,5 sec
4	8	5	10s	485 sec
4	8	5	1m	48,5 min
4	8	5	10m	485 min
4	8	5	1h	48,5 hour
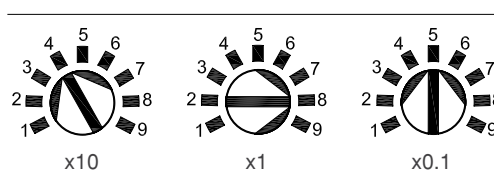
Technical Specifications

Specifications	TMR-01
Time Interval	0.5sec – 99.9 hours
Accuracy	<1%
Power Supply	220/230 Vac ± 20% 24 Vac / dc ± 10%
Power Consumption* (220 Vac 50 Hz)	Active Power 0.9 W Visible Power 8 VA
Sudden Impact Voltage Resistance* Surge (IEC 61000-4-5)	2 kV
Quick Temporary Sudden Impact Voltage* Resistance Burst (IEC 61000-4-4)	4.4 kV
Electromagnetic RF Fields Resistance* (IEC 61000-4-3)	10 V/m
Assembly Form	Th Rail assembly (EN 60715)
Protection Class	IP20 (EN 60529),
Ambient Temperature	-5°C + 50°C (Operation) -25°C + 75°C (Storage)
Contact Current /Power	1 C/O, 8A, 2000 VA

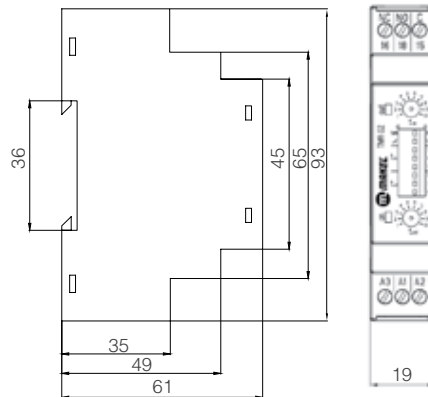* Applies to 220/230 Vac (A1-A2) supply line

Time Relay TMR-02

TMR-02

Outline Dimensions

Draw Delayed Relays: draw contact at the end of the T period after voltage is applied to the time relay.

Release Delayed Relays: draw contact when voltage is applied to the time relay and release contact at the end of the t period.

Note: In order for time settings which have been made when the time relay is with power to be valid, the time relay power supply needs to be provided again.

General Specifications

Time Relays are used in industry for their following feature.

▶ General purpose use

▶ Easily adjustable time interval

▶ Easy attachment to rail

▶ Narrow and small size

Wiring Diagrams

24 VAC/DC ± 10%

220 / 230 V AC ± %20

Safety Warnings

▸ The assembly and electrical connections must be done by technical personnel according to the instructions.

▸ While the device is being assembled there should be no power on the connection cables.

▸ The device should be mounted inside of the panel.

▸ Check the cable connections before operating the device.

▸ Do not open the device.

▸ Do not operate the device in dirty, wet or vibrating conditions.

▸ Use a dry cloth to clean the device, never use a solvent or chemical substance.

Time Setting

TM-02 timer operated as On-Delay (ER), Off Delay(EM), On Flash mode or Off Flasher mode according to user needs. Adjustable time range of TMR-02 is between 0.5 second- 30 hours.

●	●	TMR	On-Delay
●	○	TMR	Off-Delay
○	○	FL	Off Flasher
○	●	FL	On Flasher
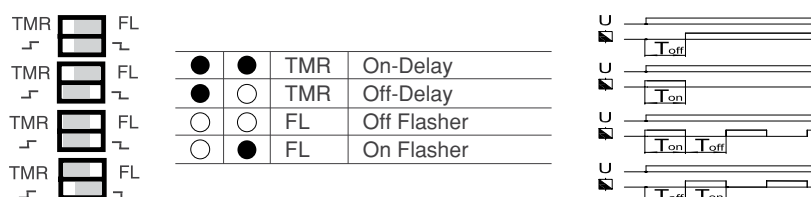
TMR-02

5	4	3	T_{on} Time Setting	
8	7	6	T_{off} Time Setting	
			Time Range	Adjustable Time Range
○	○	○	5 sec	0,5-5 sec
○	○	●	10 sec	1-10 sec
○	●	○	30 sec	3-30 sec
○	●	●	60 sec	6-60 sec
●	○	○	10 min	1-10 min
●	○	●	60 min	6-60 min
●	●	○	10 hour	1-10 hour
●	●	●	30 hour	3-30 hour

T_{on} time is setting by 3,4,5 switches and ton trimmer,
T_{off} time is setting are by 6,7,8 switches and toff trimmer.

T_{on} and/or T_{off} time settings are calculated according to the following formulas

a: Selected time range (by switches)

x: Position of timmer

t: Desired time

$$x=\frac{10.t}{a} \text{ and } t=\frac{x.a}{10}$$

Technical Specifications

Specifications	TMR-02	Specifications	TMR-02
Time Interval	0,5sec – 30 hours	Electromagnetic RF Fields Resistance * (IEC 61000-4-3)	10 V/m
Accuracy	<1%		
Power Supply	220/230 Vac ± 20% 24 Vac / dc ± 10%	Assembly Form	Th Rail assembly (EN 60715)
Power Consumption* (220 Vac 50 Hz)	Active Power 0.9 W Visible Power 8 VA	Protection Class	IP20 (EN 60529),
		Ambient Temperature	-5°C + 50°C (Operation) -25°C + 75°C (Storage)
Sudden Impact Voltage Resistance* Surge (IEC 61000-4-5)	2 kV	Contact Current /Power	1 C/O, 8A, 2000 VA
Quick Temporary Sudden Impact Voltage * Resistance Burst (IEC 61000-4-4)	4.4 kV		

* Applies to 220/230 Vac (A1-A2) supply line

Time Relay TMR-30 / TMR-60

TMR-30   TMR-60

Outline Dimensions
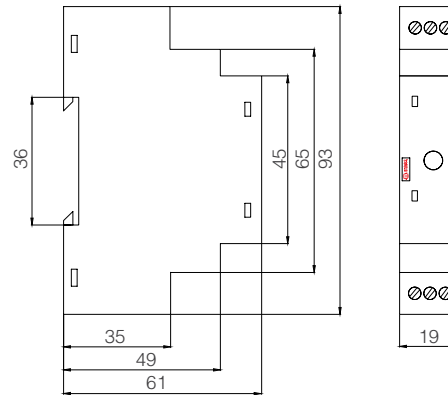
Draw Delayed Relays: draw contact at the end of the T period after voltage is applied to the time relay.

Note: *In order for time settings which have been made when the time relay is with power to be valid, the time relay power supply needs to be provided again.*
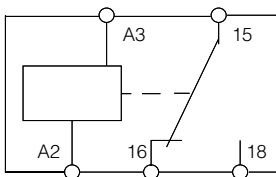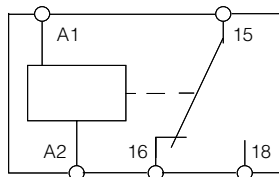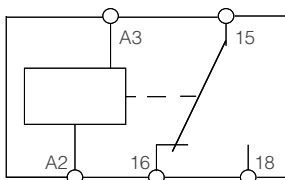
General Specifications

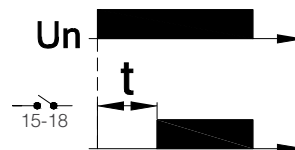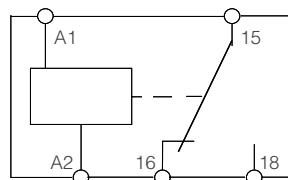Time Relays are used in industry for their following feature.

▸ General purpose use

▸ Easily adjustable time interval

▸ Easy attachment to rail

▸ Narrow and small size

Wiring Diagrams

24 V AC / DC ± %10   220 / 230 V AC ± %20

Safety Warnings

▸ The assembly and electrical connections must be done by technical personnel according to the instructions.

▸ While the device is being assembled there should be no power on the connection cables.

▸ Check the cable connections before operating the device.

▸ Do not open the device.

▸ Do not operate the device in dirty, wet or vibrating conditions.

▸ Use a dry cloth to clean the device, never use a solvent or chemical substance.

Technical Specifications

| Specifications	TMR-30	TMR-60
Time Interval	2-30 sec	2-60 sec
Power Supply	220/230 Vac ± 20% 24 Vac / dc ± 10%	220/230 Vac ± 20% 24 Vac / dc ± 10%
Power Consumption* (220 Vac 50 Hz)	Active Power 0.9 W Visible Power 8 VA	Active Power 0.9 W Visible Power 8 VA
Sudden Impact Voltage Resistance* Surge (IEC 61000-4-5)	2 kV	2 kV
Quick Temporary Sudden Impact Voltage* Resistance * Burst (IEC 61000-4-4)	4.4 kV	4.4 kV
Electromagnetic RF Fields Resistance* (IEC 61000-4-3)	10 V/m	10 V/m
Assembly Form	TH Rail assembly (EN 60715)	TH Rail assembly (EN 60715)
Protection Class	IP20 (EN 60529)	IP20 (EN 60529)
Ambient Temperature	-5°C + 50°C (Operation) -25°C + 75°C (Storage)	-5°C + 50°C (Operation) -25°C + 75°C (Storage)
Contact Current /Power	1 C/O, 8A, 2000 VA	1 C/O, 8A, 2000 VA

* Applies to 220/230 Vac (A1-A2) supply line.

Photocell relays provide energy efficiency by opening and closing lighting systems and keeping lights on for the time interval that is set with the sleep mode.

Outline Dimensions

FRM-01
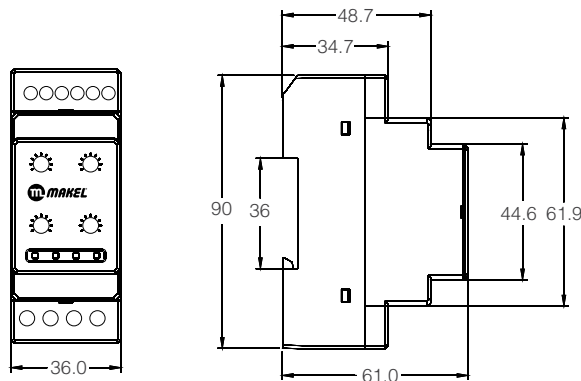
Photocell Relays

These relays turn lights on and off according to the level of daylight and the sleep mode keeps the lights on for a set period to provide energy efficiency.

Photocell relays have a sensor that can detect light intensity and a relay-out that operates according to the light intensity. The device controls the lighting systems that are connected to this outlet. Thus lighting can be turned on automatically when dark and turned off when light.

Operation of the Device

The necessary connections are made according to the connection chart. The sensor optic connected to the photocell relay must be attached so that the lighting system is not exposed to direct light. Also it is recommended that the optic be attached to areas which are less likely to get dirty.

 If the Sleep Mode is not desired in FRM-02S this setting must be brought to Off. When the lux adjustment is being set it should be on 0 Lux for moderate darkness and 1 Lux for the darkest.

Normal Operation: If the ambient light intensity is lower than the set Lux level it means it has gotten dark and the "Dark" led will light up. The On-Delay period will be waited out. (30 sec is fixed on FRM-01). If at the end of the period the setting is dark the "Out" led goes on and the relay-out becomes active.

If the ambient light intensity is higher than the set Lux level it means it has gotten light and the "Light" led will light up. The Off-Delay period will be waited out. (30 sec is fixed on FRM-01). If at the end of the period the setting is light the "Out" led goes off and the relay-out becomes passive.

Operation in Sleep Mode (In the FRM-02S model): After it has gotten dark the relay-out becomes active for as long as the number of hours in the sleep setting. After this period is over the "Sleep" led goes on, the "Out" led goes off and the relay-out becomes passive. Thus the lighting will have operated for as long as the set Sleep time and energy efficiency will have been achieved for the time remaining until morning.

After the intensity of the light increases 1 minute goes by. If it is still light when the period is up the "Sleep" led goes off and the normal operation mode starts.

If you do not want the photocell relay to work in Sleep mode set it to "Off". In this situation the "Sleep" led will flash to inform that the Sleep mode has been cancelled.

Relay connection points
Photo sensor connection inlets

User settings

Display leds

Power supply inlets
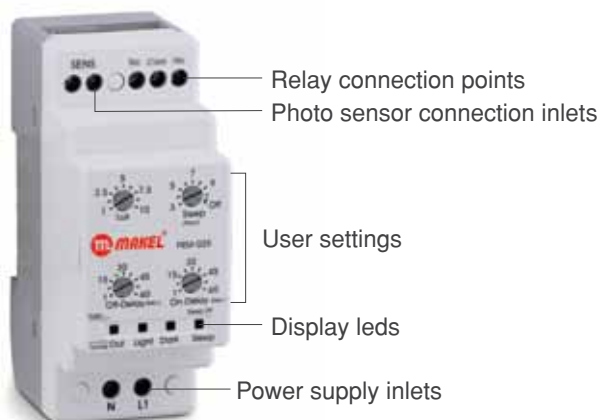
| Meanings of the display leds	Out	Light	Dark	Sleep
Operate in daylight (Light)		X		
Dark Has Set (On Delay period countdown)			X	
Operate in dark (Dark)	X		X	
Light Has Set (Off Delay period countdown)	X	X		
Operation in sleep mode (Sleep)			X	X
Exit Sleep Mode (Period countdown)		X		X
Sleep Mode off (Sleep off)				Flash

Note: *There are no Sleep leds and Off-Delay and On-Delay settings on the FRM-01 model.*

Wiring Diagrams

FRM-01 / FRM-02S

Photocell Optic

N Lighting System

L1
L2
L3
N
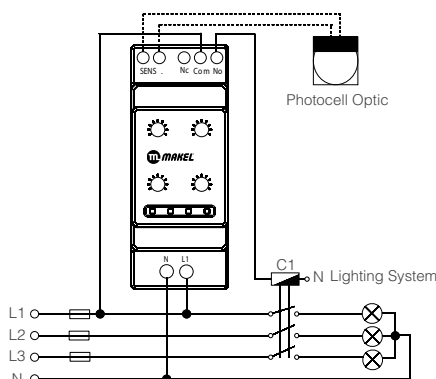
Technical Specifications

Specifications	FRM-01	FRM-02S
Operation Voltage (Un)	230 V AC	230 V AC
Operation Voltage Interval (U)	150-300 V AC	150-300 V AC
Operation Frequency	50 Hz	50 Hz
Power Consumption (Max)	2.5 VA	2.5 VA
Lux adjustment	1…10	1…10
Sleep Adjustment	None	3-10 hours Set/Sleep off
Off-Delay (Release delay)	30 sec fixed	1…60 sec Set
On-Delay (Draw delay)	30 sec fixed	1…60 sec Set
Setting Accuracy	+ or -5%	+ or -5%
Exit Relay	5 A 250 V AC	5 A 250 V AC
Operation Temperature	Between -20°C…50°C	Between -20°C…50°C
Relative Humidity	Less than 90% (Without condensation)	Less than 90% (Without condensation)
Cable Sections	2.5 mm^2 multi vessel cable	2.5 mm^2 multi vessel cable
Assembly Types	Rail type	Rail type
Protection Class	IP20 (Terminals), IP40 (Front Panel)	IP20 (Terminals), IP40 (Front Panel)
Dimensions	36x90x61	36x90x61
Weight	125gr	125gr
Insulation	400 V insulation voltage 4 KV source impact	400 V insulation voltage 4 KV source impact

Motor Protection Relays

Product Name	Code No.	Piece in Box	Piece in Package	Gross Weight (kg)	Size of Package (mm)	Absence of Phase	Phase Order	Ptc	Fixed Asymmetry	Set Asymmetry	Without Neutral	Draw Delay	Open Delay	Insufficient Power Supply Warning
New MKT - 01	152070001	1	12	1,40	253 x 138 x 103	•	•	–	•	–	–	–	–	•
New MKT - 02P	152070002	1	12	1,40	253 x 138 x 103	•	•	•	–	•	–	•	•	•
New MKN - 02P	152070003	1	12	1,40	253 x 138 x 103	•	•	•	–	•	•	•	•	•
New MKT - 01S	152070028	1	12	1,40	253 x 138 x 103	•	•	–	•	–	–	–	–	•

Current Protection Relays

Product Name	Code No.	Technical Specifications	Piece in Box	Piece in Package	Gross Weight (kg)	Size of Package (mm)	Low Current Warning	Excessive Current Warning	Monophase	External Current Transformer	Relay Delay	Start Delay
New AKM-01	152070007	1-10.000/5 A veya 0.5-5 A Poles	1	12	1,75	253 x 138 x 103	•	•	•	–	•	•
New AKM-01T	152070008	7,5-82,5 A (AT-20 included Current Transformer)	1	12	2,10	265 x 138 x 112	•	•	•	•	•	•

Low Voltage Current Transformer

Product Name	Code No.	Piece in Box	Piece in Package	Gross Weight (kg)	Size of Package (mm)
AT-20	152070025	1	50	2,90	185 x 230 x 45

Technical Specifications

Current Rating	200 A / 80 mA
Wrap Interval	1 / 2500
Frequency	50/60 Hz
Accuracy	Class 1 (%1)
RL	3.3 Ohm
Operation Temperature	-10°C...65°C
Hole Diameter	12.8 mm
Out Diameter	37 mm

AT-20

Voltage Protection Relays

Product Name	Code No.	Piece in Box	Piece in Package	Gross Weight (kg)	Size of Package (mm)	Absence of Phase	Phase Order	Ptc	Low Voltage Warning	Over Voltage Warning	Monophase	Three-phase	Neutral	Draw Delay	Open Delay	Insufficient Power Supply Warning
New GKM-01	152070004	1	12	1,40	253 x 138 x 103	•	–	–	•	•	•	–	•	•	•	•
New GKT-02P	152070005	1	12	1,40	253 x 138 x 103	•	•	•	•	•	–	•	•	•	•	•
New GKN-02P	152070006	1	12	1,40	253 x 138 x 103	•	•	•	•	•	–	•	–	•	•	•
New GKT-01S	152070029	1	12	1,40	253 x 138 x 103	–	•	–	–	•	–	•	•	–	–	•

Liquid Level Protection Relays

Product Name	Code No.	Piece in Box	Piece in Package	Gross Weight (kg)	Size of Package (mm)	Fixed Sensitivity	Set Sensitivity	Monophase	Fixed Draw Delay	Fixed Open Delay	Set Draw Delay	Set Open Delay	1 C/O Kontak	Small Size Electrode	Large Size Electrode
SRM-01	152070013	1	12	1,40	253 x 138 x 103	●	–	●	●	●	–	–	●	–	–
SRM-02A	152070026	1	12	1,40	253 x 138 x 103	–	●	●	–	–	●	●	●	–	–
SRE-01(Small Electrode)	152070015	1	12	0,38	-	–	–	–	–	–	–	–	–	●	–

Time Relays

Product Name	Code No.	Piece in Box	Piece in Package	Gross Weight (kg)	Size of Package (mm)	Draw Delayed (ER)	Release Delayed (ER)	Control Entry Release Delayed (R)	Drawn Control Entry (R)	Triggered in Release Delayed in Release (TS)	Triggered in Release Delayed in Draw (TA)	Symmetric Flasher (EF)	Trigger Entry	Open Flasher	Closed Flasher	Down Meter	Right-Left	Delayed Fall	24V AC/DC	220/230V AC	12-240C AC/DC	24-240C AC/DC
TMR-30 (2-30sn)	152070009	1	22	-	253 x 138 x 103	●	–	–	–	–	–	–	–	–	–	–	–	–	●	●	–	–
TMR-60 (4-60sn)	152070010	1	22	-	253 x 138 x 103	●	–	–	–	–	–	–	–	–	–	–	–	–	●	●	–	–
TMR-01 (0,1sn-999dk)	152070011	1	22	-	253 x 138 x 103	●	●	–	–	–	–	–	–	–	–	–	–	–	●	●	–	–
TMR-02 (0,1sn-60 h. featured blinker)	152070012	1	22	-	253 x 138 x 103	●	●	–	–	–	–	–	–	●	●	–	–	–	●	●	–	–

Photocell Relays

Product Name	Code No.	Piece in Box	Piece in Package	Gross Weight (kg)	Size of Package (mm)	Light Intensity Setting	Sleep Economy Mode	Monophase	Fixed Draw Delay	Fixed Open Delay	Set Draw Delay	Set Open Delay
FRM-01*	152070014	1	10	1,45	330 x 180 x 98	●	–	●	●	●	–	–
FRM-02S*	152070016	1	10	1,45	330 x 180 x 98	●	●	●	–	–	●	●
FRG-01 (Lens)	152070024	1	15	0,48	-	–	–	–	–	–	–	–

*Optical lens is included.

Notes:

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Makel Elektrik Malzemeleri San. ve Tic. A.Ş.
İstiklal Mah. Mareşal Fevzi Çakmak Cad. No: 38
Kıraç - 34522 Esenyurt - İSTANBUL
Tel: 0212. 689 50 50 (pbx) • Fax: 0212. 689 50 61
www.makel.com.tr • makel@makel.com.tr

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