MEASUREMENT DEVICES

Digital Measurement Devices

FYA72 - FYA96

FYV72 - FYA96

FMM50

Analogue Measurement Devices

FA72 - FYA96

FMA72 - FYA96

FV72 - FYA96

FF72 - FYA96

Power Analyzer

FPA100 - FPA120

FPA50

Over Current Relay

FAA200

CONTENTS

Comparison of a known size and an unknown size in the same kind is called measurement.

Ammeter:
Ammeters are the devices measuring current strength (amount of current passing through conductive) of electrical current. They are serially connected to receiver in the electrical circuit. Current of the receiver should pass through the ammeter. However, the ammeter should measure this passing current but should not hinder it. For this purpose, inner resistance of the ammeter should be very low (0-1 Ohm). In order to have a low inner resistance of the ammeter, coil is wrapped with less spins than thick section conductive. The value measured by ammeters is shown with value L and expressed with letter A (such as I = 10A). There are "-", "~" and "≂" marks on the ammeter dial. "≂" represents measurement in direct current, "~" represents measurement in alternative current and "o" represents measurement in both direct current and alternative current. In addition to ammeters measuring direct current (DC) and alternative current (AC); there are ammeters measuring both DC and AC.

Ammeters with demand meter can show the highest average current value drawn within a time period of 15 minutes. When it is required, ammeter with demand meter can be made in 5 or 8-minute periods. In addition to dial ammeters, electronic (digital) ammeters are used and their areas of application increase day by day. There is no reading error in these ammeters and their features of use are same with the dial ammeters. Ammeters must be serially connected to the circuit. They fail when connected parallel.

Voltmeter:
These are the tools measuring voltage (potential difference) of the receiver or the circuit in an electrical circuit. Voltmeters are connected parallel to the receiver, voltage of which shall be measured.

Since voltmeter is connected parallel to the receiver, a current pass through it. In order to have a low current, inner resistance should be high. In order to ensure this situation, which is contrary to ammeters, coils are wrapped with more spins than thin section conductive. The value measured by voltmeter is represented with letter U and expressed with letter V (such as U= 220 V). Voltmeters have two kinds as DC voltmeter and AC voltmeter. Moreover, there are voltmeters capable of measuring both DC and AC. Attention should be paid prior to connecting voltmeter to the circuit. In addition to dial (analogue) voltmeters, digital voltmeters are used. Just like digital ammeters, voltmeters become widespread every day. Because, there is no reading error in them and they occupy less space and reduce costs in time. Voltmeters are connected to the circuit parallel. No harm is caused in the device if they are connected serially to the receiver. However, since there shall be a big resistance in the circuit, the receiver shall not operate.

Frequency meter:
Devices measuring frequency are called frequency meters. Frequency meters indicate number of cycles in 1 second and their unit is cycle/second or Hertz (Hz). Frequency meters are connected to the circuit, frequency of which shall be measured, parallel just like voltmeters. They are manufactured to be connected between phases or phase and neutral.

Measurement Device Classes:
It is percentage expression of the error rate of the measurement device at the highest value to be measured.
0,1 - 0,2 Class: Measurement devices used in manufacture of measurement devices.
0,5 - 1 Class: Measurement devices usually used portable.
1,5 - 2,5 Class: Table-type measurement devices used in industrial measurements.

Technical Specification

	Ammeters		Max, Demand Ammeters		Voltmeters		Frequencymeters	
Type	FA 72	FA 96	FMA 72	FMA 96	FV 72	FV 96	FF 72	FF 96
Measuring wave form	AC (r.m.s)		AC (r.m.s)		AC (r.m.s)		AC (r.m.s)	
Measuring range	From 10A to 100A (direct) From 30/5A to 4000/5A (current trans)		1 A, 5 A Direct (15 min.) X/5 A with current trans.(15 min)		250 V ve 500 V		45 - 55 Hz ve 55 - 65 Hz	
Accuracy class	1.5		3		1.5		1.5	
Operating method	Moving iron		Bimetal		Moving iron		Moving coil	
Operating frequency	45 - 65 Hz		45 - 65 Hz		45 - 65 Hz		45 - 55 Hz	
Continously overload (2 hour)	1.2 x In		1.2 x In		1.2 x Un		1,2 x Un, 1,2 x 55 Hz	
Short-time overload	10 x In		10 x In		2 x Un		2 x Un	
Consumption (max.)	1 VA		2.2 VA		3 VA		1 VA	
Insulation testing voltage	2000 V		2000 V		2000 V		2000 V	
Operating position	Scale vertical position		Scale vertical position		Scale vertical position		Scale vertical position	
Standards	TS 5590 EN 60051-2		TS 5590 EN 60051-2		TS 5590 EN 60051-2		TS 5592 EN 60051-4	
Dimensions	72 X 72	96 X 96	72 X 72	96 X 96	72 X 72	96 X 96	72 X 72	96 X 96

Federal anologue meters are manufactured according to IEC 60051-2 / EN 60051-2 standards and CE certificate. There is no need to stock for ammeters due to inter changeable scale system. Only scale is sufficient to have in stock.

Order Code

	Type	Dimensions	Using Type	Order Code
	FA 72	72x72	Direct	9KA-AA120-□□□□
			With current transformer	9KA-AA121-□□□□
	FA 96	96x96	Direct	9KA-AA220-□□□□
			With current transformer	9KA-AA221-□□□□
	FMA 72	72x72	Direct	9KA-MA120-□□□□
			With current transformer	9KA-MA120-□□□□
	FMA 96	96x96	Direct	9KA-MA220-□□□□
			With current transformer	9KA-MA220-□□□□
	FV 72	72x72	Direct	9KV-AA120-ΔΔΔΔ
	FV 96	96x96	Direct	9KV-AA220-ΔΔΔΔ
	FF 72	72x72	Direct	9KF-A0120-0055
	FF 96	96x96	Direct	9KF-A0220-0055

□□□□: Measuring range of ammeter is written (Amper)
Types for direct using: 0010, 0015, 0020, 0025, 0040, 0050, 0080, 0100.
Types used with current tranformer: 0030, 0040, 0050, 0060, 0080, 0100, 0200, 0250, 0300, 0400, 0500, 0600, 0800, 1000, 1200, 1500, 2000, 2500, 3000, 4000.
ΔΔΔΔ : Measuring range of voltmeter is written like 0250, 0500.

DIGITAL AMMETER (FYA72-FYA96):
When used with current transformers by entering current transformer conversion ratio, it allows measurement up to 9999A (rms). It resets memory of the ammeter by pressing a single button and allows display of the lowest and the highest current value as of that time. Relay digital ammeters have been developed to be employed at facilities that require current limitation.

DIGITAL VOLTMETER (FYV72-FYV96):
It measures AC voltage of any line between 0-500 V sensitively. It allows display of the lowest and the highest voltage values as of reset of the memory at any time.

Technical Features:

				
	Ammeter	Ammeter (with 2 Relay)	Voltmeter	Voltmeter (with 2 Relay)
Type	FYA 72 - FYA 96	FYA 96 - 2R	FYV 72 - FYV 96	FYV 96 - 2R
Measurement wave form	AC (rms)	AC (rms)	AC (rms)	AC (rms)
Measuring Range	0 -200 A direct 0 -10 A direct, 0 - 9999 A (With C.T.)	0 -10 A direct 0 - 9999 A (With C.T.)	0 - 500 V	0 - 500 V
Accuracy class	1	1	1	1
Operating frequency	50 Hz	50 Hz	50 Hz	50 Hz
Operating temperature	-5°C / 55°C	-5°C / 55°C	-5°C / 50°C	-5°C / 50°C
Operating level distance	(0,8 - 1,2)xUn	(0,8 - 1,2)xUn	(0,8 - 1,2)xUn	(0,8 - 1,2)xUn
Permanent overload	1,2 x In	1,2 x In	1,2 x Un	1,2 x Un
Feeding voltage	220 V AC	220 V AC	220 V AC	220 V AC
Dimensions	72 x 72 - 96 x 96	96 x 96	72 x 72	96 x 96
Order code	9KB-DA110-0200 9KB-DA211-0000	9KD-DA211-0500	9KV-DA110-0500 9KY-DA210-0500	9KY-DA212-0500

Federal digital measurement devices are manufactured according to IEC 60051-2 / EN 60051-2 standards and CE certificate.

Technical Values

Operating Voltage (Un)	: 220V AC.
Operating Interval	: (0,8-1,2)xUn
Class	: %1
Frequency	: 50 Hz
Measurement Interval	: 0..5A
Operating Temperature	: -20°C, + 70°C

Multimeter:
It measures phase voltages, currents and powers, joint cosφ and ground current, total power and frequency values. LCD display has been designed to show 8 electrical sizes at the same time, in addition to symbols like FPA50 analyzer. It does not have energy counters only. Information row is different.

LCD Display and Indication of Values:
When voltage multiplier is entered, if measured voltage exceeds 999 volts, k (kV) indication is displayed on the top. 12, 23, 31 indications are displayed under L phase information in phase voltages. If (-) is displayed on the left of cosφ value of any phase, the value is interpreted as capacitive.

↵ button shows respectively phase-neutral voltages, phase-phase voltage, power coefficient at left top 3 indications

⌒ button shows respectively each phase current, expanding power on each phase at right top 3 indications

⌒ button shows common cosφ, total power, frequency, ground current information alternately

Multi meter with relay Set Values and Relay Functions

Fixed Values :
While entering all fixed values, the flashing number in the middle is taken to the desired value by pressing ⌒ and ⌒ buttons and ↵ button is pressed.

100 - Voltage transformer rate: (vt)

200 - Current transformer rate: (Ct)
For example, if a 600/5 current transformer is used, the value should be entered as 120.

300 - Relay Operating Mode: (0..4)

0 : Control is not ensured with relay outputs

1 : Voltage and Current Limitation Mode
Relay1,2 : 1.phase low / high voltage
Relay3,4 : 2.phase low / high voltage
Relay5,6 : 3.phase low / high voltage
Relay7 : Low current at any phase
Relay8 : High current at any phase

2 : Voltage and Current Limitation Mode
Relay1,2 : 1.phase low / high current
Relay3,4 : 2.phase low / high current
Relay5,6 : 3.phase low / high current
Relay7 : Low voltage at any phase
Relay8 : High voltage at any phase

3 : Voltage and Cosφ Limitation Mode
Relay1,2 : 1.phase low / high voltage
Relay3,4 : 2.phase low / high voltage
Relay5,6 : 3.phase low / high voltage
Relay7 : Low Cosφ at any phase
Relay8 : High Cosφ at any phase

4 : Current and Cosφ Limitation Mode
Relay1,2 : 1.phase low / high current
Relay3,4 : 2.phase low / high current
Relay5,6 : 3.phase low / high current
Relay7 : Low Cosφ at any phase
Relay8 : High Cosφ at any phase

301 - Relay Pulse Adjustment (x10ms): Relay's pull and release duration is determined. For example, when 5 is entered, Relay remains pulled for 50ms.

302 - Relay Start Adjustment (sec):
Starting time of Relays after energy supply to the device is determined.

303 - Relay Delay Time (sec):
Seconds of a designated condition are determined to pull the Relay. For example, when 5 is entered, in order to pull the low voltage Relay, low value should be read for 5 seconds.

304 - Relay Zero Function (0/1):
0 : Zero function is not considered to be low value.
1 : Zero function is considered to be low value.

305 - Relay Sealing Function (0/1):
0 : After relay is pulled, if the concerned value returns to normal limits, the Relay returns to normal position. There is no sealing!
1 : After relay is pulled, even if the concerned value returns to normal limits, the Relay remains pulled. There is sealing!

306 - Voltage Bottom Limit (V) :

307 - Voltage Top Limit (V) :

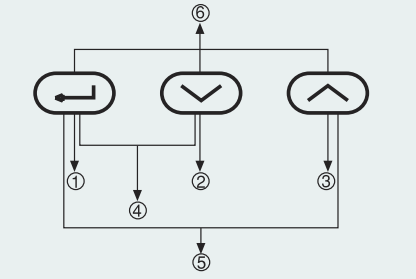
308 - Current Bottom Limit (I) :

309 - Current Top Limit (I) :

310 - Cosφ Bottom Limit (Cosφ) :

311 - Cosφ Top Limit (Cosφ) :

If Relay Operating Mode (Menu 300) is selected 0, as there shall be no need to make entry in 301 and following menus, the device records it and returns to operating mode.



Function buttons :
① 1. area control button
② 2. area control button
③ 3. area control button
④ 4. area control button
⑤ Entering fixed values function
⑥ Value reset

↵ button; shows phase-neutral voltages, phase-phase voltages and Cosφ value of each phase;
⌄ button; shows currents, active powers, apparent powers and reactive powers;
⌃button; shows energy values. The device can show individual harmonic current and voltage values of each phase up to 33rd harmonic.

Power Analyzers: FPA100 Power Analyzer has been designed to measure the energy consumed in 3-phase systems. 10 of measured sizes can be seen on the display at the same time. 3 programs can be made. Measures can be taken against extraordinary situations thanks to relay output. Thanks to standard RS232 port, values measured by the analyzer can be monitored and archived in computer.

Programming Features: You have to enter some fixed values before using them.

Entering Fixed Values: While fixed values are entered, 4 display on bottom left and bottom right is used. In order to get into the mode to enter these values, ↵ and ⌃ buttons are pressed at the same time. The following view is displayed. The display on bottom left (big digits) is used as menu number. As variables to be programmed are entered, next menu is progressed. 3rd digit of the menu number is used for entering number of the Relay to be used for that variable.

Top of the 3 digits on the right shows the maximum value of the value to be entered and bottom shows the minimum vale; users cannot change them. Display in the middle is the field for users entering appropriate value. Value to be entered flashes to direct the user.

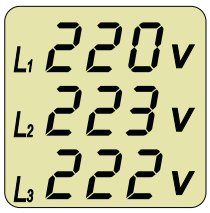
These fixed values are:
1. Voltage transformer rate
2. Current transformer rate
3. Low voltage value (When voltage goes down to the value we have adjusted, we set the Relay to send the signal with this function).
4. High voltage value and Relay output (Relay operates if higher than set value)
5. Low voltage value and Relay output (Relay operates if lower than set value)
6. High current value and Relay output (Relay operates if higher than set value)
7. Inductive low power factor value and Relay output (Relay operates if lower than set value)
8. Capacitive high power factor value and Relay output (Relay operates if lower than set value)
9. Operating delay of alarm function in seconds after energy supply
10. Alarm output delay after set values are exceeded
11. Network number of the device (1-250, 1 is entered in single use)
12. Communication speed (1200-2400-4800-9600-19200-38400 baud)
13. Parity (none,odd,even)

FPA120 series Energy Analyzers are designed to measure all the electrical parameters in 3-phase electrical systems. They can be directly used in medium and high voltages by entering voltage and current transformer multipliers. Measured parameters can directly be read on the display. Analyzers have measurement values better than 1% and there are general-purpose inputs and outputs on the analyzer. These inputs and outputs can be programmed according to measurement parameters or completely be used in remote-access and control functions. There are standard optical insulated RS232 and RS485 ports and the analyzer has the required software for use with GPRS and Network TCP/IP converters. Standard monitoring software is provided with the analyzer. MODBUS TRU Protocol is used in these analyzers and communication is ensured with MODBUS/TCP protocol on internet.

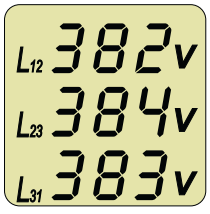
LCD display is designed with 10x10 cm. dimensions to show 10 electrical sizes at the same time, in addition to symbols. Positions of 8 input and 8 output warnings can be seen on the display. Negative (-) marks mean capacitive or export. Import and export energy values can be read at the same time as 3 parts of 5+3 characters.

Display of Harmonic Values:

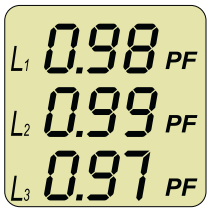
3 rows of 3 characters on top left of LCD display show voltage values and power factors measured by the analyzer.



Phase neutral screen



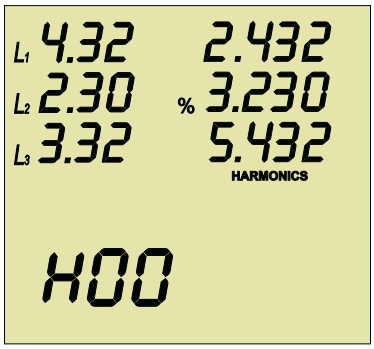
Phase phase screen



Power factor screen

Phase-neutral voltage,
Phase-phase voltage,
Each phase's Cosφ

Display of Harmonic Values:



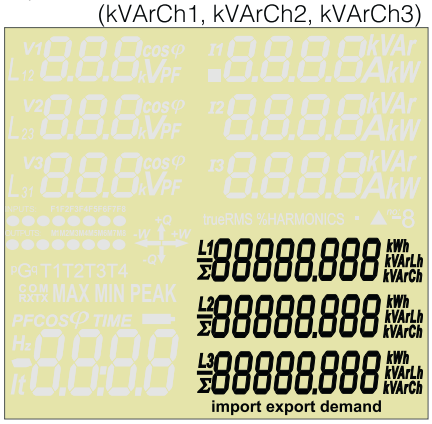
When ⌄ and ⌃ buttons are pressed together, Harmonic screen is displayed. The letter "H" is displayed in the beginning of 3 digits on bottom left of the harmonic display page.
When the number next to letter H is 00, total harmonic values are shown. Three values on top left show total harmonic of 1st, 2nd and 3rd phase voltages respectively and three values on top right show total harmonic of 1st, 2nd and 3rd phase currents respectively.

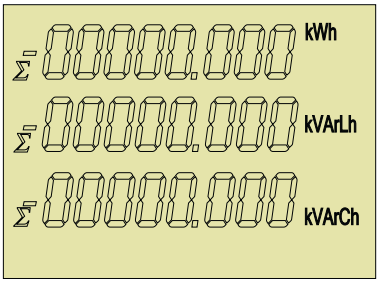
Display of Current and Power Values:

In 3 rows of 4 characters on top right of LCD display;
Current,
Active power,
Apparent power,
Reactive power
values can be seen.

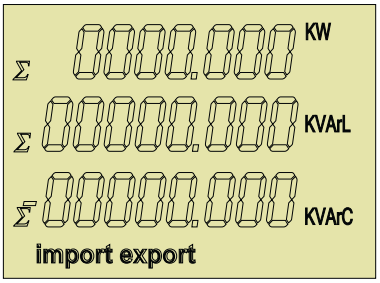
Display of Energy Values:

Energy meters are present in 3rd part on bottom right of the display.
(-) sign on the left indicates capacitive reactive energy or export active energy.
If each phase is displayed separately, L1, L2, L3 symbols; if they are displayed as a whole, "S" symbol is seen on the left.
If status is capacitive on the reactive phase display, kVArC symbol is seen on the right in the relevant phase. When you press ⌃ each time, respectively;
General power statuses
(Total : kW, kVArL, kVArC)
Phase active powers,
(kW1, kW2, kW3
(-) symbol means export)
Phase reactive power,
(kVArL or if capacitive, kVArC)
General total meters
(Total kWh, kVArLh, kVArCh)
Import active energy
(kWph1, kWph2, kWph3)
Export active energy
(kWnh1, kWnh2, kWnh3)
Reactive inductive energy (Phases separate):
(kVArLh1, kVArLh2, kVArLh3)
Reactive capacitive energy (Phases separate):
(kVArCh1, kVArCh2, kVArCh3)

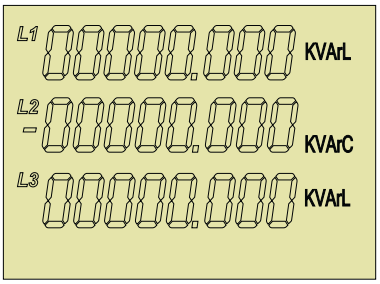




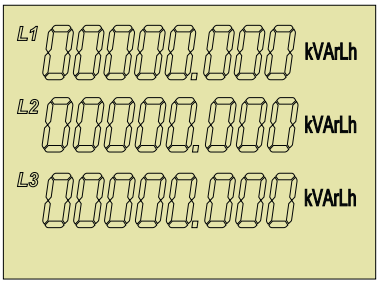
Total energy display



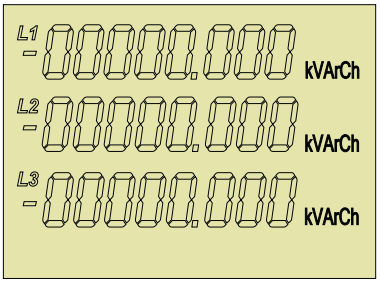
General power display



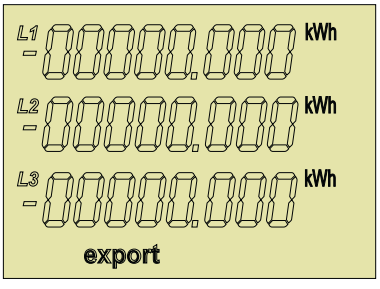
Phases separate reactive power display



Phases separate inductive energy display



Phases separate capacitive energy display



Phases export energy display

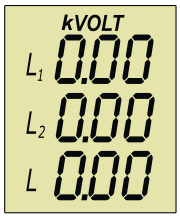
FPA50
FPA50 Energy Analyzers manufactured in 96x96 housing has LCD display indicating 8 electrical sizes at the same time.

They operate in 3 different modes:
1. Normally, 4th characters are not lighted and device shows voltages and currents in the system.
2. In energy display mode, 4th characters are also lighted and energy values are shown in single row. In addition, import-export and inductive-capacitive statuses are shown with 4 quadrant arrows. If value of sizes is negative, "-" symbol is displayed in front of them.
3. In display of harmonics, voltage and current harmonics are shown as pages. Harmonic screen is displayed when ⌄ and ⌃ buttons are pressed simultaneously for this mode.

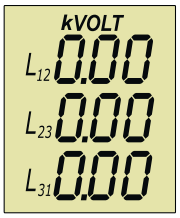
Display of Electrical Values:
First 3 rows of 3 characters on the left of LCD display indicate voltage and cosφ values measured by the device; first 3 rows of 4 characters on the right of LCD indicate current and power values.

When voltage multiplier is entered, if measured voltage exceeds 999 volts, kV (kvolt) indication is displayed on the top. Measured value is interpreted as kVolt. 12, 23, 31 indications are displayed under L phase information in phase-phase voltages. Value is capacitive if (-) sign is displayed on the left of cosφ value of each phase.

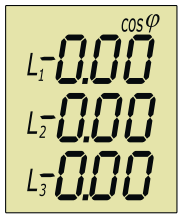
Phase-neutral voltage



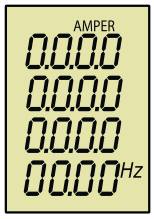
Phase-phase voltage



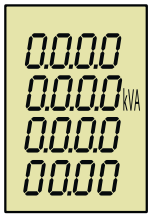
Cosφ value of each phase



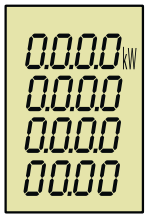
Voltage display



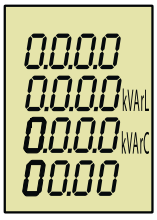
Apparent power display



Active power display



Reactive power display

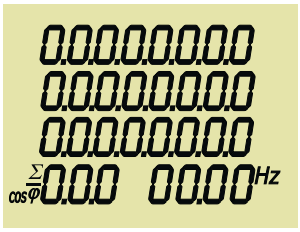


Display of Energy Values:
When phase information are displayed separately, the 4th row at the bottom show total information of these 3 phases.
If there is (-) sign on the left, it means capacitive reactive power or export active power and energy. If each phase are indicated separately, L1, L2, L3 symbols; if they are shown as total, "S" symbol is displayed on the left. If status is capacitive on active phase display, "kVARC" symbol is displayed on the right.

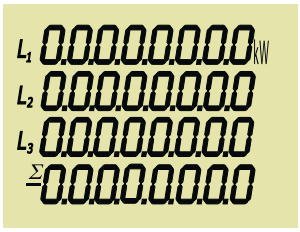
The following values are displayed in order:

kW, kVARL, kVARC	(3 phases total),
kW	(3 phases and total)
kVARLC	(3 phases and total)
kWh, kVARLh, kVARCh	(3 phases total)
kWh	(import 3 phases separate and total)
kWh	(export 3 phases separate and total)
kVArLh	(inductive energy 3 phases separate and total)
kVArCh	(capacitive energy 3 phases separate and total)

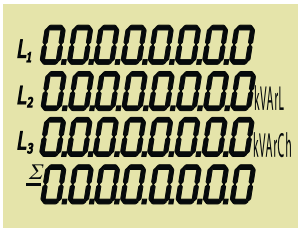
Total active and reactive powers



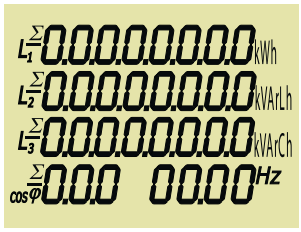
Phases and total active powers



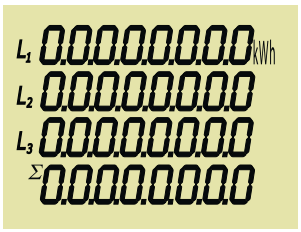
Reactive powers and totals of phases



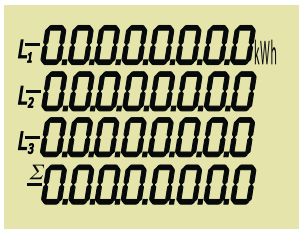
Total energy meters



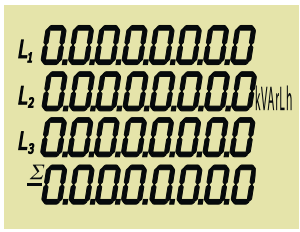
Import active energy meters



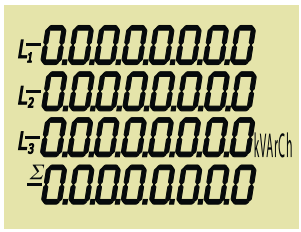
Export active energy meters



Inductive energy meters



Capacitive energy meters



FAA200 Over Current Protection Relays:
Basically, they have been developed to provide 3 phases and one ground protection and can be used with high level of safety thanks to demountable transformer structure.

There are 15 warning/notice leds, as 4 of them are multi-colored, and 4 control buttons on front face of FAA200 Over Current Relay with large LCD Display. These control buttons are used to each menus to make Relay adjustments. All the set values belonging to a phase or ground can be seen with current information on the LCD display.

Relay allows separate adjustment for phases and grounding. In accordance with IEC specifications, it has Thermal Opening, Delayed Instant Opening and Instant Opening functions. For Thermal Opening, one of the curves prepared in accordance with IEC standards or ANSI standard can be selected. Furthermore, thanks to the user-defined curve in IEC menu, curve in any characteristic can easily be defined. In this way, all the special opening curves can be realized in devices such as line, motor, transformer, rectifier etc.

Opening delay can be changed linear by scrolling t1 variable on time axis upwards and downwards. For delayed instant opening, current fold and opening duration values can be entered in the Relay.

The user enters only over current fold for instant opening. When peak point of over current sinus curve reaches this value entered, Relay opens the circuit without waiting. Normally, systems draw high current at first due to a few reasons. For example, first start of transformers, drive of motors, enablement of capacitors, capacitive effects of long aerial lines etc.

Due to these reasons, a delay in current delay may be required in cases where system is driven. A fixed delay can be entered in long time, delayed instant opening and instant opening functions depending on characteristics of these initial currents or they can temporarily be adjusted to a higher set value. When system starts up, these values are cancelled and nominal operating curves are enabled.

The device gives an alarm as pre-warning when the current passing through the line reaches 90% of the nominal load and continues for 15 minutes.

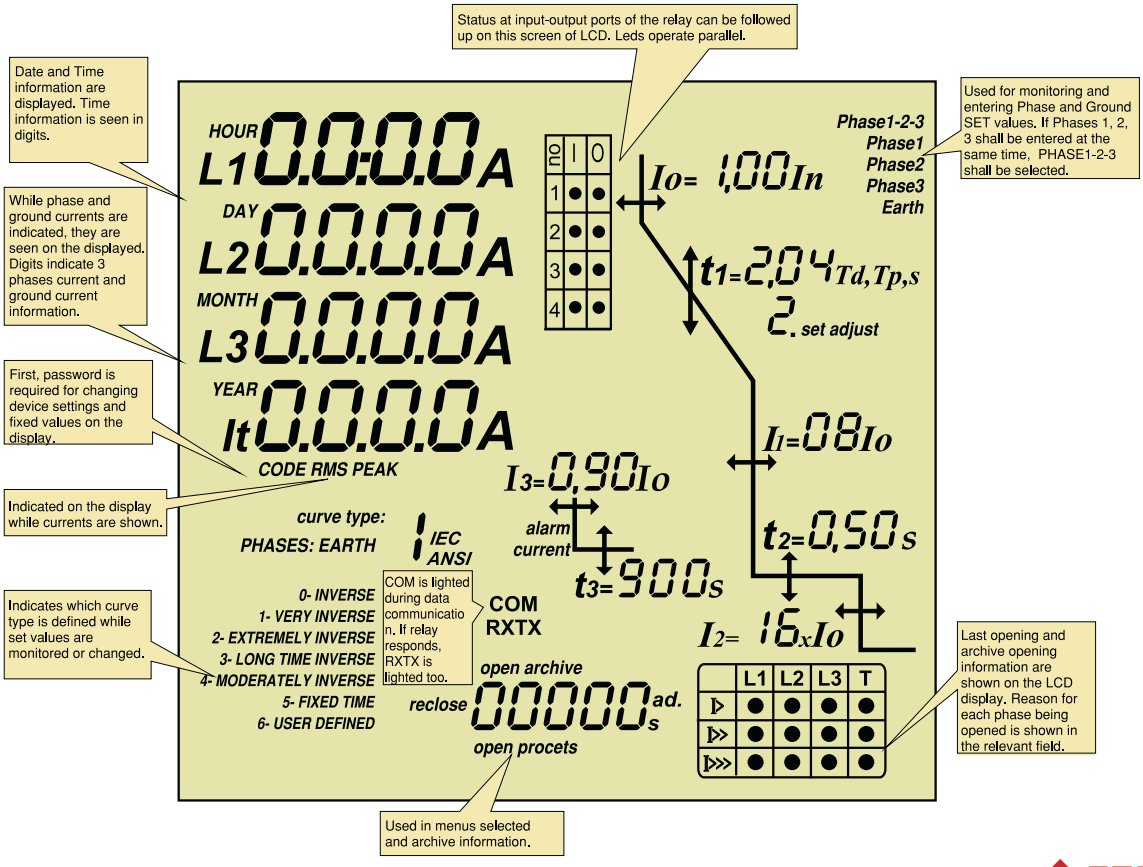
Opening and alarm operations are kept in the memory by the Relay. Failure time, duration, phase (or ground) and type of failure are kept in detail in this memory, which records the last 20 failures. Opening duration in milliseconds is recorded in instant openings. The relay complies these data according to first in first out principle and provides them to the user in a sequence from last failure to first failure. Closing can be made again by seeing failure type and pattern.

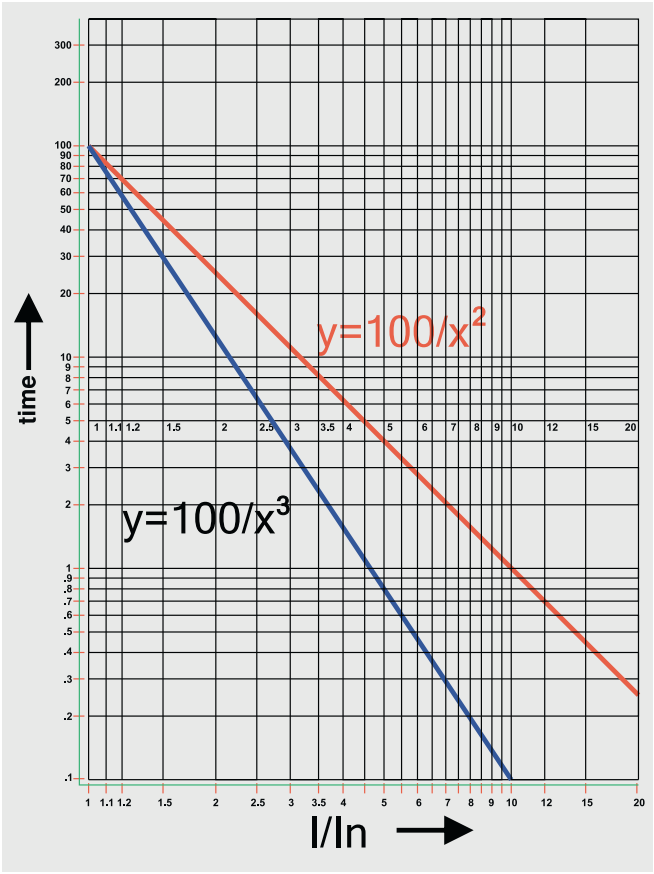
In normal conditions, cooling curves adjusted to opening curve should be used in protection function of devices such as motor etc. Because, opening duration should be shortened by considering previous stress in possible consecutive over current stresses. Otherwise, as opening duration shall always be reset in pulse operation, the protected device may be damaged. In addition, immediate reset may be required during over current in receivers such as aerial lines. Because, it is easy to cool down aerial lines and many receivers may remain without electricity in case of opening. Therefore, cooling function may be left active or passive.

RS232 and GPRS connections are available through the serial port on front face and RS232, RS485 and GPRS connection is available through connectors on back face.

LCD display is designed with 10x10 cm sizes in a way to indicate 4 current sizes simultaneously, in addition to symbols, and all the fixed coefficients saved for a phase or ground.

All the fixed phase coefficients can be seen on the display by pressing buttons. Date-Time information, input-output statuses, details of archive information, PC communication can be monitored on the display. Standard and curve selection can be made easily.

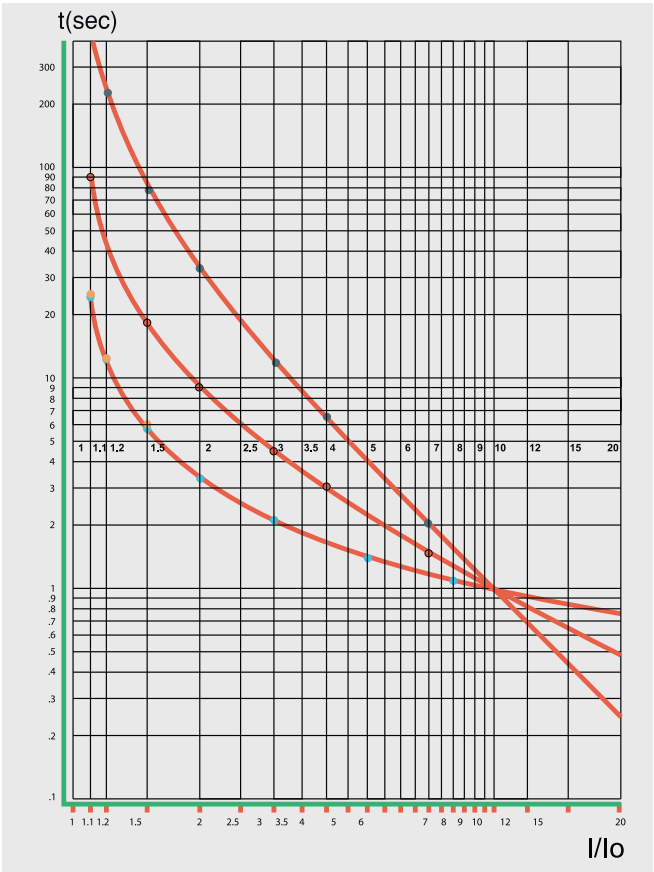


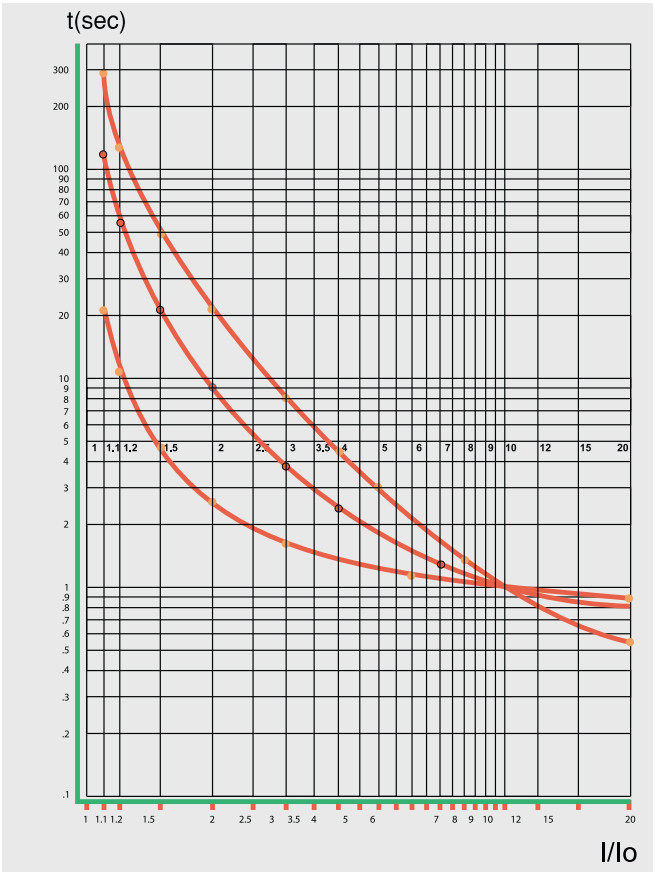


As it is known, energy in electrical systems is found with square of current. In high short circuit currents, revealing energy is directly proportional to square of current and time. When it is considered in this view, a protection mechanism is needed to check how much the short circuit is higher than the nominal current and to determine opening duration at square of the result. In a logarithmical axis, if we take a fixed coefficient like 100 and draw the graphic $y=100/x^2$, we obtain a totally linear graphic.

$y=100/x^3$ curve gives a more curved line. As a result, exponential functions show linearity in logarithmical curve. Starting from this point, it is more appropriate to show opening curves in logarithmical axes.

However, although revealing energy is in direct proportion to square of current, as a result of systems not remaining without energy in case of short-term or instant failures or insulation, burning etc. tests of devices such as transformer, motor etc., various curves are obtained and accepted by adding coefficients to increase short durations and decrease long durations when compared to current fold. When these curves are selected, their tolerance to heating and resistance to energy failures of the system should be taken into consideration. Whereas the system is opened in case of a small current increase; long-term openings should be selected in some cases to avoid energy failure.





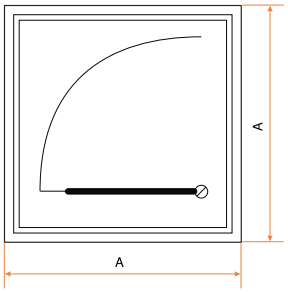
Curve type	A	B	K	a	T
IEC A REVERSE	0,140	0,000	0,337	0,020	1,000
IEC B VERY REVERSE	13,500	0,000	0,667	1,000	1,000
IEC C MEDIUM REVERSE	80,000	0,000	1,238	2,000	1,000
IEC LONG TERM REVERSE	120,000	0,000	0,075	1,000	1,000
IEC MEDIUM REVERSE	0,010	0,000	4,700	0,020	1,000
FIXED TIME		t2			
Used defined default values	0,050	0,000	1,929	0,040	1,000
ANSI REVERSE	5,950	0,180	4,165	2,000	1,000
ANSI VERY REVERSE	3,880	0,096	7,381	2,000	1,000
ANSI EXCESSIVE REVERSE	5,670	0,035	10,814	2,000	1,000
ANSI LONG TERM REVERSE	5,614	2,186	0,357	1,000	1,000
ANSI MEDIUM REVERSE	0,010	0,023	4,111	0,020	1,000
FIXED TIME		t2			
Used defined default values	0,003	0,003	13,300	0,020	1,000

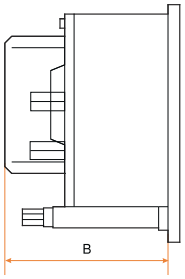
The curve formulation has been described below. B Is zero In IEC curves and ANSI has acquired various values. K multiplier provides curves coinciding with each other as 1 second opening of all curves at 10-times over current. In this way, it is possible to compare curves in long-term openings more easily. In relay, these formulas can be selected with or without adding this multiplier. Td is a multiplier having linear impact on Relay's opening duration and adjusts delay duration by getting the curve (without corrupting it) upwards and downwards in time axis.

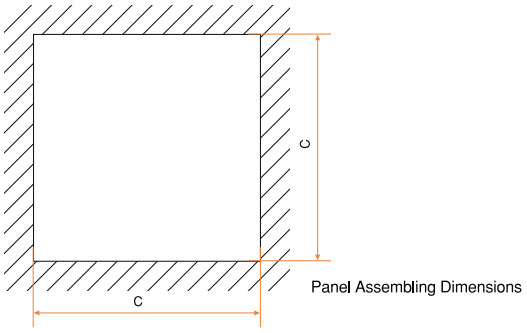
$$t=\left[\frac{A}{(I/Is)^{\alpha}-1}+B\right]\times K\times Td$$

I/Is	IEC A REVERSE	IEC B VERY REVERSE	IEC C MEDIUM REVERSE	IEC LONG TERM REVERSE	IEC MEDIUM REVERSE	FIXED TIME	IEC K.T.	ANSI REVERSE	ANSI VERY REVERSE	ANSI EXCESSIVE REVERSE	ANSI LONG TERM REVERSE	ANSI MEDIUM REVERSE	FIXED TIME	ANSI K.T.
1,10	24,70	90,00	471,43	90,00	25,62		25,26	118,76	137,07	292,36	20,81	22,50		23,87
1,20	12,90	45,00	225,00	45,00	13,38		13,18	57,07	65,79	139,73	10,79	11,80		12,49
1,30	8,96	30,00	143,48	30,00	9,29		9,14	36,66	42,21	89,24	7,46	8,22		8,68
1,40	6,98	22,50	103,13	22,50	7,24		7,12	26,56	30,54	64,25	5,79	6,42		6,77
1,50	5,79	18,00	79,20	18,00	6,00		5,90	20,57	23,62	49,43	4,79	5,34		5,62
1,60	4,99	15,00	63,46	15,00	5,18		5,08	16,64	19,07	39,69	4,12	4,62		4,85
1,70	4,42	12,86	52,38	12,86	4,58	t	4,50	13,86	15,86	32,82	3,64	4,10	t	4,30
1,80	3,99	11,25	44,20	11,25	4,13	1	4,06	11,81	13,49	27,75	3,28	3,71	1	3,88
1,90	3,65	10,00	37,93	10,00	3,78		3,71	10,24	11,68	23,87	3,00	3,40		3,56
2,00	3,38	9,00	33,00	9,00	3,50		3,43	9,01	10,26	20,82	2,78	3,16		3,29
3,00	2,12	4,50	12,38	4,50	2,20		2,15	3,85	4,29	8,05	1,78	2,02		2,08
4,00	1,68	3,00	6,60	3,00	1,74		1,69	2,40	2,62	4,47	1,45	1,61		1,65
5,00	1,44	2,25	4,13	2,25	1,49		1,45	1,78	1,90	2,94	1,28	1,40		1,43
6,00	1,29	1,80	2,83	1,80	1,34		1,30	1,46	1,53	2,13	1,18	1,26		1,28
7,00	1,19	1,50	2,06	1,50	1,23		1,19	1,27	1,31	1,66	1,11	1,17		1,18
8,00	1,11	1,29	1,57	1,29	1,15		1,11	1,14	1,17	1,35	1,07	1,10		1,11
9,00	1,05	1,13	1,24	1,13	1,09		1,05	1,06	1,07	1,15	1,03	1,04		1,05
10,00	1,00	1,00	1,00	1,00	1,04		1,00	1,00	1,00	1,00	1,00	1,00		1,00
20,00	0,76	0,47	0,25	0,47	0,79		0,76	0,81	0,78	0,53	0,89	0,79		0,77
30,00	0,67	0,31	0,11	0,31	0,69		0,66	0,78	0,74	0,45	0,85	0,70		0,68

FA72 / FA96 / FMA72 / FMA96 / FV72 / FV96 / FF72 / FF96

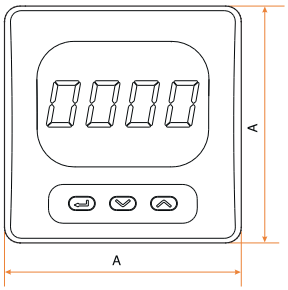


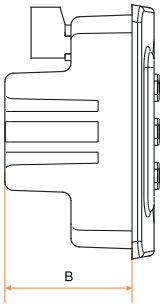


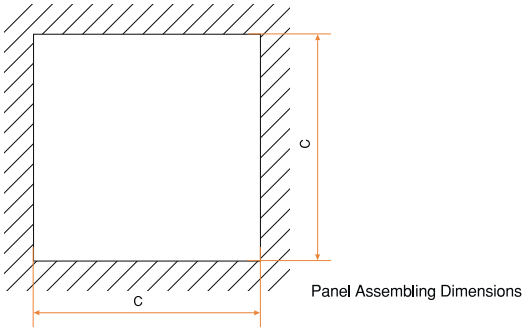


Dimensions (mm)	A	B	C
72 x 72	72	60	67
96 x 96	96	60	91

FYA72 / FYA96 / FYV72 / FYV96

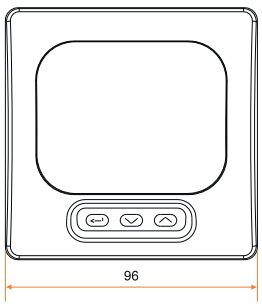


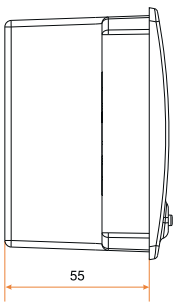


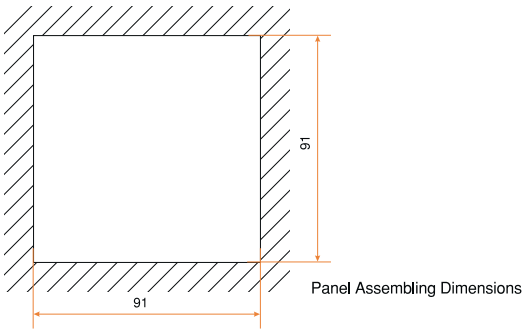


Dimensions (mm)	A	B	C
72 x 72	72	55	67
96 x 96	96	55	91

FPA50 / FPA80R / FMM50







FPA100 / FPA120 / FPA280R