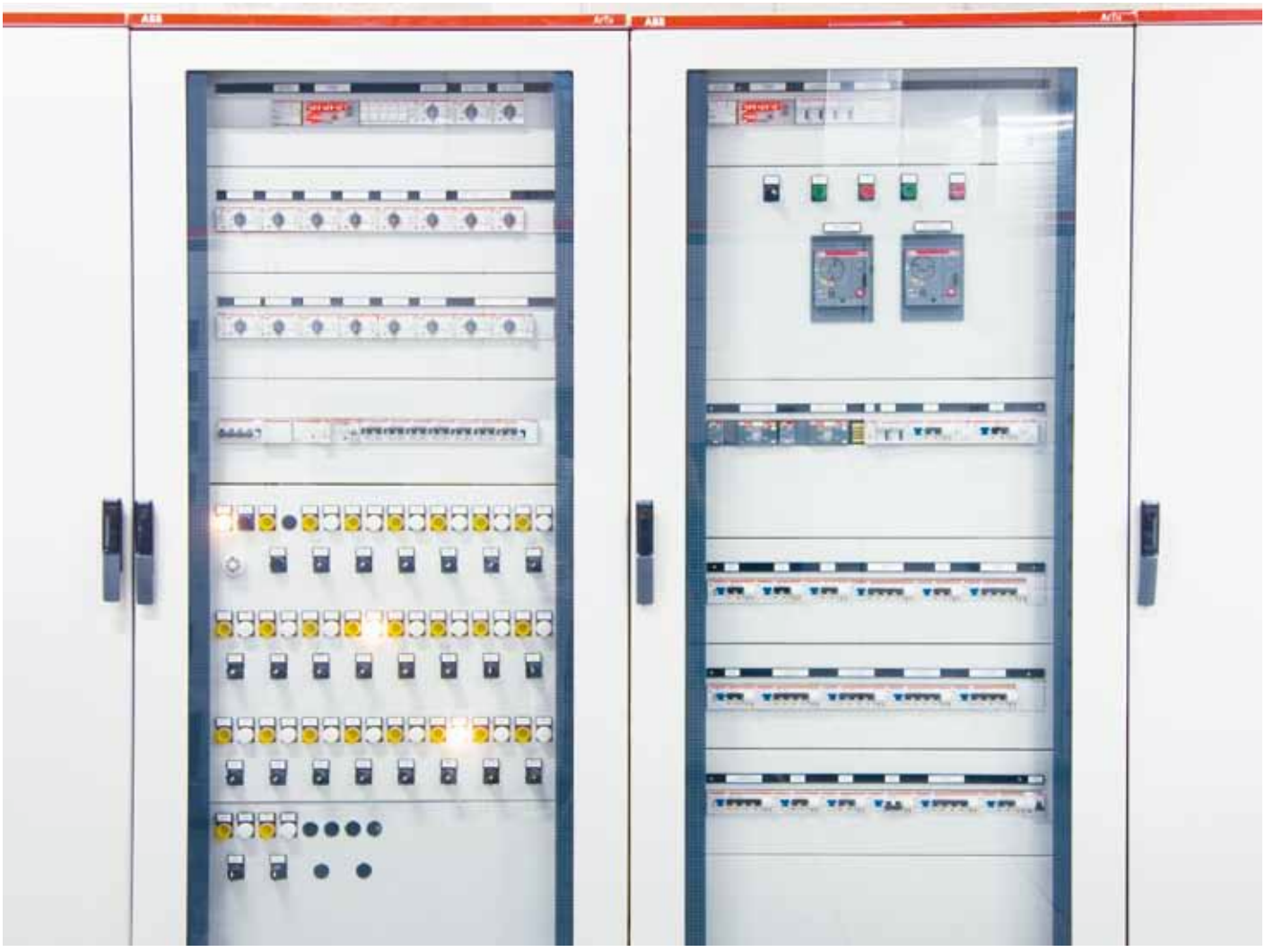
Multimeters and network analyzers
Fully monitored installations

Power and productivity
for a better world™

The advantages of measuring, why measure?

In the present day market, reducing the cost of electricity and ensuring continuity of service are becoming increasingly more important issues.

In-depth knowledge of the way the electrical system works is therefore essential. Only in this way can all the factors, i.e. consumption, load curves, harmonic disturbance, voltage interference and so forth, be optimized so as to make the installations more efficient, more competitive and to reduce emissions that are liable to harm the environment.
Lastly, when it comes to installation management, fault prevention can be improved and maintenance work planned by measuring and monitoring the electrical quantities since, this allows problems to be identified in advance. So much so, that not only are the installations protected to a greater degree, but so are all the other devices and structures to which they are connected.



When should a measuring instrument be used?
Always!

An efficient system able to measure and monitor the electrical quantities can be successfully used in all situations that require
- Lower energy costs
- A good quality electric network
- Uninterrupted service

Lower energy costs
- Electricity submetering and cost distribution
- Load trend monitoring
- Peak management
- Power factor improvement

A good quality electric network
- Harmonic analysis
- Detection of overvoltage, variations and loss of voltage

Uninterrupted service
- Installation monitoring in real time
- Remote monitoring via serial link
- Load management by means of alarm thresholds
- Preventive maintenance and repairs for the equipment connected

DIN rail multimeters
DMTME

DMTME
DIN rail multimeters are ideal for installation in secondary distribution switchboards

Main features
- Measurement of the main electrical parameters
- Active, reactive and apparent energy metering
- Auxiliary power supply
- RS485 serial port
- Modbus RTU protocol
- Two digital outputs programmable as alarms or impulses
- Indirect insertion via current transformer with 5 A secondary in 3P, 3P+N and 1P systems

The instrument directly and indirectly measures the current and voltage values of each individual phase, the frequency, cosφ the displacement between the phases and the power factor of the three-phase system by means of measuring transformers. The internal electronics calculate all the other, subsequent parameters, such as the power and energy values.

The multimeters are the type equipped with LEDs display, the individual phase parameters are shown on 4 displays with red LEDs. The first three displays show the individual phase parameters, while the fourth display shows the values of the three-phase system. The parameters can be scrolled with the arrow buttons which, once the relative measurement numbers appear on the display, turn the LEDs underneath so as to find the unit of measurement that allows the user to understand which parameter is being displayed. As shown in the figure below.

The energy values are shown by using all three displays as though they were a single one: by reading the numbers that appear, one after the other, the user will obtain the energy count per phase and of the total three-phase system.

Network voltages

V_{12} = 400
V_{23} = 403
V_{31} = 398

Frequency of the three-phase system

50 Hz

Active energy of phase L1

780654321 kWh

Front panel multimeters
DMTME-72 and DMTME-96

DMTME-96

Able to fully display and monitor the electrical parameters of a low voltage single/three-phase system.

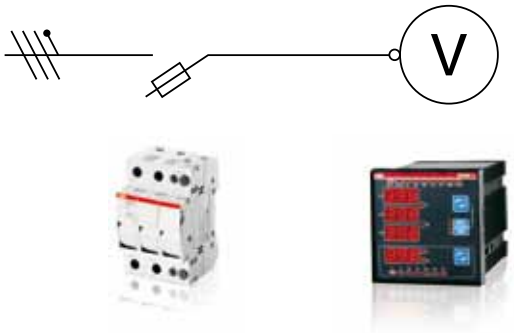
DMTME-72

Thanks to its compact size, this version is ideal for use in MCC Motor Control Centers, where it monitors all the electrical parameters of each motor start-up.

Measuring instruments must always be protected. Most especially, the auxiliary power supply line and the voltage measuring inputs must be protected with fuses and fuse holders.

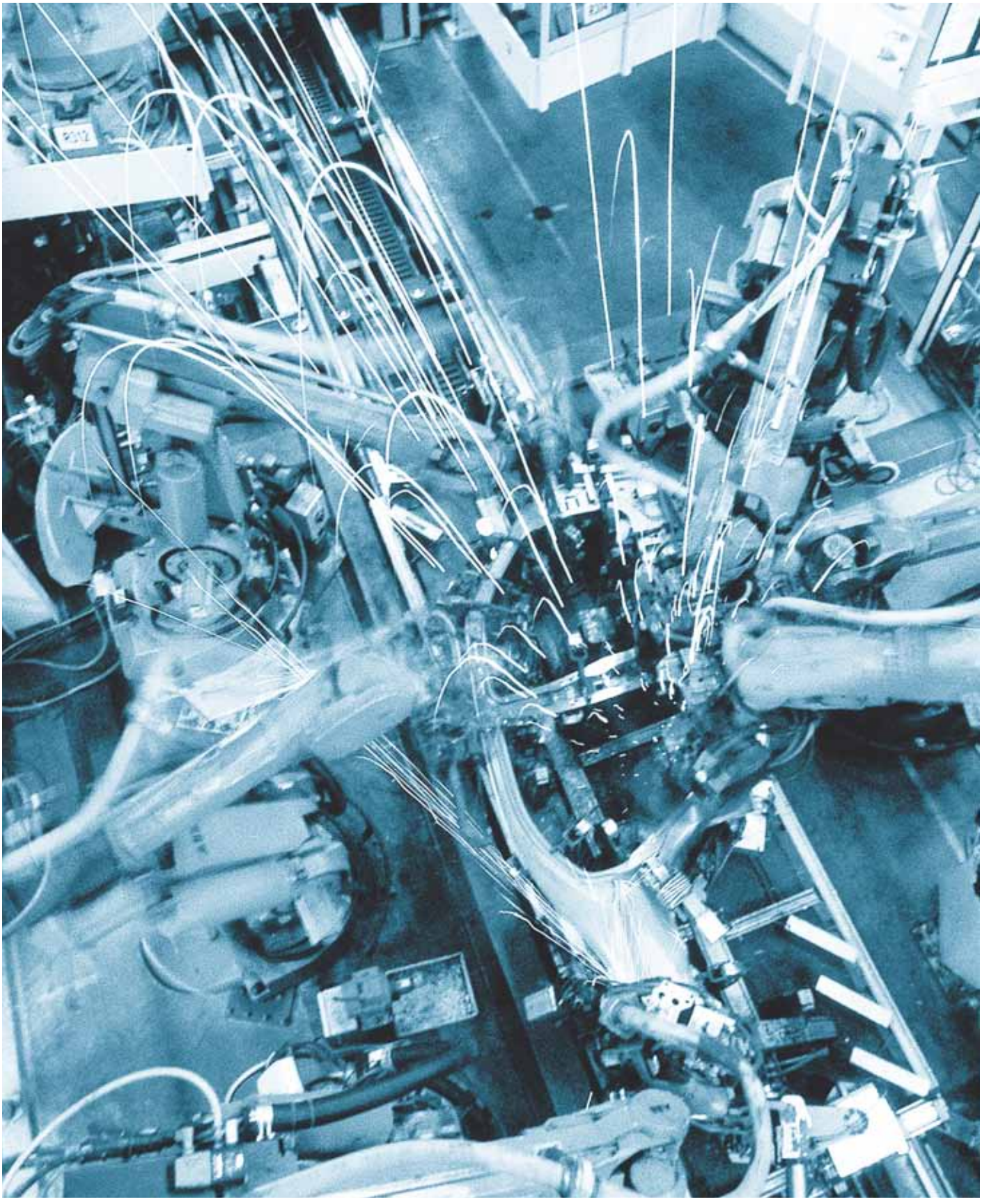
Main features

- Measurement of the main electrical parameters
- Active, reactive and apparent energy metering
- Auxiliary power supply
- RS485 serial port
- Modbus RTU protocol
- Two digital outputs programmable as alarms or impulses
- Indirect insertion via current transformer with 5 A secondary in 3P, 3P+N and 1P systems
- Pull-out terminal bars for easy installation



Protection of the multimeter's voltage inputs:
1 A fuse and E 93hN/32 fuse holder

Network analyzers
ANR



Complete and absolute monitoring of the installation

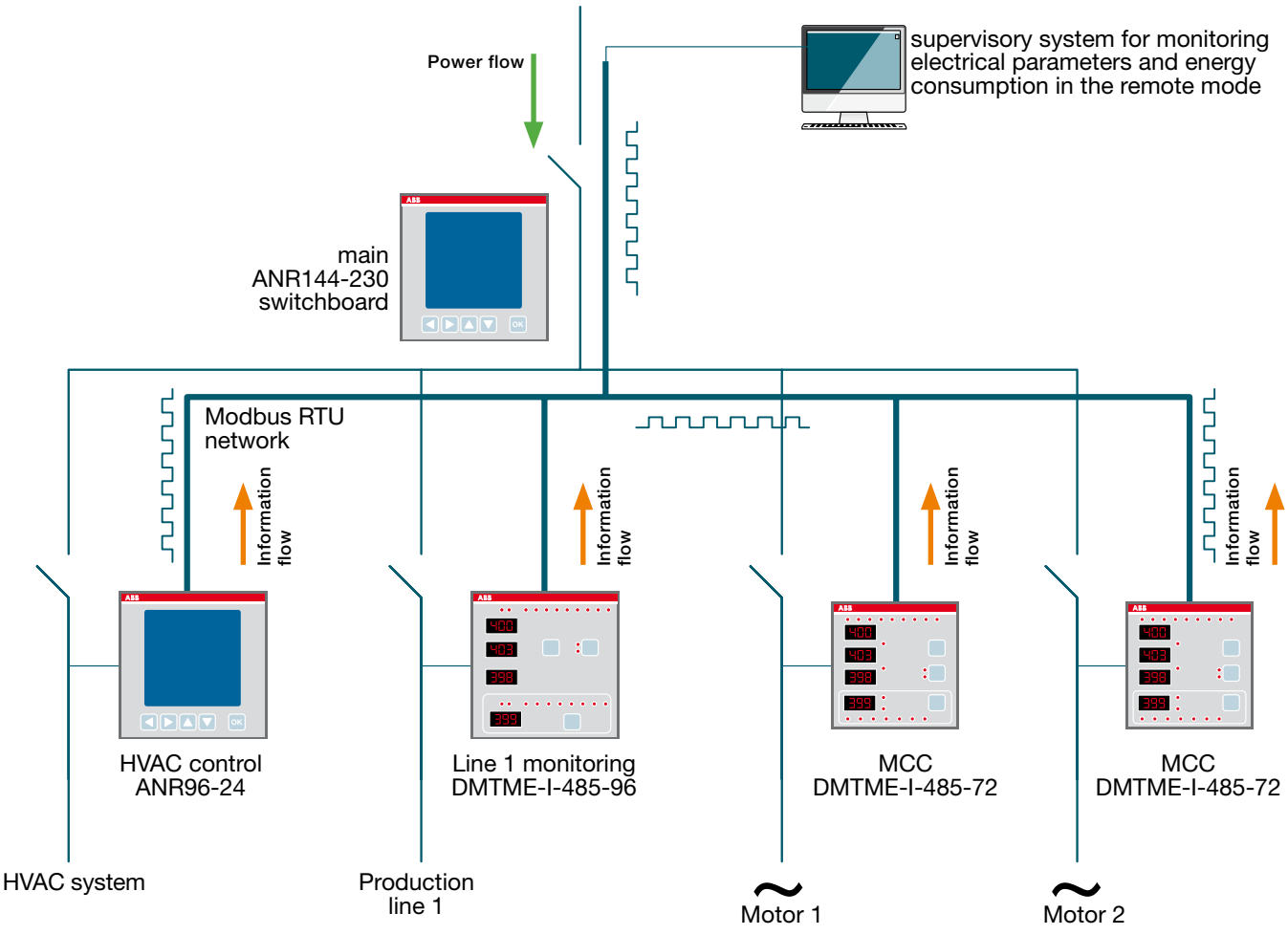
- ANR meters the **energy values in 4 quadrants**. It can monitor the energy consumption, the energy produced and the difference between the energy produced and consumed, in cogeneration or photovoltaic systems for instance.
- ANR keeps an account of the energy consumption according to **timebands** that can be selected by the user, allowing him to double-check with the bill at the end of the month.
- ANR reads and displays the energy values measured in other energy meters connected to the network. This is achieved thanks to **digital inputs**, which are able to acquire the impulses generated by the meters in the installation. In this case, ANR acts as a data concentrator. It not only collects information from the electricity meters but also from the water and gas meters, after which all the data can be transmitted to the remote monitoring system.
- Moreover, ANR allows a complete, in-depth analysis of the quality of the network to be made thanks to measurement of the **harmonic distortion rate** of the voltage and current signals measured through to the 31st harmonic. **Display of the wave form for both voltage and current** allows signal deviations from the ideal situation to be observed in real time, without interference, and highlights any signal interference.
- ANR **analyzes** voltage variations, power outage, micro-perturbations and voltage drops over time.
- Thanks to the function that **manages loads and disconnects them** if the preset network power consumption threshold is exceeded, energy consumption can be optimized so as to save on costs.
- ANR can also monitor the quantities in the analogue mode thanks to **analogue outputs** with settings that can be completely entered by the user.

Moreover ANR96 provides an even superior performance and allows other protocols such as **Ethernet** and **Profibus** to be used besides the standard Modbus available on all models. ANR144 can be expanded with the accessory boards.
The analogue and digital outputs can be fully programmed so as to completely monitor the installation.

Serial communication

A low voltage electrical installation is rather like an industrial process for distributing electricity and as such, needs a supervisory monitoring system able to make it more reliable and optimize the way it is managed.

It's the supervisory system that handles the flow of information transiting through the communication network. The monitoring level is formed by the SCADA (Supervisory Control and Data Acquisition) system. In simpler applications, this level comprises a computer containing the data acquisition, monitoring or supervisory software of the system.
The field level includes field devices equipped with communication interface (measuring instruments, sensors, actuators and protection circuit-breakers complete with electronic releases) installed in the electrical system, that interact directly with this latter and allow the monitoring level to communicate with it.
The standard communication language in industrial environments is Modbus RTU, which is both reliable and easy to program. Modbus is a standard protocol, thus any product linked to the network via serial port able to support that protocol can be integrated and can communicate with other products.



Choice of the right product for your specific needs

	DIN rail and front panel multimeters			Front panel network analyzers	
					
	DMTME	**DMTME-72**	**DMTME-96**	**ANR96**	**ANR144**
Overall dimensions	6 DIN rail modules	72x72x90	96x96x103	96x96x130	144x144x66
Display	LEDs			Backlighted graphic LCD	
Auxiliary power supply	110 V a.c. - 230 V a.c.	230 V a.c. - 400 V a.c.	110 V a.c. - 230 V a.c.	20-60 V a.c./d.c.	85-265 V a.c./d.c.
Phase and three-phase voltage TRMS Phase and three-phase current TRMS Frequency Phase and three-phase power factor Phase and three-phase cosφ Phase and three-phase active power Phase and three-phase reactive power Phase and three-phase apparent power Phase and three-phase active energy Phase and three-phase reactive energy Phase and three-phase total energy Min/max/mean peak values Count up and count down hour counter	**Measurement of the electrical parameters**				
Energy metering by timebands Maximum demand Harmonic analysis up to 31st order Wave form display 1 MB data store				**Energy management**	
Outputs	**Digital**				**Digital and analogue**
Inputs				**Digital**	
Serial port	**RS485**			**RS485, RS232 and RJ45**	
Protocols available	**Modbus RTU**			**Modbus RTU Ethernet TCP/IP Profibus DP**	

Technical specifications

	DMTME, DMTME-96, DMTME-72		ANR	
Technical data	**DMTME DMTME-96 DMTME-72**	**DMTME-I-485 DMTME-I-485-96 DMTME-I-485-72**	**ANR96-230, ANR96-230 02 ANR96PRF-230 ANR96LAN-230**	**ANR96-24, ANR96-24 02 ANR96PRF-24 ANR96LAN-24**
Dimensions [mm]	6 modules; 72 x 72 x 90; 96 x 96 x 103	6 modules; 72 x 72 x 90; 96 x 96 x 103	96 x 96 x 130	96 x 96 x 130
Weight	350 [g]	350 [g]	430 [g]	430 [g]
Power supply	110 V a.c. 230 V a.c.	110 V a.c. 230 V a.c.	85÷265 V a.c./d.c.	20÷60 V a.c./d.c.
Power supply frequency	from 45 Hz to 65 Hz	from 45 Hz to 65 Hz	from 30 Hz to 500 Hz	from 30 Hz to 500 Hz
Power consumption	< 6 VA	< 6 VA	5 VA	5 VA
Internal data store	EEprom	EEprom	128 kb	128 kb
Measuring range				
TRMS current	external CT …/5A	external CT …/5A	CT …/5A	CT …/5A
TRMS voltage	direct up to 500 V P-N external VT …/100 V	direct up to 500 V P-N external VT …/100 V	660 V phase/phase KVT programmable	660 V phase/phase KVT programmable
Frequency	from 40 Hz to 500 Hz	from 40 Hz to 500 Hz	from 30 Hz to 500 Hz	from 30 Hz to 500 Hz
THD V and I (Total Harmonic Distortion)	-	-	up to the 31st harmonic	up to the 31st harmonic
CT transformer ratio (I n / I sec)	1…1250	1…1250	0.01 to 5000.00	0.01 to 5000.00
VT transformer ratio (V n / V sec)	1…500	1…500	0.01 to 5000.00	0.01 to 5000.00
Measurable maximum current	6250 A	6250 A	25000 A	25000 A
Measurable maximum voltage	50000 V	50000 V	500000 V	500000 V
Communication				
Digital outputs programmable as alarms or impulses	-	2	2	2
Vmax on contact	-	48 V (d.c. or a.c. of max)	230 V a.c./d.c	230 V a.c./d.c
Imax on contact	-	100 mA (d.c. or a.c. of max)	150 mA	150 mA
Impulse programming constant	-	10, 100, 1000, 10000 Wh/ imp (Varh/imp)	programmable	programmable
Analogue outputs	-	-	-	-
Digital inputs	-	-	2	2
Voltage	-	-	from 12 to 24 V d.c.	from 12 to 24 V d.c.
Serial port	-	RS485	RS485, RS232	RS485, RS232
Protocols	-	Modbus RTU ASCII	Modbus RTU Profibus DP ANR96PRF-230 Modbus TCP/IP ANR96LAN-230	Modbus RTU Profibus DP ANR96PRF-24 Modbus TCP/IP ANR96LAN-24
Max Baud rate	-	2.4, 4.8, 9.6, 19.2 bps	1.2, 2.4, 4.8, 9.6, 19.2 bps	1.2, 2.4, 4.8, 9.6, 19.2 bps
User interface				
Display	LEDs	LEDs	Backlighted graphic LCD	Backlighted graphic LCD
Wave form display for V and I of each phase	-	-	yes	yes
Accuracy rating				
Accuracy rating for V	±0.5% ±1 digit	±0.5% ±1 digit	±0.5% ±1 digit [1]	±0.5% ±1 digit [2]
Accuracy rating for I	±0.5% ±1 digit	±0.5% ±1 digit	±0.5% ±1 digit [2]	±0.5% ±1 digit [1]
Accuracy rating Power	±1% ±0.1% f.s. from cosφ=0.3 to cosφ=-0.3	±1% ±0.1% f.s. from cosφ=0.3 to cosφ=-0.3	±0.5% ±0.1% f.s. from cosφ=0.3 to cosφ=-0.3	±0.5% ±0.1% f.s. from cosφ=0.3 to cosφ=-0.3
Accuracy rating for active energy	Class 1	Class 1	Class 1 [3]	Class 1 [4]
Accuracy rating for reactive energy	Class 2	Class 2	Class 2	Class 2
Frequency	±0.2% ±0.1Hz from 40 to 99.9Hz ±0.2% ±0.1Hz from 100 to 500 Hz	±0.2% ±0.1Hz from 40 to 99.9Hz ±0.2% ±0.1Hz from 100 to 500 Hz	±0.2% ±0.1 Hz from 30 to 500 Hz	±0.2% ±0.1 Hz from 30 to 500 Hz
Operating conditions				
Operating temperature	from 0 °C to 50 °C	from 0 °C to 50 °C	from -10 °C to 50 °C	from -10 °C to 50 °C
Storage temperature	from -10 °C to 60 °C	from -10 °C to 60 °C	from -15 °C to 70 °C	from -15 °C to 70 °C
Reference standards	EN61010-1; IEC 60688; IEC 62053-23	EN61010-1; IEC 60688; IEC 62053-23	EN61010-1; IEC 60688; IEC 62053-23	EN61010-1; IEC 60688; IEC 62053-23

[1] 0.2% only for ANR96-230 02; [2] 0.2% only for ANR96-24 02; [3] class 0,5 only for ANR96-230 02; [4] class 0,5 only for ANR96-24 02

ANR			
ANR96P-230	**ANR96P-24**	**ANR144-230**	**ANR144-24**
96 x 96 x 130	96 x 96 x 130	144 x 144 x 66	144 x 144 x 66
430 [g]	430 [g]	430 [g]	430 [g]
85÷260 V a.c./d.c.	20÷60 V a.c./d.c.	85÷260 V a.c./d.c.	24÷60 V a.c./d.c.
from 30 Hz to 500 Hz	from 30 Hz to 500 Hz	from 30 Hz to 500 Hz	from 30 Hz to 500 Hz
5 VA	5 VA	5 VA	5 VA
1 Mb	1 Mb	1 Mb optional	1 Mb optional
CT …/5A	CT …/5A	CT …/5A	CT …/5A
660 V phase/phase KVT programmable	660 V phase/phase KVT programmable	660 V phase/phase KVT programmable	660 V phase/phase KVT programmable
from 30 Hz to 500 Hz	from 30 Hz to 500 Hz	from 30 Hz to 500 Hz	from 30 Hz to 500 Hz
up to the 31st harmonic	up to the 31st harmonic	up to the 31st harmonic	up to the 31st harmonic
0.01 to 5000.00	0.01 to 5000.00	0.01 to 5000.00	0.01 to 5000.00
0.01 to 5000.00	0.01 to 5000.00	0.01 to 5000.00	0.01 to 5000.00
25000 A	25000 A	25000 A	25000 A
500000 V	500000 V	500000 V	500000 V
2	2	2	2
230 V a.c./d.c	230 V a.c./d.c	230 V a.c./d.c	230 V a.c./d.c
150 mA	150 mA	150 mA	150 mA
programmable	programmable	programmable	programmable
-	-	up to 4 with additional board	up to 4 with additional board
4	4	2; 4 optional	2; 4 optional
from 12 to 24 V d.c.	from 12 to 24 V d.c.	from 12 to 24 V d.c.	from 12 to 24 V d.c.
RS485, RS232	RS485, RS232	RS485, RS232	RS485, RS232
Modbus RTU ASCII	Modbus RTU ASCII	Modbus - ASCII Profibus-DP optional Ethernet TCP/IP optional	Modbus - ASCII Profibus-DP optional Ethernet TCP/IP optional
1.2, 2.4, 4.8, 9.6, 19.2 bps	1.2, 2.4, 4.8, 9.6, 19.2 bps	1.2, 2.4, 4.8, 9.6, 19.2 bps	1.2, 2.4, 4.8, 9.6, 19.2 bps
Backlighted graphic LCD	Backlighted graphic LCD	Backlighted graphic LCD	Backlighted graphic LCD
yes	yes	yes	yes
±0.5% f.s. ±1 digit	±0.5% f.s. ±1 digit	±0.5% f.s. ±1 digit	±0.5% f.s. ±1 digit
±0.5% f.s. ±1 digit	±0.5% f.s. ±1 digit	±0.5% f.s. ±1 digit	±0.5% f.s. ±1 digit
±0.5% ±0.1% f.s. from cosφ=0.3 a cosφ=-0.3	±0.5% ±0.1% f.s. from cosφ=0,3 a cosφ=-0.3	±0.5% ±0,1% f.s. from cosφ=0.3 a cosφ=-0.3	±0.5% ±0.1% f.s. from cosφ=0.3 a cosφ=-0.3
Class 1	Class 1	Class 1	Class 1
Class 2	Class 2	Class 2	Class 2
±0.2% ±0.1 Hz from 30 to 500 Hz	±0.2% ±0.1 Hz from 30 to 500 Hz	±0.2% ±0.1 Hz from 30 to 500 Hz	±0.2% ±0.1 Hz from 30 to 500 Hz
from -10 °C to 50 °C	from -10 °C to 50 °C	from -10 °C to 50 °C	from -10 °C to 50 °C
from -15 °C to 70 °C	from -15 °C to 70 °C	from -15 °C to 70 °C	from -15 °C to 70 °C
EN61010-1; IEC 60688; IEC 62053-23	EN61010-1; IEC 60688; IEC 62053-23	EN61010-1; IEC 60688; IEC 62053-23	EN61010-1; IEC 60688; IEC 62053-23

Order codes

Description			Type code	Order code	Bbn 8012542 EAN
Auxiliary power supply	Serial port and protocol	Digital inputs and outputs			
DMTME DIN rail multimeters					
110 V a.c -230 V a.c.			**DMTME**	2CSM170040R1021	**975700**
110 V a.c -230 V a.c.	RS485 Modbus RTU	2 digital outputs	**DMTME-I-485**	2CSM180050R1021	**975809**
DMTME-96 and DMTME-72 front panel multimeters					
110 V a.c -230 V a.c.			**DMTME-96**	2CSG133030R4022	**046752**
110 V a.c -230 V a.c.	RS485 Modbus RTU	2 digital outputs	**DMTME-I-485-96**	2CSG163030R4022	**046851**
400 V a.c -230 V a.c.			**DMTME-72**	2CSG132030R4022	**046554**
400 V a.c -230 V a.c.	RS485 Modbus RTU	2 digital outputs	**DMTME-I-485-72**	2CSG162030R4022	**046653**
ANR network analyzers					
24 V a.c./d.c. power supply	RS485 RS232 Modbus RTU	2 digital outputs	**ANR96-24**	2CSG113000R4051	**943402**
230 V a.c./d.c. power supply	RS485 RS232 Modbus RTU	2 digital outputs	**ANR96-230**	2CSG213000R4051	**943501**
24 V a.c./d.c. power supply 1 Mb data store	RS485 RS232 Modbus RTU	2 digital outputs 4 digital inputs	**ANR96P-24**	2CSG123000R4051	**943600**
230 V a.c./d.c. power supply 1 Mb data store	RS485 RS232 Modbus RTU	2 digital outputs 4 digital inputs	**ANR96P-230**	2CSG223000R4051	**943709**
24 V a.c./d.c. power supply	RS485 Profibus DP	2 digital outputs	**ANR96PRF-24**	2CSG258333R4051	**583332**
230 V a.c./d.c. power supply	RS485 Profibus DP	2 digital outputs	**ANR96PRF-230**	2CSG257153R4051	**571537**
24 V a.c./d.c. power supply	RJ45 Modbus TCP/IP	2 digital outputs	**ANR96LAN-24**	2CSG277253R4051	**772538**
230 V a.c./d.c. power supply	RJ45 Modbus TCP/IP	2 digital outputs	**ANR96LAN-230**	2CSG277033R4051	**770336**
24 V a.c./d.c. power supply Accuracy class V and I 0,2	RS485 RS232 Modbus RTU	2 digital outputs	**ANR96-24 02**	2CSG257383R4051	**573838**
230 V a.c./d.c. power supply Accuracy class V and I 0,2	RS485 RS232 Modbus RTU	2 digital outputs	**ANR96-230 02**	2CSG256203R4051	**562030**
ANR144 expandable with additional boards					
24 V a.c./d.c. power supply Expandable	RS485 RS232 Modbus RTU	2 digital outputs 2 digital inputs	**ANR144-24**	2CSG114000R4051	**943808**
230 V a.c./d.c. power supply Expandable	RS485 RS232 Modbus RTU	2 digital outputs 2 digital inputs	**ANR144-230**	2CSG214000R4051	**943907**
Additional boards for ANR144 versions					
Memory expansion up to 1 Mb			**ANR-1 MB**	2CSG000010R4051	**944003**
Board with 6 digital inputs			**ANR-6I**	2CSG000020R4051	**944102**
Board with 4 digital outputs			**ANR-4O**	2CSG000030R4051	**944201**
Board with 2 digital inputs and 2 digital outputs			**ANR-2I2O**	2CSG000040R4051	**944300**
Board with 2 analogue outputs			**ANR-2AN**	2CSG000050R4051	**944409**
Board with 4 analogue outputs			**ANR-4AN**	2CSG000060R4051	**944508**
RS485 second serial port board			**ANR-CM2**	2CSG000070R4051	**944607**
Profibus DP serial port board			**ANR-PRF**	2CSG000080R4051	**944706**
TCP/IP ethernet port board			**ANR-LAN**	2CSG000090R4051	**944805**
Multimeters and Network analysers accessories					
Serial converter and repeater RS485/232 for Modbus RTU		6 DIN modules	**CUS**	2CSM200000R1031	**333807**
Serial converter 485 TCP/IP, from Modbus RTU to Modbus TCP/IP		3 DIN modules	**CUS 485 TCP/IP**	2CSG258563R4051	**585633**

Complete measuring system
Current and voltage transformers

	Circuit-breakers available						
Modular types	S200, S280, S290, S700, S800						
Tmax	T1, T2, T3, T4	T5	T6, T7		T6, T7		
Emax			E1, E2	E1, E2	E1	E2, E3, E4, E5, E6	E2,E3,E4

	Rated current choice							
[A]	CT3	CT4	CT6	CT8	CT8-V	CT12	CT12-CTV	Class
40	2CSG121060R1101							3
50	2CSG121070R1101							3
60	2CSG121080R1101							3
80	2CSG121090R1101							3
100	2CSG121100R1101	2CSG221100R1101						1
150	2CSG121110R1101	2CSG221110R1101						0,5
200	2CSG121120R1101	2CSG221120R1101						0,5
250	2CSG121130R1101	2CSG221130R1101	2CSG421130R1101					0,5
300	2CSG121140R1101	2CSG221140R1101	2CSG421140R1101	2CSG521140R1101				0,5
400		2CSG221150R1101	2CSG421150R1101	2CSG521150R1101	2CSG631150R1101			0,5
500		2CSG221160R1101	2CSG421160R1101	2CSG521160R1101	2CSG631160R1101	2CSG721160R1101		0,5
600		2CSG221170R1101	2CSG421170R1101	2CSG521170R1101	2CSG631170R1101	2CSG721170R1101		0,5
800			2CSG421180R1101	2CSG521180R1101	2CSG631180R1101	2CSG721180R1101	2CSG831180R1101	0,5
1000			2CSG421190R1101	2CSG521190R1101	2CSG631190R1101	2CSG721190R1101	2CSG831190R1101	0,5
1200			2CSG421200R1101	2CSG521200R1101	2CSG631200R1101	2CSG721200R1101	2CSG831200R1101	0,5
1250							2CSG831210R1101	0,5
1500			2CSG421220R1101	2CSG521220R1101	2CSG631220R1101	2CSG721220R1101	2CSG831220R1101	0,5
2000			2CSG421230R1101	2CSG521230R1101		2CSG721230R1101	2CSG831230R1101	0,5
2500						2CSG721240R1101	2CSG831240R1101	0,5
3000						2CSG721250R1101	2CSG831250R1101	0,5
4000						2CSG721260R1101	2CSG831260R1101	0,5
5000						2CSG721270R1101		
6000						2CSG721280R1101		

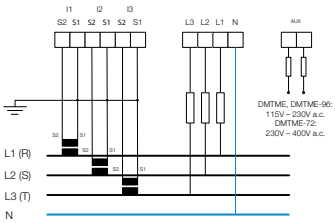
		Primary conductor choice						
		CT3	CT4	CT6	CT8	CT8-V	CT12	CT12-V
Section Conductor [mm]	◯	21	25	50	2x30	2x35	2x50	2x35
	▭	30x10	40x10	60x20	80x30	-	125x50	-
	▯	20x10	40x10	-	-	3x80x5	-	4x125x5

Selection table of the main codes of the range of voltage transformers with 100 V secondary, accuracy rating 0.5

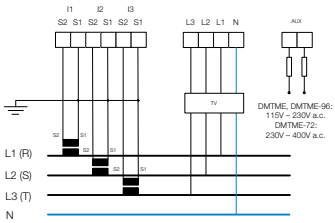
	Primary voltage						
	100	230	380	400	440	500	600
3P	2CSG324010R5021	2CSG324070R5021	2CSG324090R5021	2CSG324110R5021	2CSG324130R5021	2CSG324150R5021	2CSG324170R5021
10VA	TV2-100/100	TV2-230/100	TV2-380/100	TV2-400/100	TV2-440/100	TV2-500/100	TV2-600/100
3P + N	2CSG323020R5021	2CSG323080R5021	2CSG323100R5021	2CSG323120R5021	2CSG323140R5021	2CSG323160R5021	2CSG323180R5021
5 VA	TV2-100R3/100	TV2-230R3/100	TV2-380R3/100	TV2400R3/100	TV2440R3/100	TV2-500R3/100	TV2-600R3/100

Wiring diagrams

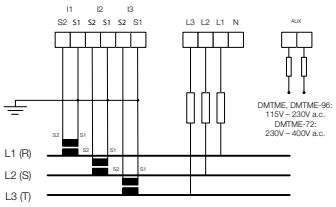
DMTME, DMTME-72 and DMTME-96



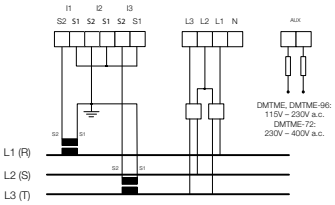
Three-phase system with neutral comprising 3 CTs



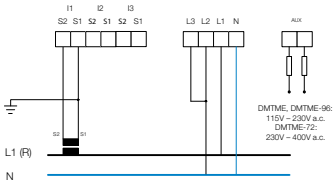
Three-phase system with neutral comprising 3 CTs and 3 VTs



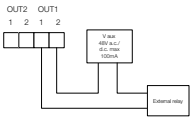
Three-phase system with 3 CTs



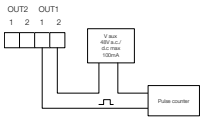
Three-phase system with 2 CTs and 2 VTs (Aron)



Single-phase system with neutral and 1 CT



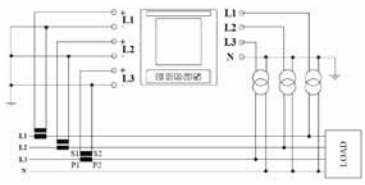
Digital outputs as alarms with external relay for controlling the loads



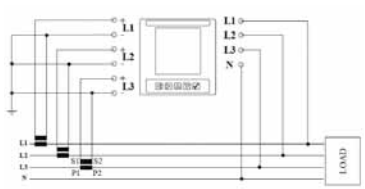
Digital outputs as impulses

ANR

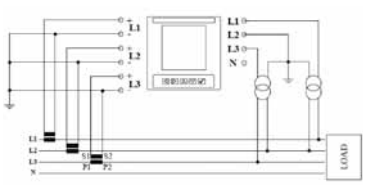
Power supply: 85 ... 265 V a.c./d.c. or 20 ... 60 V a.c./d.c. according to the type



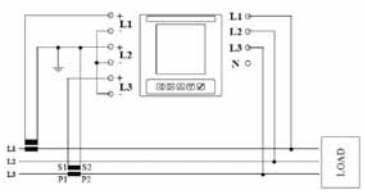
Insertion with 3 CTs and 3 VTs



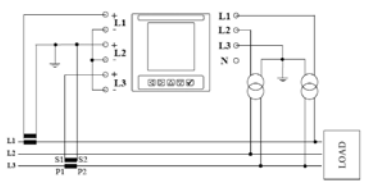
Insertion with 3 CTs



Insertion with 3 CTs and 2 VTs



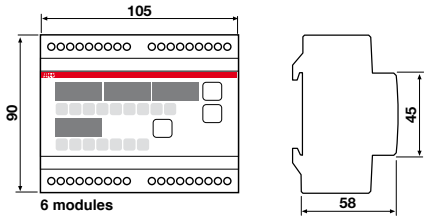
Insertion with 2 CTs



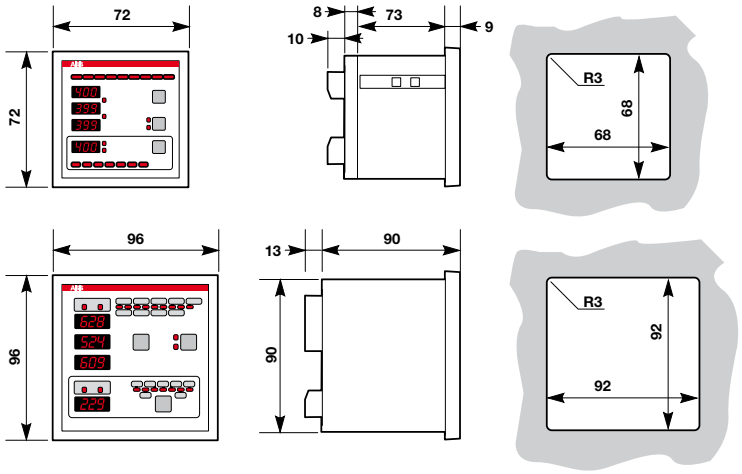
Insertion with 2 CTs and 2 VTs (Aron)

Overall dimensions

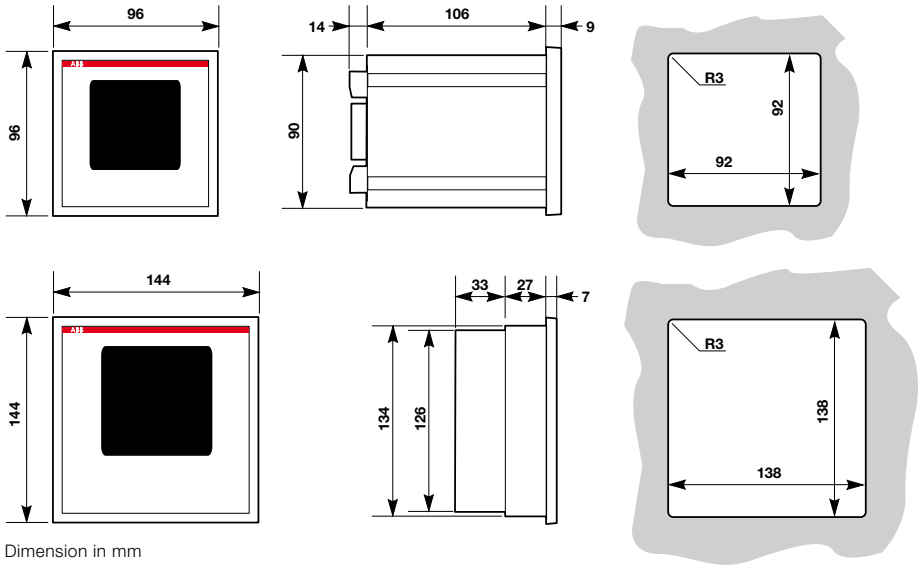
DIN rail multimeter DMTME



Front panel multimeter DMTME-72 and DMTME-96



Network analyzer ANR96 and ANR144



Dimension in mm

Questions & answers

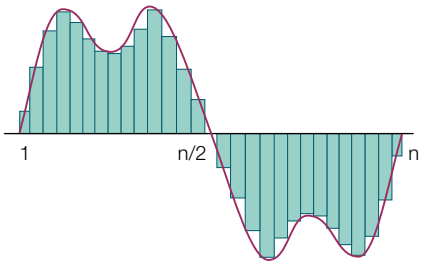
TRMS measurements

When the electricity is generated by the public utility company, the voltage has a sine wave form.
The current consumption of a purely resistive load, such as filament lamps, or an inductive load, such as motors and transformers, has the same shape, thus the same wave form as the voltage that powers it. This means that the wave shape of the current in linear loads is the same as the voltage wave shape (both are sinusoidal) and there are no harmonics.

There are two types of measuring instrument:
- instruments that measure the root mean square value (RMS) of the quantity;
- instruments that measure the true root mean square value (TRMS) of the quantity.

Instruments that measure the root mean square value of the quantities, assess the mean value of the rectified wave multiplied by waveform factor 1.11 (typical of the sine wave) and therefore achieve an approximate measurement of the wave's root mean square value.
Instruments that measure the true root mean square value (TRMS) of the quantity perform the following operations:
- wave sampling throughout the entire period;
- they square the samples;
- they add up the squares and calculate the mean value;
- lastly, they calculate the square root.

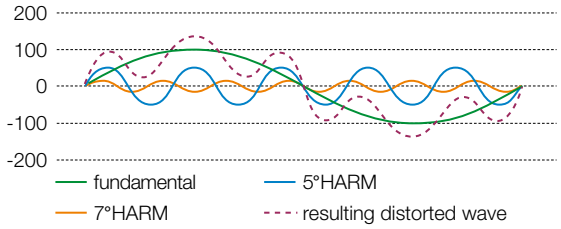
$$Y_{RMS} = \sqrt{\frac{\sum_{i=1}^{n} \left[Y_i\right]^2}{n}}$$



The TRMS must always be measured when there are distorted waves because errors due to harmonics that subtract from the total wave are avoided by squaring the samples.
Moreover, measurement of a wave's TRMS allows you to establish the power linked to that wave form and to define the equivalent in direct current of the original wave form, or in alternate current.

Difference between cosφ and power factor

Cosφ is the angle of phase displacement between voltage and current in an alternate current electrical system. The phase displacement is null and the cosφ equals one in a purely resistive system. Power factor PF is the ratio between active power and apparent power. Power factor PF must be considered when the power lines contain harmonics since the effect of these harmonics must be assessed. Thus, there is no sense in considering the cosφ in non-sinusoidal conditions as the power factor is the value to evaluate.



Protection of the instrument and earthing

To ensure that the instrument is adequately protected, it is always advisable to install fuses on the supply cables of digital instruments and on the voltage measuring inputs.
The CT secondaries should be earthed as this does not affect the measurement and provides a reference towards earth if the transformer develops a fault. A large difference in potential between the neutral and earth could negatively affect the measurement in instruments with measuring inputs that have not been galvanically isolated.

Harmonic distortion and THD

Harmonics are sine waves whose frequency equals whole multiples of the fundamental wave. Non-linear loads are sources of current harmonics. Current harmonics interact with the impedance of the distribution system, thereby distorting the voltage and leading to power losses. THD, or Total Harmonic Distortion, is the total harmonic distortion of the fundamental wave and considers the contribution of all the harmonic components present. THD is expressed as a percentage of the fundamental wave and is a valid indicator of the presence of harmonic interference in networks.

Direct measurements and indirect measurements: how is the correct transformer ratio established?

Direct connection to the line establishes a direct measurement of the quantity as the instrument is connected in the measuring point without any adapters in between.
Direct measurement can only be obtained when the level of the quantity measured is within the range of the instrument.
When the quantity is larger than the range of the measuring instrument, a transformer must be installed so as to reduce the quantity and provide the instrument with values that are compatible with its range. Measurements made via a measuring transformer are called indirect measurements because they are not taken directly from the line in question.
All multifunctional digital instruments require indirect connection via current transformers and sometimes via voltage transformers. The main measuring parameters to assess are the transformer ratios of the CT and VT, defined as the mathematical ratio between rated value and value of the secondary. For example, setting the transformer ratio of a CT3/100 with a 5 A secondary means setting kCT = 100: 5 = 20.

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