



CS INSTRUMENTS

Multifunctional measuring instrument DS 500 mobile

# DS 500 mobile

The intelligent mobile chart recorder - energy analysis according to DIN EN 16001

Energy analysis - consumption measurement - leakage calculation at compressed air systems



## Your advantages at a glance

### Easy and clear layout:

Very easy operation via 7" color display with touch panel

### Versatile:

Up to 12 sensors/meters connectible also third-party sensors/meters including power supply

### Reliable:

Stores all measured values on a memory card, easy reading-out via USB stick possible

### Intelligent energy analysis:

Daily/weekly/monthly evaluations  
Mathematic function for internal calculations, e.g. the typical key data of a compressed air plant:  
- costs in € per generated m<sup>3</sup> air  
- kWh/m<sup>3</sup> of generated air  
- consumption of single lines including summation

Blindingly easy operation

Easy & intuitional in its operation

Saves time & costs on installation



# Multifunction

## Multifunction measuring instrument **DS 500 mobile** energy analysis according to DIN EN 16001

If we talk about operational costs of compressed air plants we are actually talking about the energy costs as they make up about 70 to 80 % of the total costs of a compressed air plant.

Depending on the size of the plant this means considerable operating costs. Even in smaller plants this may quickly add up to 10,000 to 20,000 € per year. This is an amount which can be considerably reduced – even in the case of well operated and maintained plants.

Does this also apply to your compressed air plant? Which actual costs per generated m<sup>3</sup> air do you actually have? Which energy is gained due to the waste heat recovery? What is the total performance balance of your plant? How high are the differential pressures of single filters, how high is the humidity (pressure dew point), how much compressed air is used? ...

By means of the new multifunction measuring instrument **DS 500 mobile** and the suitable sensors and meters all these questions can be answered easily. For example by means of a long-term measurement over 7 days, data recording and evaluation at the PC.

Touch screen



12 sensor inputs



including voltage supply  
for all sensors

USB stick



External GSM module



Ethernet connection





## Consumption sensor s for compressed air and gases

- Installation and removal under pressure via standard 1/2" ball valve
- A safety ring avoids the uncontrolled ejection in case of installation/removal under pressure
- Usable for different gases: compressed air, nitrogen, argon, CO<sub>2</sub>, oxygen



## Dew point sensor s

- Extremely long-term stable
- Quick adaption time
- Large measuring range (-80° to +20° Ctd)
- For all dryers: Adsorption dryers, membrane dryers, refrigeration dryers
- Easy installation under pressure via the standard measuring chamber with quick coupling



## Pressure sensors

- Large selection of pressure sensors with different measuring ranges for each measuring purpose
- Quick installation under pressure by quick coupling
- Pressure sensors 0 - 10/16/40/100/250/400/600 bar overpressure
- Pressure sensors -1 - +15 bar (under-/overpressure)
- Differential pressure 1,5 mbar up to 4,2 bar
- Absolute pressure: 0 - 1,6 bar (abs.)



## Temperature sensors

- Large selection of temperature sensors e.g. for measurement of the ambient temperature or gas temperature
- Pt100 (2-wire or 3-wire)
- Pt1000 (2-wire or 3-wire)
- KTY sensors
- Temperature sensors with measuring transducer (4 - 20 mA output)



- For direct measurement of the heat volume (in kWh)
- Customary heat meters e.g. at heating systems, heat exchangers, district heating networks and so on can be connected to **DS 500 mobile** either via pulse signals or 4 - 20mA



## Heat meters/water and gas meters



- For the analysis of compressors (load and unload times, energy consumption, switch-on/switch-off cycles) the current input of up to 12 compressors is recorded via clamp-on ammeters
- Measuring ranges of the clamp-on ammeters:  
0 - 200 A  
0 - 500 A  
0 - 1000 A



## Clamp-on ammeters



- Mobile current/effective power meters with 32 A CEKON socket and plug for small machines and plants
- Easily to join up into the current circuit by means of an extension cable with 32 A CEKON plug
- Measures kW, kWh, cos phi, kVar, kVA
- Data transfer to **DS 500 mobile** via Modbus



## Current/effective power meters



- Mobile current/effective power meters with external current transformer for big machines and plants
- External current transformers for clamping around the phases (up to 200, 500, and 1000 A)
- External magnetic measuring tips for measuring the voltage
- Measures kW, kWh, cos phi, kVar, kVA
- Data transfer to **DS 500 mobile** via Modbus



## Current/effective power meters

By means of the multifunction measuring instrument **DS 500 mobile** for the first time all measuring data of a compressor station can be recorded, indicated and evaluated.

At **12 freely assignable sensor inputs** all CS Instruments sensors can be connected as well as any optional third-party sensors and meters with the following signal outputs:

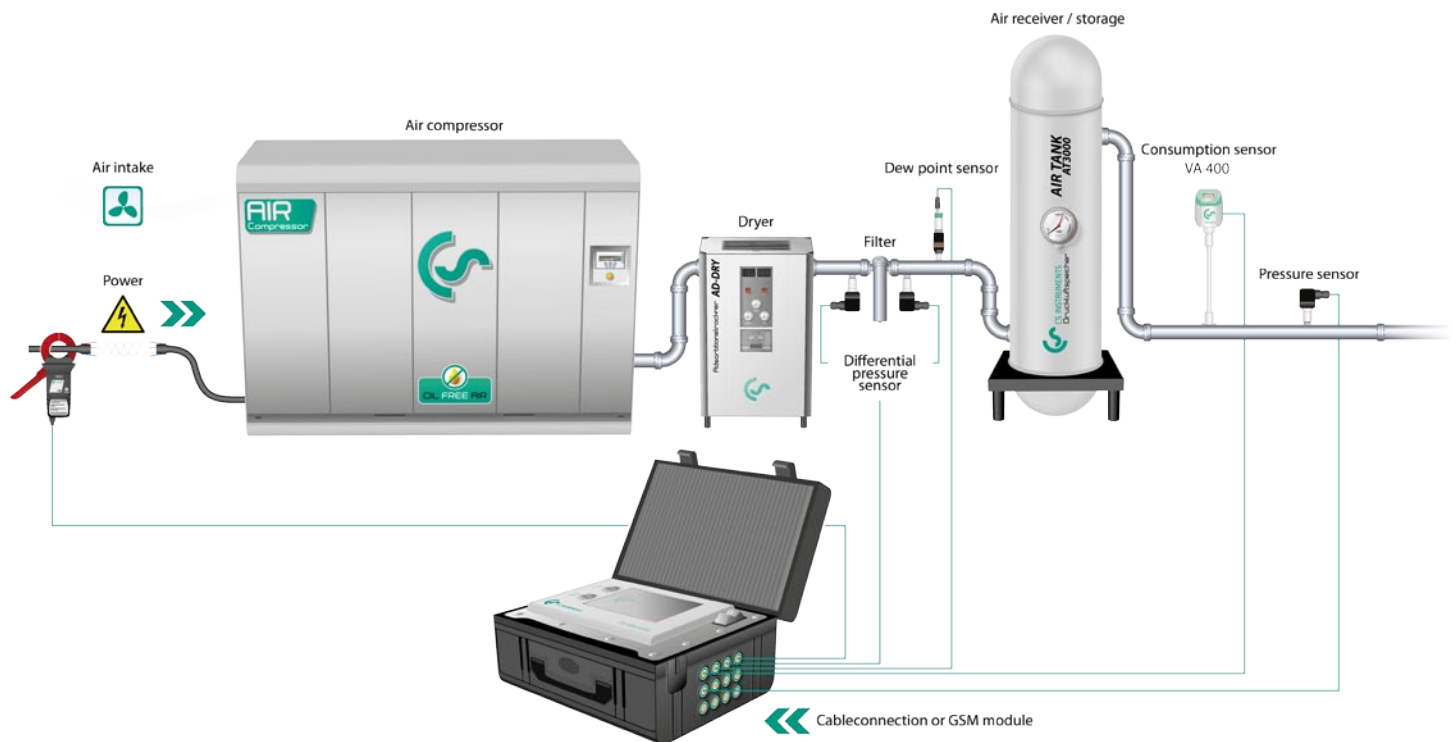
4 - 20 mA, 0-20 mA | 0-1 V / 0-10 V / 0-30 V | Pt100 (2- or 3-wire), Pt1000 (2- or 3-wire), KTY | pulse outputs (e.g. of gas meters) frequency output | Modbus protocol





## Step 1: The measurement

It is a special advantage that up to 12 compressors can be measured with one DS 500 mobile at the same time.



## Step 2:

### 1 Compressor analysis (current / power measurement)

The energy consumption of every single compressor is measured by means of a clamp-on ammeter. The produced compressed air quantity is calculated by the software on the basis of the performance data of the compressor which have to be entered. The following parameters are calculated additionally: Energy consumption in kWh, load-, unload-, stop time, compressor load in %, number of load/unload cycles.

### 2 System analysis (current measurement and real consumption measurement)

The system analysis has the same function like the compressor analysis, however, it additionally offers the possibility to measure the actually produced resp. used quantity of compressed air by means of the consumption sensor VA 400.

With the additional „real consumption measurement“ the leakages and therefore the cost share of the leakages in comparison to the total costs in € can be determined.

### 3 Leakage calculation

The leakage calculation is done during the production free time (shutdown, weekend, holidays). The consumption sensor VA 400 measures the supplied quantity of air. During the down time the compressor delivers compressed air in order to keep a constant pressure.

According to statistics even if production is carried out day and night there is at least one short period of time during which all load is switched off. By means of this data the software defines a leakage rate and calculates the incurred leakage costs in €.



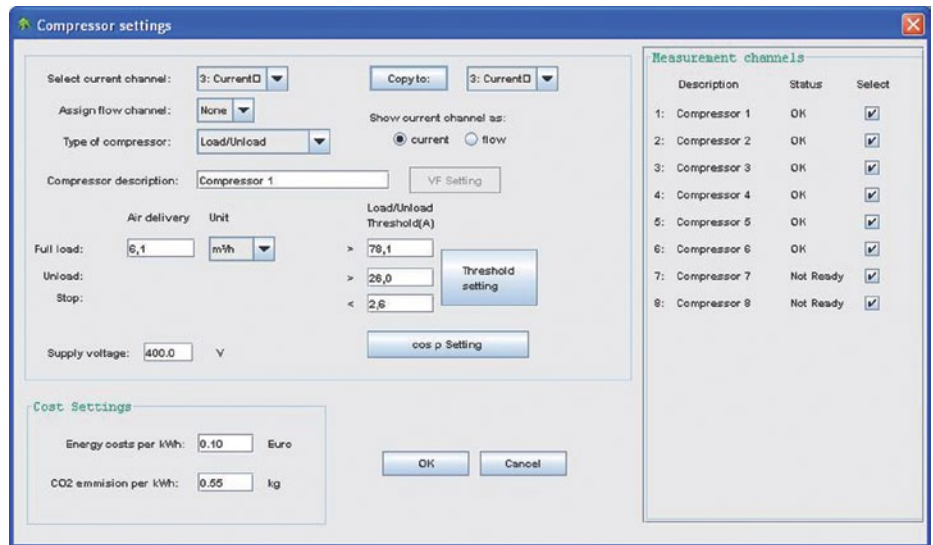
## Step 3:

### Evaluation at the PC with graphics and statistics

#### 3.1 Entry of necessary parameters

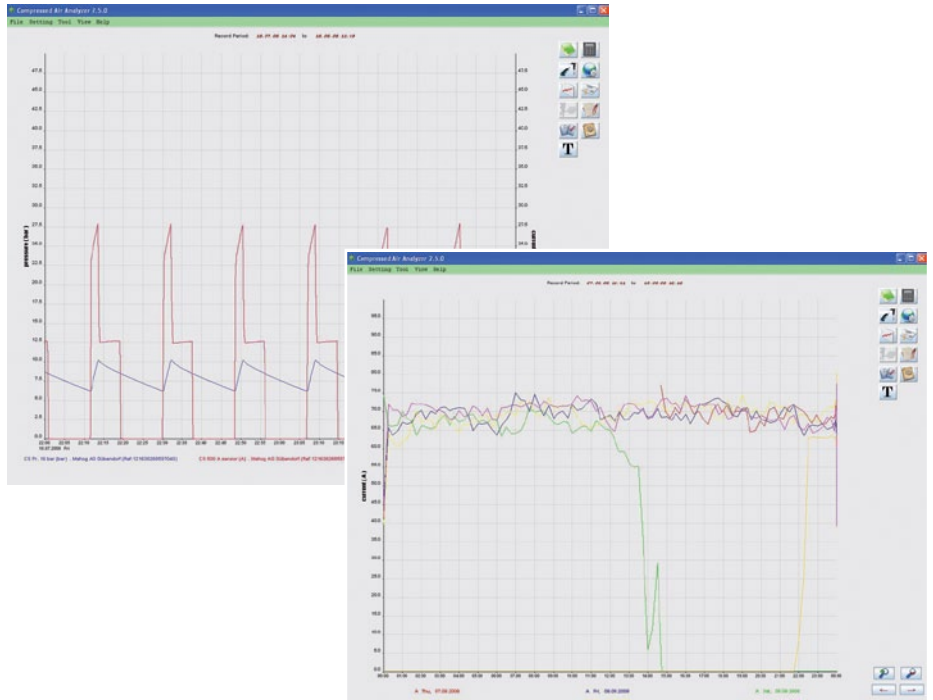
Specific data have to be entered before the analysis is carried out:

- Selection of compressor type (load/idle resp. variable speed drive controlled)
- as well as entry of the performance data according to data sheet
- Period of measurement
- Costs in € for 1kWh



#### 3.2 Graphic evaluation with day view and week view

Everything at a glance: The user gets a day and a week view of all stored measured data with his company logo (can be easily integrated) at the touch of a button. By means of the zoom and the crosslines function peak values can be determined.



#### 3.3 Compressed air costs in €/US\$

At the touch of a button the user gets all important data like e.g.

- Energy costs
- Compressed air costs
- Leakage costs in €/US\$
- Compressor data with load / unload time
- Specific energy kWh/m<sup>3</sup>
- costs for 1m<sup>3</sup> in €/US\$

	Compressor 1	Compressor 2	Compressor 3	Sum Of All
<b>System Analyzes</b>				
3	Load/Unload	Variable Frequency	Load/Unload	
6	Valid record time	167.1 h	167.1 h	167.1 h
7	Load analyzes			
8	Full load time (h[%])	30.8 (18%)	119.0 (71%)	54.2 (32%)
9	Unload time (h[%])	0.1 (0%)	0.8 (0%)	0.5 (0%)
10	Stop time (h[%])	136.2 (81%)	47.3 (28%)	112.5 (67%)
11	Number of starts	11	68	33
12	Number of load/unload cycles	32	118	97
<b>Energy</b>				
15	Full load energy (kwh)	999.9	3010.5	1687.1
16	Unload energy (kwh)	1.6	4.4	5.4
17	Stop energy (kwh)	0.2	58.7	0.9
18	Total energy consumption (kwh)	1001.7	3073.6	1693.4
19	Specific power (kwh/m <sup>3</sup> )	0.117	0.132	0.113
<b>Costs</b>				
22	Full load costs (Euro)	99	301	168
23	Unload costs (Euro)	0	0	0
24	Stop costs (Euro)	0	5	5
25	Total costs (Euro)	99	306	168
26	Costs per m <sup>3</sup> (Euro)	0.0116	0.0131	0.0112
<b>Air delivery</b>				
29	Average flow (m <sup>3</sup> /min)	0.9	2.3	1.5
30	Max flow (m <sup>3</sup> /min)	4.63	6.13	4.63

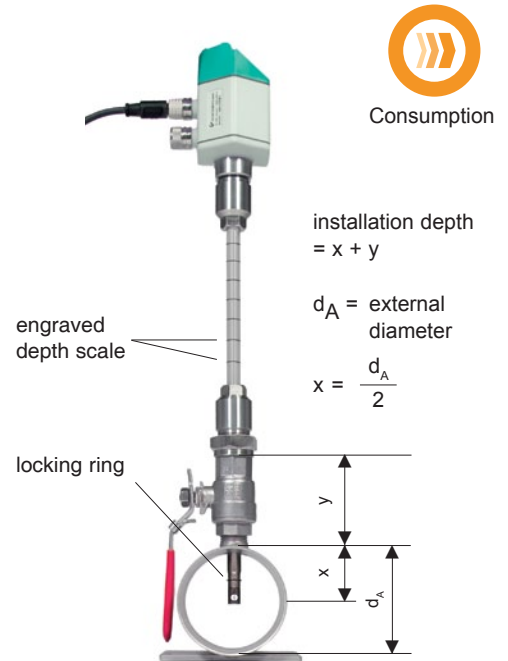


## Suitable probes from the CS Instruments product range

Consumption sensors VA 400:	Order no.
VA 400 consumption sensor in basic version: Standard (92,7 m/s), sensor length 220 mm, without display	0695 4001
Options for VA 400:	
Max. version (185 m/s)	Z695 4003
HighSpeed version (224 m/s)	Z695 4002
Sensor length 120 mm	ZSL 0120
Sensor length 160 mm	ZSL 0160
Sensor length 300 mm	ZSL 0300
Sensor length 400 mm	ZSL 0400

### Flow measuring ranges VA 400 for compressed Air (ISO 1217: 1000 mbar, 20°C)

Inner diameter of pipe			VA 400 Standard (92,7 m/s)	VA 400 Max. (185,0 m/s)	VA 400 HighSpeed (224,0 m/s)
Inch	mm	DN	Meas. ranges from ... to	Meas. ranges from ... to	Meas. ranges from ... to
1/2"	16,1	DN 15	2,5... 760 l/min	3,5... 1516 l/min	6,0... 1836 l/min
3/4"	21,7	DN 20	0,3... 89 m³/h	0,4... 178 m³/h	0,7... 215 m³/h
1"	27,3	DN 25	0,5... 148 m³/h	0,6... 295 m³/h	1,1... 357 m³/h
1 1/4"	36,0	DN 32	0,9... 280 m³/h	1,2... 531 m³/h	2,5... 644 m³/h
1 1/2"	41,8	DN 40	1,2... 365 m³/h	1,5... 728 m³/h	3,0... 882 m³/h
2"	53,1	DN 50	2... 600 m³/h	2,5... 1198 m³/h	4,6... 1450 m³/h
2 1/2"	71,1	DN 65	3,5... 1096 m³/h	5... 2187 m³/h	7... 2648 m³/h
3"	84,9	DN 80	5... 1570 m³/h	7... 3133 m³/h	12... 3794 m³/h
4"	110,0	DN 100	9... 2645 m³/h	12... 5279 m³/h	16... 6391 m³/h
5"	133,7	DN 125	13... 3912 m³/h	18... 7808 m³/h	24... 9453 m³/h
6"	159,3	DN 150	18... 5560 m³/h	25... 11097 m³/h	43... 13436 m³/h
8"	200,0	DN 200	26... 8786 m³/h	33... 17533 m³/h	50... 21230 m³/h
10"	250,0	DN 250	40... 13744 m³/h	52... 27429 m³/h	80... 33211 m³/h
12"	300,0	DN 300	60... 19815 m³/h	80... 39544 m³/h	100... 47881 m³/h



### Consumption counters VA 420 with integrated measuring section:

Consumption counter VA 420 0,8 ... 90 l/min	(R 1/4" DN 8)	0695 0420
Consumption counter VA 420 0,2 ... 90 m³/h	(R 1/2" DN 15)	0695 0421
Consumption counter VA 420 0,3 ... 170 m³/h	(R 3/4" DN 20)	0695 0422
Consumption counter VA 420 0,5 ... 290 m³/h	(R 1" DN 25)	0695 0423
Consumption counter VA 420 0,7 ... 480 m³/h	(R 1 1/4" DN 32)	0695 0426
Consumption counter VA 420 1,0 ... 550 m³/h	(R 1 1/2" DN 40)	0695 0424
Consumption counter VA 420 2,0 ... 900 m³/h	(R 2" DN 50)	0695 0425



### Dew point sensors:

FA 410 dew point sensor, -80°...20°Ctd including inspection certificate	0699 0410
FA 415 dew point sensor, -20°...50°Ctd including inspection certificate	0699 0415
Standard measuring chamber for compressed air up to 16 bar	0699 3390














### Connection cables for VA 400, VA 420, FA 410 und FA 415: Connection cables for consumption sensors / dew points sensors:

Connection cable	5 m	0553 0503
Extension cable	10 m	0553 0504



Dew point

## Suitable probes from the CS Instruments product range

Pressure sensors:	Order no.		
Standard pressure sensor CS 16, 0...16 bar, $\pm 1\%$ accuracy of full scale	0694 1886		 Pressure
Standard pressure sensor CS 40, 0...40 bar, $\pm 1\%$ accuracy of full scale	0694 0356		
Standard pressure sensor CS 1,6 absolut, 0...1,6 bar abs., $\pm 1\%$ accuracy of full scale	0694 3551		
Standard pressure sensor CS 100, 0...100 bar, $\pm 1\%$ accuracy of full scale	0694 3557		
Standard pressure sensor CS 250, 0...250 bar, $\pm 1\%$ accuracy of full scale	0694 3558		
Standard pressure sensor CS 400, 0...400 bar, $\pm 1\%$ accuracy of full scale	0694 3559		
Precision pressure sensor CS, -1...+15 bar, $\pm 0,5\%$ accuracy of full scale	0694 3553		
Precision differential pressure sensor CS, 0...400 mbar differential pressure, accuracy 0,075 % of full scale, static pressure max. 40 bar	0694 3560		
Temperature probes:			
Screw-in temperature probe Pt100, Class A, length 300 mm, $\varnothing 6$ mm, with measuring transducer 4...20 mA = -50...+500 °C (2-wire-technology)	0693 0002		 Temperature
Temperature probe cable Pt100, Class A, length 300 mm, $\varnothing 6$ mm, -50...+180 °C, 5 m probe connection cable with open ends	0604 0102		
Temperature probe cable Pt100, Class A, length 150 mm, $\varnothing 6$ mm, -50...+180 °C, 5 m probe connection cable with open ends	0604 0100		
Clamp screwing 6 mm, G $1/2$ ", VA-clamping, pressure-tight up to 10 bar	0554 6004		
Connection cables for pressure sensors / temperature probes:			
Connection cable	5 m	0553 0501	
Connection cable	10 m	0553 0502	
Extension cable	10 m	0553 0504	
Clamp-on ammeters			
Clamp-on ammeter 0...1000 A TRMS incl. 5 m connection cable	0554 0508		 Power
Current/effective power meter up to 32 A	0554 5340		
- Mobile current/effective power meter with 32 A CEKON socket and plug for small machines and plants			 Power
- Easy to link into the current circuit by means of an extension cable with 32 A CEKON plug			
- Measures kW, kWh, cos phi, kVar, kVA			
- Data transfer to DS 500 mobile via Modbus			
Current/effective power meter up to 100/600 A	0554 5341		
- Mobile current/effective power meter with 32 A CEKON socket and plug for big machines and plants			 Power
- External current transformers for clamping on cables (up to 200, 500 and 1000 A)			
- External magnetic measuring tips for measuring the voltage			
- Measures kW, kWh, cos phi, kVar, kVA			
- Data transfer to DS 500 mobile via Modbus			
Optional third-party sensors connectible:			
e.g. heat meters, current meters, gas meters, water meters and so on			
At the <b>12 freely assignable sensor inputs</b> all sensors of CS Instruments can be connected as well as optional third-party sensors			
Third-party sensors and meters with the following signal outputs:			 3rd Party
4-20 mA, 0-20 mA   0-1 V / 0-10 V / 0-30 V   Pt100 (2- or 3-wire), Pt1000 (2- or 3-wire), KTY   pulse outputs (e.g. of gas meters)   frequency output   Modbus protocol			

## Technical Data DS 500 mobile

### Measurement of up to 12 compressors

#### Technical data DS 500 mobile

<b>Case dimensions</b>	360 x 270 x 150 mm
<b>Connections</b>	4 / 8 / 12 sensors and supply, 1 x RJ 45 Ethernet connection
<b>Weight</b>	4,5 kg
<b>Material</b>	diecast, front foil polyester, ABS
<b>Sensor inputs</b>	4/8/12 sensor inputs for analogue and digital sensors; freely assignable, see options  Digital CS sensors for dew point and consumption with SDI interface FA/VA 400 series, digital third-party sensors RS 485 / MODBUS RTU  Analogue CS sensors for pressure, temperature, clamp-on ammeters pre-configured  Analogue third-party sensors 0/4 ..20 mA, 0..1/10/30V, pulse, Pt100 / Pt1000, KTY, counter
<b>Voltage supply for sensor</b>	24 VDC, max. 130 mA per sensor, integrated mains unit, max. 24 VDC, 25 W In case of version 8 / 12 sensor inputs 2 integrated mains units, each max. 24 VDC, 25 W
<b>Interfaces</b>	USB stick, Ethernet / RS 485 Modbus RTU / TCP, SDI other bus systems on request, WEB Server optionally, GSM module
<b>Memory Card</b>	Memory size 2 GB SD Memory card standard, optionally up to 4 GB
<b>Voltage supply</b>	100...240 VAC / 50-60 Hz
<b>Colour display</b>	7" touch panel TFT transmissive graphics, curves, statistics
<b>Accuracy</b>	Please see sensor specifications
<b>Operating temperature</b>	0...50°C
<b>Storage temperature</b>	-20...70°C



Description	Order no.
Multifunction measuring instrument DS 500 mobile, 4 sensor inputs	0500 5012
Multifunction measuring instrument DS 500 mobile, 8 sensor inputs	0500 5013
Multifunction measuring instrument DS 500 mobile, 12 sensor inputs	0500 5014
Option "integrated Webserver"	Z500 5003
Option "consumption report" statistics, daily/weekly/monthly report	Z500 5004
Option "quick measurement with 10 ms sampling rate" for analogue sensors, max/min value storage per second	Z500 5005
Option "mathematics calculation function" for 4 freely selectable "virtual" channels (mathematical functions: addition, subtraction, division, multiplication)	Z500 5008
CS Soft Basic for DS 500 data evaluation in graphic and table form, reading out of the measured data of one DS 500 via USB or Ethernet	0554 7040
CS Soft Energy Analyzer for energy and leakage analysis of compressed air stations	0554 7050
GSM module for data transfer via the GSM network (mobile network)	on request
Connection cable DS 500 mobile ODU/open ends, 5 m	0553 0501
Connection cable DS 500 mobile ODU/open ends, 10 m	0553 0502
Connection cable DS 500 mobile ODU/M12 for VA/FA series, 5 m	0553 0503
Extension cable DS 500 mobile ODU/ODU 10 m	0553 0504

#### Input signals

<b>Signal current</b>	(0...20mA/4...20mA) internal or external voltage supply
Measuring range	0...20 mA
Resolution	0,0001 mA
Accuracy	± 0,003 mA ± 0,05 %
Input resistance	50 Ω

<b>Signal voltage</b>	(0...1 V)
Measuring range	0...1 V
Resolution	0,05 mV
Accuracy	± 0,2 mV ± 0,05 %
Input resistance	100 kΩ

<b>Signal voltage</b>	(0...10 V / 30 V)
Measuring range	0...10 V
Resolution	0,5 mV
Accuracy	± 2 mV ± 0,05 %
Input resistance	1 MΩ

<b>RTD Pt 100</b>	
Measuring range	-200...850° C
Resolution	0,1° C
Accuracy	± 0,2° C (-100...400° C) ± 0,3° C (remain. range)

<b>RTD Pt 1000</b>	
Measuring range	-200...850° C
Resolution	0,1° C
Accuracy	± 0,2° (-100...400° C)

<b>Pulse</b>	
Measuring range	Min. pulse length 100 µs Frequency 0...1 kHz Max. 30 VDC