



DS 500

Intelligent chart recorder for compressed air and gases

Measurement - control - indication - alarm - recording - evaluation



Advantages at a glance:

- **Clear layout:** 7" color screen with touch panel...
- **Versatile:** Up to 12 optional sensors can be connected...
- **Suitable for industrial applications:** Metal housing IP 65 or panel mounting
- **Data available though world wide web:** Network-compatible and remote transmission via webserver
- **Intelligent:** Daily/weekly/monthly reports...
- **Mathematical function** for internal calculations
- **Totalizer function** for analogue signals
- **... Saves time and costs during installation**

DS 500 - the intelligent chart recorder of the next generation

From recording of the measured data, indication on a big color screen, alerting, storage up to remote read-out via webserver... this is all possible with DS 500. By means of the CS Soft Basic software alarms can be sent via SMS or e-mail.

All measured values, measured curves and threshold exceeding are indicated. The curve progressions from the beginning of the measurement can be viewed by an easy slide of the finger.

Daily/weekly/monthly reports with costs in € and counter reading in m³ for each consumption sensor are completing the

sophisticated system concept. The big difference to ordinary paperless chart recorders reveals in the easy initiation and in the evaluation of the measured data. All sensors are identified directly and powered by DS 500. Everything is matched and tuned.

Mathematical function for internal calculations, e.g. the typical figures of a compressed air plant:

- costs in € per generated m³ air
- kwh/m³ generated air
- consumption of single lines including summation

Totalizer function for analogue signals (e.g. 0/4...20 mA, 0...10 V). In case of third-party sensors which e.g. only give a 4...20 mA signal for the actual flow in m³/h a total counter reading in m³ can be generated by means of the totalizer function.

No time consuming studying of the instruction manual... **this saves time.** Internal voltage supply of all sensors, no wiring of external mains units ... **this saves additional costs.**



All important information at a glance

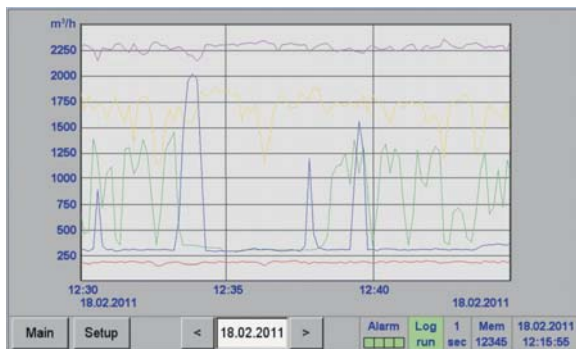
Measured values, statistics, curves with the 7" color screen touch panel

A1 Compressed Air	A2 Compressed Air	A3 Compressed Air	A4 Compressed Air
A1a 237.7 m³/h 34106 m³	A2a 729.702 m³/h 13423271 m³	A3a 537.0 m³/h 155132 m³	A4a 254.7 m³/h 55234063 m³
B1 Nitrogen	B2 Nitrogen	B3 Nitrogen	B4 Nitrogen
B1a 337.7 ltr/min 27734 ltr	B2a 657.7 ltr/min 240041 ltr	B3a 15.7 ltr/min 34131 ltr	B4a 237.7 ltr/min 235322 ltr
C1 Oxygen	C2 Oxygen	C3 Oxygen	C4 Oxygen
C1a 17.7 ltr/min 4080 ltr	C2a 37.7 ltr/min 234108 ltr	C3a 223.7 ltr/min 3749 ltr	C4a 75.8 ltr/min 43584 ltr

Zurück Virtuelle Kanäle Alarm Lg.stop days, Info... 24.03.2014 16:41:52

Real time measured values

All measured values can be seen at a glance. Threshold exceeding are indicated in red color. A „measuring site name“ can be allocated to each sensor.



Graphic display

This display replaces the former evaluation of ordinary paper chart recorders and offers lots of advantages. The time axis can be moved by a finger slide. The „zoom function by finger movement“ which enables an analysis of peak values is unique.



Real time measured values and graph

Additionally to the measurement curves the real time value is indicated as well.

*** Consumption report ***						
Month/Year	<A1> Hall 1.1 compressed air					Total
	Consumption per month m³	Costs €	max value m³/h	min value m³/h	average m³/h	€
2010 May	7257	109	3.7	35.8	15.8	308
2010 June	9530	143	3.8	36.1	18.9	402
2010 July	7325	110	3.9	37.2	14.5	327
2010 August	8099	121	3.9	37.1	16.1	353
2010 September	7842	118	3.9	36.8	15.6	367
2010 October	6167	93	3.9	37.3	12.2	291
2010 November	9030	135	3.9	37.5	17.9	311
2010 December	9062	136	3.9	37.5	18.0	388
2010 Total	97953	1469	3.8	37.1	16.3	4164
2011 January	8880	133	3.5	37.7	17.6	412

Home Day/Week Week Month/Year

Statistics and reports

Different to ordinary chart recorders the DS 500 offers not only the recording of the measured data but also the evaluation of all flow sensors optionally as daily/ weekly/monthly report at the push of a button. It is no longer necessary to read-out the counter and transfer the values manually into a list. The reports can be imported to every PC into Excel® by means of a USB stick and after that they can be printed out without any additional software. This saves time and money and simplifies the evaluation enormously.



Chart recorder

DS 500

Intelligent chart recorder for compressed air and gases



Versatile:

Up to 12 sensors, incl. all CS sensors (consumption, dew point, pressure, current, KTY, PT 100, PT 1000) are identified automatically by DS 500. Optional analogue sensors (0/4...20mA, 0...1/10/30 V, pulse) can be configured easily and quickly. Digital sensors can be connected via RS 485, Modbus RTU and SDI.

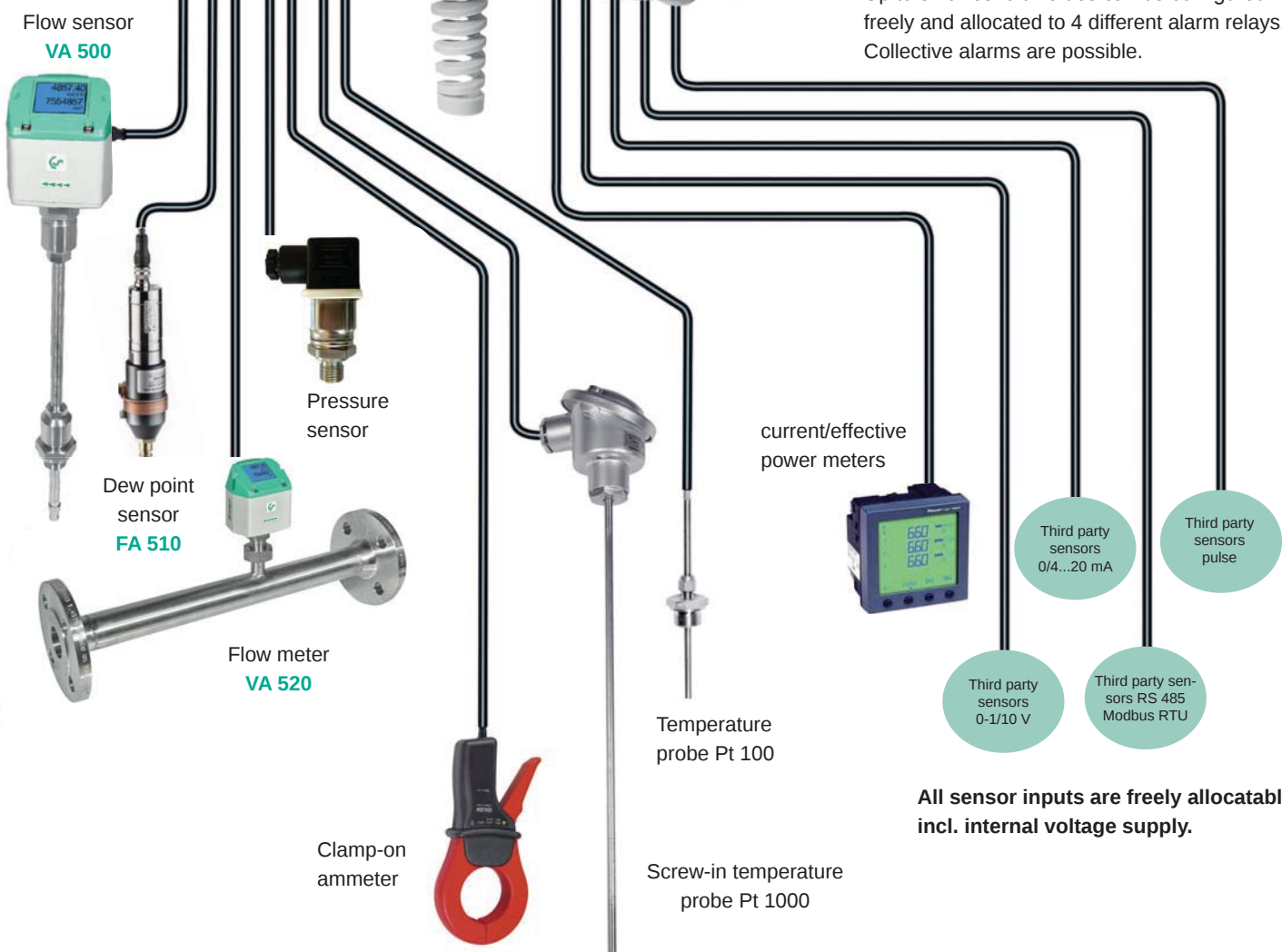
Digital sensors can be connected via RS 485, Modbus RTU and SDI.

Flexible:

Network-compatible and worldwide remote data transmission via Ethernet, integrated webserver.

Alarm relay/ fault indication:

Up to 32 threshold values can be configured freely and allocated to 4 different alarm relays. Collective alarms are possible.



All sensor inputs are freely allocatable, incl. internal voltage supply.





Flow sensors

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, CO₂, oxygen



Dew point sensors

- Extremely long-term stable
- Quick adaption time
- Large measuring range (-80° to +20° Ctd)
- For all driers: Desiccant driers, membrane driers, refrigeration driers
- 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.)



- 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)



Temperature sensors



- 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 either via pulse signals or 4-20 mA



Heat meters-/ water and gas meters



- CS PM 210 current/effective power meters for panel mounting with external current transformer for big machines and plants
- External current transformers for clamping around the phases (max. 2000 A)
- Measures KW, kWh, cos phi, kVar, kVA
- Data transfer DS 500 via Modbus



Current/effective power meters

By means of the intelligent chart recorder **DS 500**, all measuring data of a compressor station can be recorded, indicated and evaluated.

At **12 freely assignable sensor inputs** all our 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 I 0-1 V / 0-10 V / 0-30 V I Pt 100 (2- or 3-wire), Pt 1000 (2- or 3-wire), KTY I pulse outputs (e.g. of gas meters) frequency output I Modbus protocol.



Chart recorder

Technical data DS 500

Dimensions of housing:	280 x 170 x 90 mm, IP 65
Connections:	18 x PG 12 for sensors and supply, alarm relays 1 x RJ 45 Ethernet connection
Version panel mounting:	Cutout panel 250 x 156 mm
Weight:	7.3 Kg
Material:	Die cast metal, front screen polyester
Sensor inputs:	4/8/12 sensor inputs for analogue and digital sensors freely allocatable. See options - Digital CS sensors for dew point and consumption with SDI interface FA/VA series, digital third-party sensors RS 485 / Modbus RTU, other bus systems realizable on request. - Analogue CS Sensors for pressure, temperature, clamp-on ammeters pre-configured. - Analogue third-party sensors 0/4...20 mA, 0...1/10/30V, pulse, Pt 100 / Pt 1000, KTY
Power supply for sensors:	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.
Interfaces:	USB stick, USB cable, Ethernet / RS 485 Modbus RTU / TCP, SDI other bus systems on request, WEB server optionally
Outputs:	4 relays (changeover contact 230 VAC, 6 A), alarm management, relays freely programmable, collective alarm - Analogue output, pulse in case of sensors with own signal output looped, like e.g. VA/FA series
Memory card:	Memory size 4 GB SD memory card standard
Power supply:	100...240 VAC / 50-60 Hz, special version 24 VDC
Color screen:	7" touch panel TFT transmissive, graphics, curves, statistics
Accuracy:	see sensor specifications
Operating temperature:	0...50°C
Storage temperature:	-20...70°C
Optionally:	Webserver
Optionally:	Quick measurement with 10 ms sampling rate for analogue sensors, Max/Min indication per second
Optionally:	Option „energy and flow report“ statistics, daily/weekly/monthly report

Description	Order No.
DS 500 - intelligent chart recorder in basic version (4 sensor inputs)	0500 5000
Option 4 additional sensor inputs for DS 500	Z500 5001
Option 8 additional sensor inputs for DS 500	Z500 5002
Option Integrated webserver	Z500 5003
Option „energy and flow report“ statistics, daily/weekly/monthly report	Z500 5004
Option version for panel mounting	Z500 5006
Option power supply 24 VDC (instead of 100...240 VAC)	Z500 5007
Option „mathematics calculation function“ for 4 freely selectable „virtual“ channels, (mathematical functions: addition, subtraction, division, multiplication)	Z500 5008
Option „Totalizer function for analogue signals“	Z500 5009
External Gateway Profibus	Z500 3008
CS Soft Basic - data evaluation in graphic and table form, reading out of the measured data via USB or Ethernet	0554 7040
CS Soft Network - Database Client/Server Solution (up to 5 DS 500) - database (MySQL) to Server - data evaluation via Client-Software	0554 7041
CS Soft Network - Database Client/Server Solution (up to 10 DS 500) - database (MySQL) to Server - data evaluation via Client-Software	0554 7042
CS Soft Network - Database Client/Server Solution (up to 20 DS 500) - database (MySQL) to Server - data evaluation via Client-Software	0554 7043
CS Soft Network - Database Client/Server Solution (> 20 DS 500) - database (MySQL) to Server - data evaluation via Client-Software	0554 7044

Input signals	
Current signal	(0...20mA/ 4...20mA)
internal or external power supply	
Measuring range	0...20 mA
Resolution	0.0001 mA
Accuracy	± 0.03 mA ± 0.05 %
Input resistance	50 Ω
Voltage signal	(0...1 V)
Measuring range	0...1 V
Resolution	0.05 mV
Accuracy	± 0.2 mV ± 0.05 %
Input resistance	100 kΩ
Voltage signal	(0...10 V / 30 V)
Measuring range	0...10 V
Resolution	0.5 mV
Accuracy	± 2 mV ± 0.05 %
Input resistance	1 MΩ
RTD Pt 100	
Measuring range	-200...850°C
Resolution	0.1°C
Accuracy	± 0.2°C (-100...400°C) ± 0.3°C (further range)
RTD Pt 1000	
Measuring range	-200...850°C
Resolution	0.1°C
Accuracy	± 0.2° (-100...400°C)
Pulse	
Measuring range	min pulse length 100 µs frequency 0...1 kHz max. 30 VDC



Suitable probes from the product range:

Flow sensors VA 500:	Order No.	
VA 500 flow sensor in basic version: Standard (92.7 m/s), sensor length 220 mm, without display	0695 5001	
Options for VA 500: (see page 81)		
Flow meters VA 520:		
Flow meter VA 520 with integrated measuring section, (R 1/4" DN 8)	0695 0520	
Flow meter VA 520 with integrated measuring section, (R 1/2" DN 15)	0695 0521	
Flow meter VA 520 with integrated measuring section, (R 3/4" DN 20)	0695 0522	
Flow meter VA 520 with integrated measuring section, (R 1" DN 25)	0695 0523	
Flow meter VA 520 with integrated measuring section, (R 1 1/4" DN 32)	0695 0526	
Flow meter VA 520 with integrated measuring section, (R 1 1/2" DN 40)	0695 0524	
Flow meter VA 520 with integrated measuring section, (R 2" DN 50)	0695 0525	
Dew point sensors:		
FA 510 dew point sensor, -80...+20 °Ctd incl.inspection certificate	0699 0510	
FA 510 dew point sensor, -20...+50°Ctd, incl.inspection certificate	0699 0512	
Standard measuring chamber for compressed air up to 16 bar	0699 3390	
Connection cables for flow sensors / dew point sensors:		
Connection cable 5 m	0553 0104	
Connection cable 10 m	0553 0105	
Pressure sensors:	± 1 % accuracy of full scale	± 0,5 % accuracy of full scale
Standard pressure sensor CS 16 from 0...16 bar	0694 1886	0694 3555
Standard pressure sensor CS 40 from 0...40 bar	0694 0356	0694 3930
Standard pressure sensor CS 1.6 from 0...1.6 bar abs.		0694 3550
Standard pressure sensor CS 10 from 0...10 bar	0694 3556	0694 3554
Standard pressure sensor CS 100 from 0...100 bar		0694 3557
Standard pressure sensor CS 250 from 0...250 bar		0694 3558
Standard pressure sensor CS 400 from 0...400 bar		0694 3559
Precision pressure sensor CS -1...+15 bar, ± 0.5 % accuracy of full scale		0694 3553
Precision differential pressure sensor CS 400, 0...400 mbar differential pressure, 0.075% accuracy of full scale, static pressure max. 40 bar	0694 3560	
Temperature sensors:		
Screw-in temperature probe PT 100 class A, length: 300 mm, d=6mm, with integrated transducer 4...20 mA = -50°C...+500°C (2-wire)	0604 0201	
Outdoor temperature probe, PT 100 class B (2-wire) in wall housing (82x55x33 mm), temperature range: -50°C to +80°C	0604 0203	
Indoor temperature probe, PT 100 class B (2-wire) in wall housing (82x55x33 mm), temperature range: -50°C to +80°C	0604 0204	
Temperature probe PT 100 class A (4-wire) with cable, length: 300 mm, d=6 mm, -70°C to +260°C, 5 m connection cable (PFA) with open ends	0604 0205	
Temperature probe PT 100 class A (4-wire) with cable, length: 100 mm, d=6 -70°C to +260°C, 5 m connection cable (PFA) with open ends	0604 0206	
Temperature probe PT 100 class A (4-wire) with cable, length: 200 mm, d=6 -70°C to +260°C, 5 m connection cable (PFA) with open ends	0604 0207	
Surface temperature probe, magnetic, magnet dimensions 39x26x25 mm, PT 100 class B (2-wire), -30 to +180°C, 5 m connection cable (PFA) with open ends	0604 0208	
Clamp screwing 6mm; G 1/2" PTFE clamp ring pressure tight up to 10 bar material: stainless steel, temperature range: max. +260°C	0554 0200	
Clamp screwing 6mm; G 1/2" stainless steel clamp ring pressure tight up to 16 bar, material: stainless steel, temperature range: max. +260°C	0554 0201	
Connection cables for pressure sensors / temperature sensors:		
Connection cable 5 m	0553 0108	
Connection cable 10 m	0553 0109	
Clamp-on ammeters:		
Clamp-on ammeter 0...1000 A TRMS incl. 5 m connection cable with open ends	0554 0518	
Clamp-on ammeter 0...400 A TRMS incl. 3 m connection cable with open ends	0554 0510	



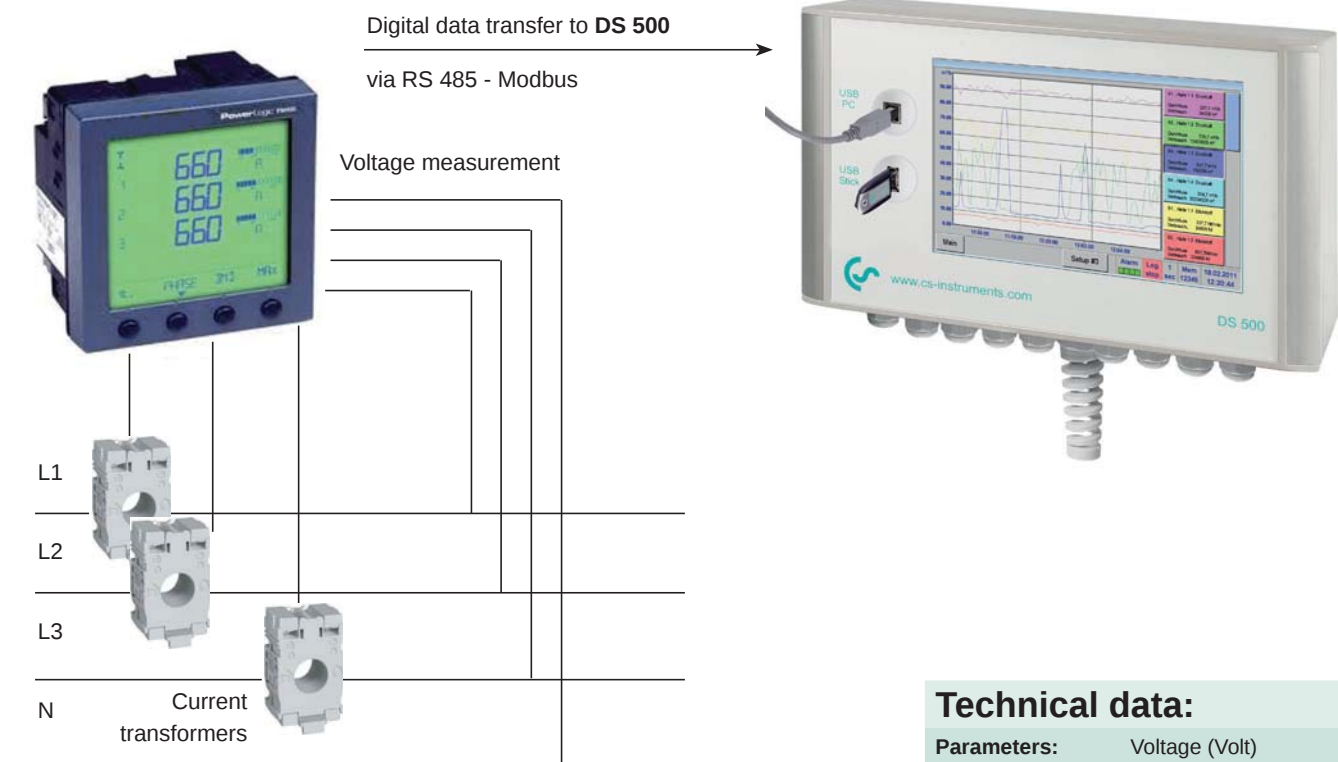
CS PM 210

Current/effective power meter for panel mounting

Measures voltage, current and calculates:

Active power	[kW]
Apparent power	[kVA]
Reactive power	[kVar]
Active energy	[kWh]
cos phi	

All measured data are transferred digitally (Modbus) to DS 500 and can be recorded there.



Technical data:

Parameters:	Voltage (Volt) Current (Ampere) Cos phi Active power (kW) Apparent power (kVA) Reactive power (kVar) Active energy (kWh) Supply frequency (Hz) All parameters are transferred digitally to DS 500
Accuracy current measurement:	± 0,5% of 1 to 6 A
Accuracy voltage:	± 0,5% of 50 V to 277 V
Accuracy active energy:	IEC 62053-21 Class 1
Interfaces:	RS 485 (Modbus protocol)
Measuring range:	Voltage measurement max. 480 Volt
Dimensions:	96 x 96 x 69 mm (W x H x D)
Operating temperature:	-5...+55°C

Description	Order No.
CS PM 210 current/effective power meter for panel mounting, current transformer from 100 A to 2000 A connectable	0554 5353
Current transformer 100/5 A connectable to current/effective power meter for panel mounting (for cables up to Ø 21 mm)	0554 5344
Current transformer 200/5 A connectable to current/effective power meter for panel mounting (for cables up to Ø 21 mm)	0554 5345
Current transformer 300/5 A connectable to current/effective power meter for panel mounting (for cables up to Ø 22 mm)	0554 5346
Current transformer 500/5 A connectable to current/effective power meter for panel mounting (for cables up to Ø 22 mm)	0554 5347
Current transformer 600/5 A connectable to current/effective power meter for panel mounting (for cables up to Ø 22 mm)	0554 5348
Current transformer 1000/5 A connectable to current/effective power meter for panel mounting (for current bar up to 65 x 32 mm)	0554 5349
Current transformer 2000/5 A connectable to current/effective power meter for panel mounting (for current bar up to 127 x 38 mm)	0554 5350
Connection cable to DS 500, 5 m, with open ends	0553 0108
Connection cable to DS 500, 10 m, with open ends	0553 0109



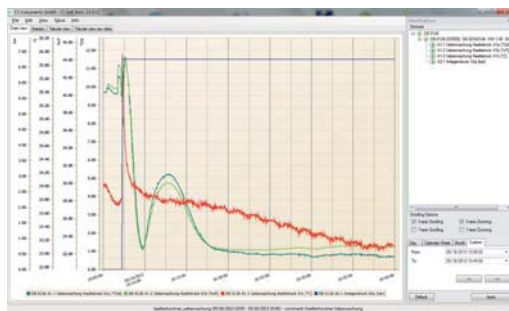
Software

CS Soft Basic - evaluation of measured data for single computers



The measured data stored in the data logger integrated in DS 500 can be read-out via USB stick.

If DS 500 has the optional Ethernet interface the measured data can also be read-out over big distances via the computer network



• • Graphic evaluation

All measurement curves are indicated in different colors. All necessary functions like free zoom, selection/deselection of single measured curves, free selection of time periods, scaling of the axis, selection of colors and so on are integrated:

This view can be stored as a pdf file and sent by e-mail. Different data can be merged in one million file.

• • Table view

All measured points are listed with the exact time interval. The desired measuring channels with the measuring site name can be selected via the diagram explorer.

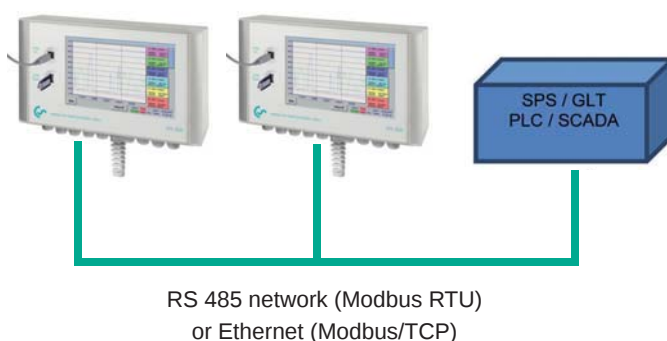
Statistics

All necessary statistics data are apparent at a glance. So the user can quickly see which minimum or maximum measured values occurred at which time and for how long.

• • Energy and flow evaluation

The software carries out on energy and flow analysis for all connected flow sensors optionally as daily, weekly or monthly report.

Connection to Bus system



With the „Ethernet / RS 485 - interface“ DS 500 can be connected to customer-owned Bus system (e.g. PLC, building management system BMS, central control system, SCADA,...).

The measured values of all sensors can be retrieved via Modbus protocol. A detailed protocol description is enclosed with each DS 500 instrument. When using the Ethernet interface the IP address at DS 500 can be freely adjusted. As an alternative DS 500 waits for the address allocation by a DHCP server.



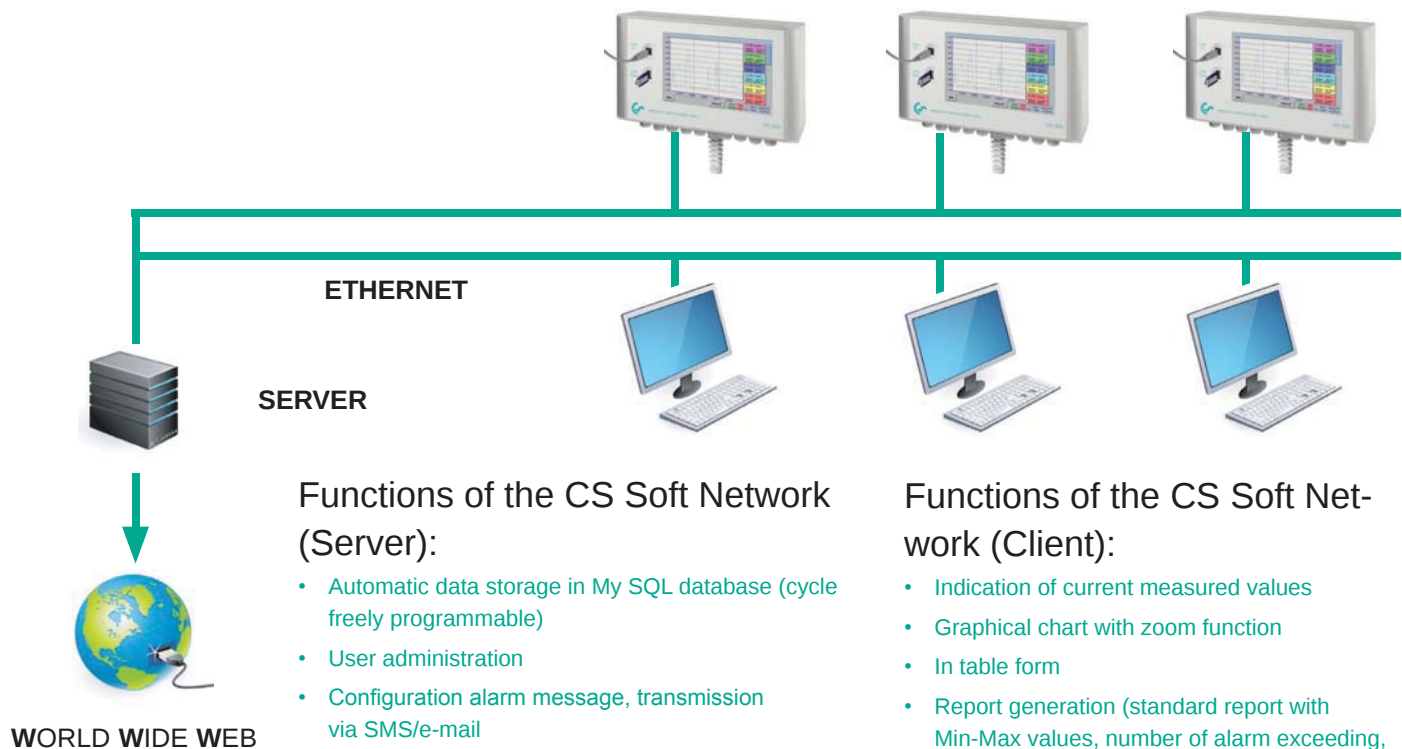
Chart recorder

CS Soft Network - Evaluation of the measured data for several computers in the network

By means of the CS Soft Network an optional number of DS 500/ DS 400 instruments can be evaluated via Ethernet. The software stores the measured data of all DS 500 / DS 400 cyclically (cycle freely selectable) in a SQL database on

the server. In case of an exceeding of the stored alarm values the software automatically sends an SMS or an e-mail. Furthermore, different user levels can be defined in the server software so that single staff members only can access the measured

data of certain DS 500 / DS 400. The evaluation of the measured data can be carried out by means of the client software from each PC within the company.

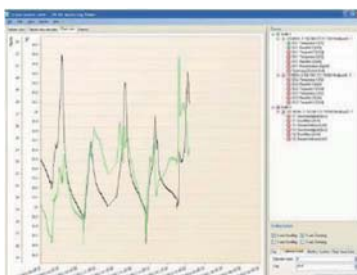


Functions of the CS Soft Network (Server):

- Automatic data storage in My SQL database (cycle freely programmable)
- User administration
- Configuration alarm message, transmission via SMS/e-mail
- Configuration backup generation

Functions of the CS Soft Network (Client):

- Indication of current measured values
- Graphical chart with zoom function
- In table form
- Report generation (standard report with Min-Max values, number of alarm exceeding, moment of alarm exceeding)
- Automatic consumption report



Graphical chart with zoom function

- Selection of the measuring channels to be indicated
- Easy zoom in and zoom out
- Up to 8 y-axis
- Quick access to day, week, month view



View: Current measurement values

- Load background image
- Place/fix window with measurement values
- Red measurement values in case of alarm exceeding

Channel	Unit	Description	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Okt	Nov	Dez	Total
CS-COMP (DS500)															
A3 VA 420 SDI	m³	start count	9.560	18.440	26.550	34.502	43.201	50.458	59.988	67.313	75.412	83.254	89.421	98.451	
	m³	end count	18.440	26.550	34.502	43.201	50.458	59.988	67.313	75.412	83.254	89.421	98.451	107.513	
	m³	total	8.880	8.110	7.952	8.699	7.257	9.530	7.325	8.099	7.842	6.167	9.030	9.062	97.953
	m³/h	average	17,6	16,1	15,8	17,3	15,8	18,9	14,5	16,1	15,6	12,2	17,9	18,0	16,2
	m³/h	min	3,5	3,5	3,7	3,7	3,7	3,8	3,9	3,9	3,9	3,9	3,9	3,9	
	m³/h	max	37,7	38,0	38,5	35,1	35,8	36,1	37,2	37,1	36,8	37,3	37,5	37,5	
	Euro	costs	133	122	119	130	109	143	110	121	118	93	135	136	1.469 €
	m³	start count	24.750	57.002	87.541	113.245	113.245	138.451	167.865	195.354	219.874	248.798	279.477	312.313	
	m³	end count	57.002	87.541	113.245	113.245	138.451	167.865	195.354	219.874	248.798	279.477	312.313	345.554	

Consumption analysis (in connection with option "consumption report")



Webserver

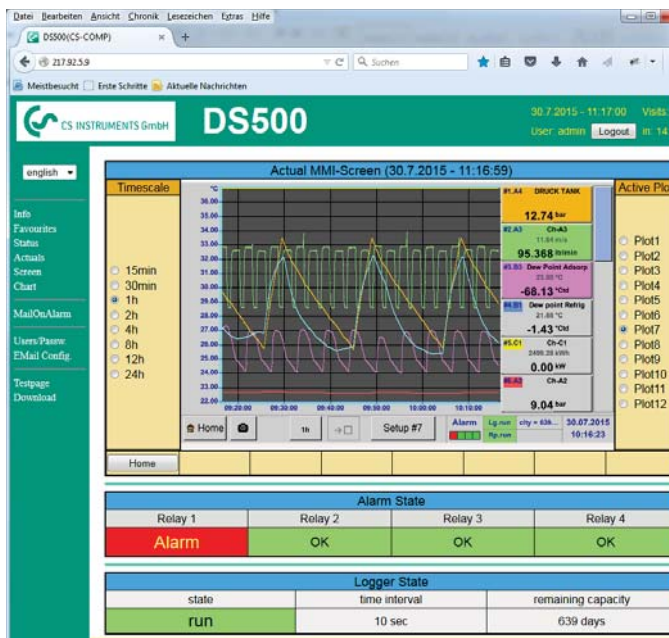
The new webserver with extended features for the chart recorders DS 500 and DS 400 is available with immediate effect. Users can get direct access to their measuring values worldwide (current and historic measuring values) and display the measuring values on their smart phone, tablet or computer. For monitoring of threshold values users can receive an automated „alarm E-mail“.

The new webserver can be ordered as an option with each stationary DS 500/400, but also for their mobile counterparts. For using the features of the webserver, the DS 500/400 must be set up with it's own IP address within the network.

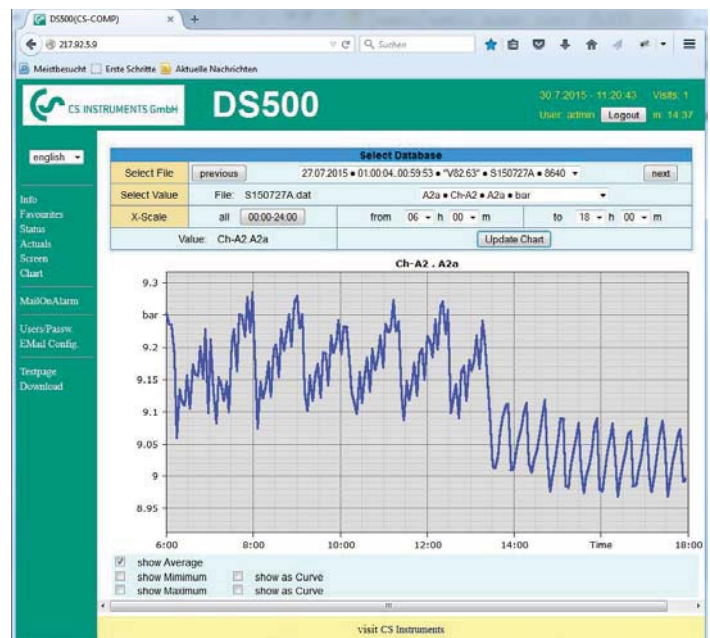
The webserver provides a website, which displays the measuring values. This website can be accessed from any web browser on each smart phone, tablet or computer via it's unique IP address. This is all possible without the installation of any new or additional software.



View of the real time measuring values (graphic and table view)



View of the historic measuring values as a single chart (time period freely selectable)



Automated „alarm e-mail“ for threshold value exceedance:

Access authorization

Different groups with different users/passwords can be assigned to different access levels.

Starting the data logger

In case of a stopped data logger the group operator or administrator can start the data logger remotely, via the web server.

PS: The new webserver can be retro fitted to any DS 500/ DS 400 already in use.



DS 500 mobile

Intelligent mobile chart recorder

The intelligent mobile chart recorder - energy analysis according to DIN EN ISO 50001

**Energy analysis - flow 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 connectable 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 m³ air
- kWh/m³ generated air
- flow of single lines including summation

Easy & intuitional
in its operation
Saves time & costs
on installation



Technical Data DS 500 mobile - measurement of up to 12 compressors

Technical data DS 500 mobile

Case dimensions:	360 x 270 x 150 mm
Connections:	4 / 8 / 12 sensors and supply, 1 x RJ 45 Ethernet connection
Weight:	4.5 kg
Material:	diecast, front foil polyester, ABS
Sensor inputs:	4/8/12 sensor inputs for analogue and digital sensors; freely relocatable. See options - Digital CS sensors for dew point and flow with SDI interface FA/VA series, digital third-party sensors RS 485 / Modbus RTU. - Analogue CS Sensors for pressure, temperature, clamp-on ammeters preconfigured - Analogue third-party sensors 0/4...20 mA, 0...1/10/30V, pulse, Pt 100 / Pt 1000, KTY, counter
Voltage supply for sensor:	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 unit, each max. 24 VDC, 25 W
Interfaces:	USB stick, Ethernet / RS 485 Modbus RTU / TCP, SDI other bus systems on request, webserver optionally, GSM module
Memory card:	Memory size 4 GB SD Memory card
Voltage supply:	100...240 VAC / 50-60 Hz
Color display:	7" touch panel TFT transmissive graphics, curves statistics
Accuracy:	Please see sensor specifications
Operating temperature:	0...50°C
Storage temperature:	-20...70°C



Description	Order No.
Intelligent chart recorder DS 500 mobile, 4 sensor inputs	0500 5012
Intelligent chart recorder DS 500 mobile, 8 sensor inputs	0500 5013
Intelligent chart recorder DS 500 mobile, 12 sensor inputs	0500 5014
Option „integrated webserver“	Z500 5003
Option „energy and flow report“ statistics, daily/weekly/monthly report	Z500 5004
Option „mathematics calculation function“ for 4 freely selectable „virtual“ channels, (mathematical functions: addition, subtraction, division, multiplication)	Z500 5008
Option „Totalizer function for analogue signals“	Z500 5009
CS Soft Basic - data evaluation in graphic and table form, reading out of the measured data via USB or Ethernet	0554 7040
CS Soft Energy Analyzer for energy and leakage analysis of compressed air stations	0554 7050
Software Upgrade of the already existing CS Soft Basic to CS Soft Energy Analyzer	0554 7045
GSM module for data transfer via the GSM network (mobile network)	on request
Connection cable on mobile instruments, ODU / open ends, 5 m	0553 0501
Connection cable on mobile instruments, ODU / open ends, 10 m	0553 0502
Connection cable for VA/FA series on mobile instruments, ODU/M12, 5m	0553 1503
Extension cable for mobile instruments ODU/ODU, 10m	0553 0504
Connection cable for mobile current/effective power meter	0553 0506
Case of all sensors (dimensions: 500 x 360 x 120 x mm)	0554 6006

Input signals

Current signal	(0...20mA/4...20mA)
internal or external power supply	
Measuring range	0...20 mA
Resolution	0.0001 mA
Accuracy	± 0.03 mA ± 0.05 %
Input resistance	50 Ω
Voltage signal	(0...1 V)
Measuring range	0...1 V
Resolution	0.05 mV
Accuracy	± 0.2 mV ± 0.05 %
Input resistance	100 kΩ
Voltage signal	(0...10 V / 30 V)
Measuring range	0...10 V
Resolution	0.5 mV
Accuracy	± 2 mV ± 0.05 %
Input resistance	1 MΩ
RTD Pt 100	
Measuring range	-200...850°C
Resolution	0.1°C
Accuracy	± 0.2°C (-100...400°C) ± 0.3°C (further range)
RTD Pt 1000	
Measuring range	-200...850°C
Resolution	0.1°C
Accuracy	± 0.2° (-100...400°C)
Pulse	
Measuring range	min pulse length 100 µs frequency 0...1 kHz max. 30 VDC



Chart recorder

Intelligent mobile chart recorder **DS 500 mobile** energy analysis to DIN EN ISO 50001

If we talk about operational costs of compressed air plants we are actually talking about the energy cost 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 m³ air do you actually have? Which energy is grind 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 intelligent chart recorder **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





Flow sensors 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, CO₂, oxygen



Dew point sensors

- Extremely long-term stable
- Quick adaption time
- Large measuring range (-80° to +20° Ctd)
- For all driers: Desiccant driers, membrane driers, refrigeration driers
- 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 - 20 mA



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 - 400 A
0 - 1000 A



Clamp-on ammeters

- Mobile current/effective power meters with 32 A CEE 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 CEE 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 (100 A or 600 A)
- External magnetic measuring tips for measuring the voltage
- Measures KW, kWh, cos phi, kVar, kVA
- Data transfer **DS 500 mobile** via Modbus



Current/effective power meters

By means of the mobile chart recorder **DS 500 mobile**, all measuring data of a compressor station can be recorded, indicated and evaluated.

At **12 freely assignable sensor inputs** all our 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 I 0-1 V / 0-10 V / 0-30 V I Pt 100 (2- or 3-wire), Pt 1000 (2- or 3-wire), KTY I pulse outputs (e.g. of gas meters) frequency output I Modbus protocol.



Chart recorder

DS 400 mobile

Affordable, mobile chart recorder

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



- **Flow**
- **Pressure / Vacuum**
- **Temperature**
- **Moisture / Dew point**
- **Optional third-party sensors**

Internal rechargeable Li-Ion batteries,
approx. 8 h continuous operation



Your advantages at a glance

Easy and clear layout:

Very easy operation via 3.5" color display with touch panel

Versatile:

Up to 4 sensors/meters connectable also third-party sensors/meters including power supply

Reliable:

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

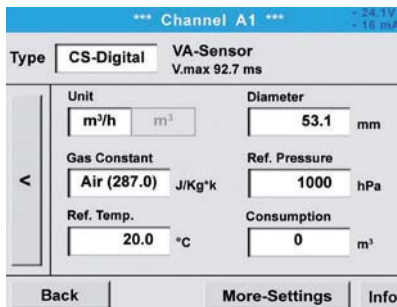
Intelligent energy analysis:

Daily/weekly/monthly evaluations mathematic function for internal calculations, e.g. the typical key data of a compressed air plant:

- costs in € per generated m³ air
- kWh/m³ generated air
- flow of single lines including summation

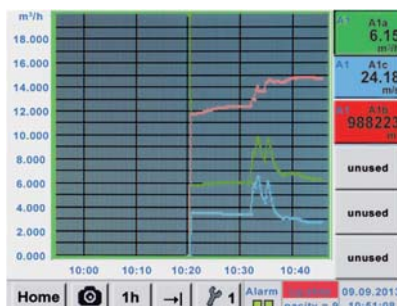


Easy operation via touch screen



Configuration of flow sensor

The flow sensor VA 500 can be adjusted to the respective inner diameter of the pipe in the menu of DS 400 mobile. Furthermore, the unit, the gas type as well as the reference conditions can be entered. The counter can be set to „zero“ if required.



Graphic view

In the graphic view all measured values are indicated as curves.

It is possible to browse back on the time axis by a slide of the finger (without data logger maximum 24 h, with data logger back to the start of the measurement).



Data logger

Measured values are stored in DS 400 mobile by means of the option „integrated data logger“. The time interval can be freely set. Furthermore there is the possibility to fix the starting time and the end time of the data recording. Reading-out of the measured data via USB interface or via the optional Ethernet interface.



Selection of the language

DS 400 „speaks“ several languages. The required language can be selected by means of the select button.



All relevant parameters at a glance

In addition to the flow in m³/h DS 400 mobile shows further parameters like the total flow in m³ and the velocity in m/s

Technical data DS 400 mobile

Dimensions:	270 x 225 x 156 mm (W x H x D)
Weight:	2.2 kg
Inputs:	2 x 2 sensor inputs for digital or analogue sensor signals
Interface:	USB (standard), Ethernet (optional)
Power supply:	Internal rechargeable Li-Ion batteries, approx 8 h continuous operation, 4 h charging time
Data logger:	100 million measuring values start/stop time, measuring rate freely adjustable
Options	
2 additional sensor inputs:	for connection of pressure sensors, temperature sensors, clamp-on ammeters, third-party sensors with 4...20 mA 0 to 10 V, Pt100, Pt1000

Input signals

Current signal	(0...20mA/4...20mA)
internal or external power supply	
Measuring range	0...20 mA
Resolution	0.0001 mA
Accuracy	± 0.03 mA ± 0.05 %
Input resistance	50 Ω
Voltage signal	(0...1 V)
Measuring range	0...1 V
Resolution	0.05 mV
Accuracy	± 0.2 mV ± 0.05 %
Input resistance	1 MΩ
Voltage signal	(0...10 V / 30 V)
Measuring range	0...10 V
Resolution	0.5 mV
Accuracy	± 2 mV ± 0.05 %
Input resistance	1 MΩ
RTD Pt 100	
Measuring range	-200...850°C
Resolution	0.1°C
Accuracy	± 0.2°C (-100...400°C) ± 0.3°C (further range)
RTD Pt 1000	
Measuring range	-200...850°C
Resolution	0.1°C
Accuracy	± 0.2°C (-100...400°C)
Pulse	
Measuring range	min pulse length 500 µs frequency 0...1 kHz max. 30 VDC



Chart recorder

Affordable, mobile chart recorder **DS 400 mobile**



Graphic display
with touch screen

USB stick



Up to 4 sensor inputs, including
voltage supply for all sensors



Description			Order No.
DS 400 - Mobile chart recorder with graphic display touch screen and integrated data logger	2 sensor inputs board 1	2 sensor inputs board 2	
	Digital (Z500 4003)	-----	0500 4012 D
	Digital (Z500 4003)	Digital (Z500 4003)	0500 4012 DD
	Digital (Z500 4003)	Analogue (Z500 4001)	0500 4012 DA
	Analogue (Z500 4001)	-----	0500 4012 A
	Analogue (Z500 4001)	Analogue (Z500 4001)	0500 4012 AA
Options			
Option: Integrated Ethernet			Z500 4004
Option: Integrated webserver			Z500 4005
Option: „Mathematics calculation function“ for 4 freely selectable channels, (virtual channels): addition, subtraction, division, multiplication			Z500 4007
Option: „Totalizer function for analogue signals“			Z500 4006
Further accessories			
CS Soft Basic - data evaluation in graphic and table form - reading out of the measured data via USB or Ethernet			0554 7040
CS Soft Energy Analyzer for energy and leakage analysis of compressed air stations			0554 7050
Connection cable on mobile instruments, ODU / open ends, 5 m			0553 0501
Connection cable on mobile instruments, ODU / open ends, 10 m			0553 0502
Connection cable for VA/FA series on mobile instruments, ODU/M12, 5m			0553 1503
Extension cable for mobile instruments ODU/ODU, 10m			0553 0504
Connection cable for mobile current/effective power meter			0553 0506
Case of all sensors (dimensions: 500 x 360 x 120 x mm)			0554 6006

Digital	Digital	Digital	Digital
m³/h, m³	°Ctd	A, kW/h	optional
			MOD-BUS
Flow sensor	Dew point sensor	Current meters	
			Third-party sensors with RS 485

Analogue	Analogue	Analogue	Analogue
bar	A	°C	°C
			4...20 mA 0...20 mA 0...10 V Pulse Pt 100 Pt 1000
Pressure sensor	Clamp-on ammeter	Temperature sensor	
			Third-party sensors analogue output



Digital	Digital	Analogue	Analogue
Flow sensors 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, CO2, oxygen 	Dew point sensors - Extremely long-term stable - Quick adaption time - Large measuring range (-80° to +20° Ctd) - For all driers: Desiccant driers, membrane driers, refrigeration driers - 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 400 mobile either via pulse signals or 4-20 mA 	 - 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 - 400 A 0 - 1000 A 	 - Mobile current/effective power meters with 32 A CEE 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 CEE plug - Measures kW, kWh, cos phi, kVar, kVA - Data transfer to DS 400 mobile via Modbus 	 - Mobile current/effective power meters with external current transformer for big machines and plants - External current transformers for clamping around the phases (100 A or 600 A) - External magnetic measuring tips for measuring the voltage - Measures kW, kWh, cos phi, kVar, kVA - Data transfer DS 400 mobile via Modbus 
Heat meters-/ water and gas meters	Clamp-on ammeters	Current/effective power meters	Current/effective power meters
Analogue	Analogue	Digital	Digital

By means of the chart recorder **DS 400 mobile**, all measuring data of a compressor station can be recorded, indicated, and evaluated.

At **digital sensor inputs** all sensors from us like flow sensor, dew point sensor, current/effective power meters and third-party sensors with Modbus RS 485 could be connected.

At **analogue sensor inputs** third party sensors and meters with the following signal output could be connected: 4-20 mA, 0-20 mA | 0-1 V / 0-10 V / 0-30 V | Pt 100 (2- or 3-wire), Pt 1000 (2- or 3-wire), KTY | pulse outputs (e.g. of gas meters) | frequency output | Modbus protocol.

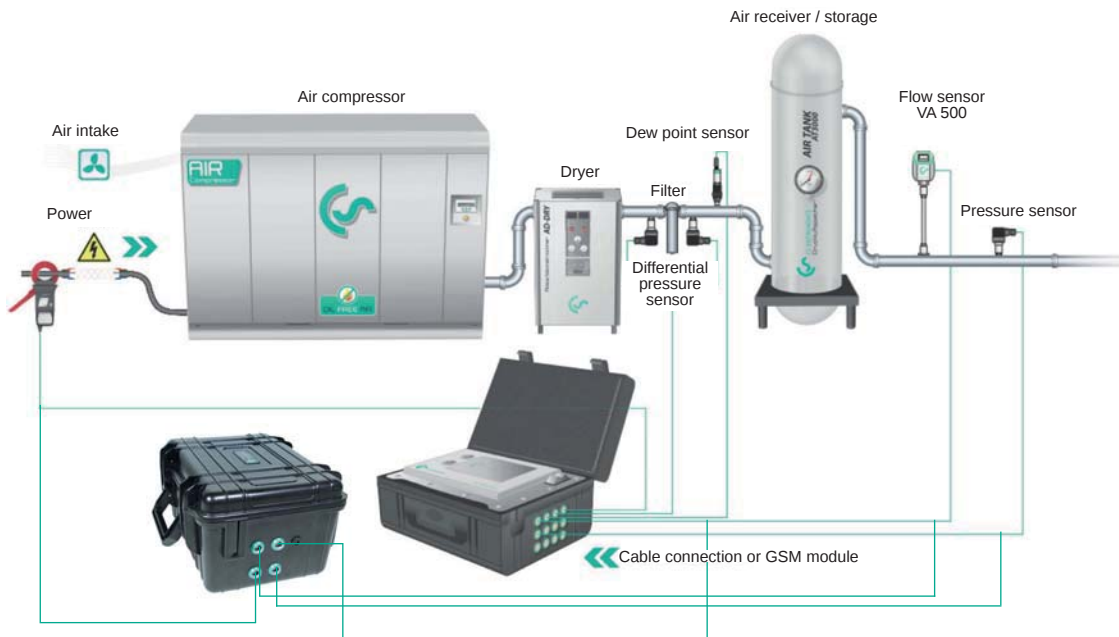


Chart recorder

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 calculated. 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 measure- ment and real flow 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 flow sensor VA 500.

With the additional „real flow 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 flow sensor VA 500 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

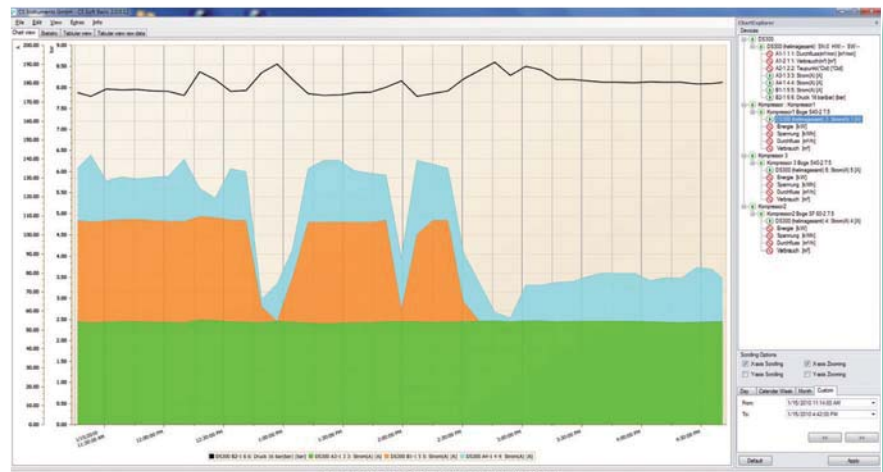
3.1 Entry of necessary parameters

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 1 kWh

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 cross lines 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/m³
- Costs for 1 m³ in €/ US\$

Analysis of Compressor-Energy and -Costs

Timespan: 1/12/2010 10:39 AM - 1/19/2010 9:44 AM
 Timespan in hours: 167.1
 Total flow rate: Sum of selected compressors
 Limit of leakage: 129.00

Tariff1: 6:00 AM - 7:59 PM
 0.15 Euro
 Tariff2: 8:00 PM - 6:00 AM
 0.11 Euro

Compressor	Capacity [h]			Switches	Energy				Flow				Costs [Euro]				Leakage				
	Load	Unload	Stop		Load / Unload	Load [kWh]	Unload [kWh]	Stop [kWh]	Spec. Power [kW/m³]	avg [m³/h]	max [m³/h]	Sum [m³]	Load	Unload	Stop	Sum	Costs per m³	avg [m³/h]	Sum [m³]	Costs [Euro]	
C1: Kompressor 1	30.8	0.1	136.2	11	19	995.81	1.48	0.08	997.38	0.126	51.44	279.00	7960.82	142.19	0.20	0.01	142.40	0.018	---	---	---
C2: Kompressor 3	34.2	0.5	112.4	33	57	1885.57	5.40	0.74	1891.77	0.118	90.40	279.00	14626.05	242.33	0.75	0.10	243.18	0.017	---	---	---
C3: Kompressor 2	118.0	0.7	47.4	69	69	2267.35	2.57	56.35	2326.27	0.093	351.68	414.19	24926.47	312.09	0.35	7.49	319.92	0.013	---	---	---
Summary	203.9	1.4	296.0	113	145	4948.74	9.51	57.17	5015.41	0.112	303.58	972.19	47453.35	696.61	1.29	7.59	705.50	0.016	9.38	1446.46	199.93



Suitable sensors for DS 500 mobile & DS 400 mobile

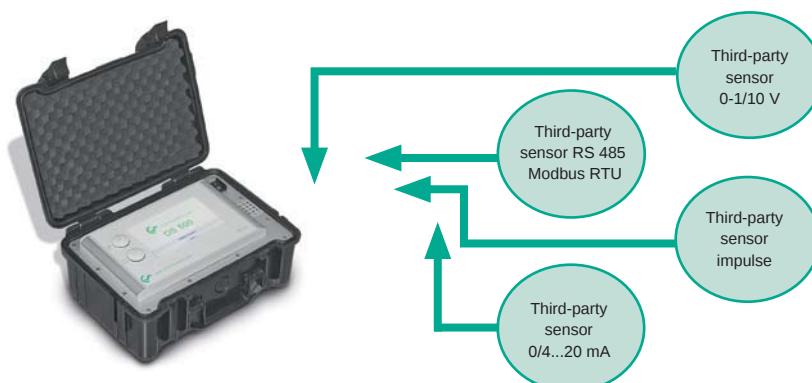
Flow sensors VA 500:	Order No.
Flow sensor VA 500-Max. Version (185 m/s) sensor length 220 mm, incl. 5 m cable to mobile instruments	0695 1124
Flow sensor VA 500 High-Speed Version (224 m/s), sensor length 220 mm, 5 m cable to mobile instruments	0695 1125
Options for VA 500: (see page 81)	
Flow measuring range VA 520 for compressed air:(ISO 1217: 1000 mbar, 20°C)	
Flow meter VA 520, 0,8... 90 l/min, (R 1/4" DN 8)	0695 0520
Flow meter VA 520, 0,2... 90 m³/h, (R 1/2" DN 15)	0695 0521
Flow meter VA 520, 0,3... 170 m³/h, (R 3/4" DN 20)	0695 0522
Flow meter VA 520, 0,5... 290 m³/h, (R 1" DN 25)	0695 0523
Flow meter VA 520, 0,7... 480 m³/h, (R 1 1/4" DN 32)	0695 0526
Flow meter VA 520, 1,0... 550 m³/h, (R 1 1/2" DN 40)	0695 0524
Flow meter VA 520, 2,0... 900 m³/h, (R 2" DN 50)	0695 0525
Dew point sensors:	
FA 510 dew point sensor for mobile instruments, -80...+20°Ctd, incl. mobile measuring chamber, 5 m cable and perforated cap	0699 1510
FA 510 dew point sensor for mobile instruments, -20...50°Ctd incl. mobile measuring chamber, 5 m cable and perforated cap	0699 1512
Connection cable for VA/FA sensors:	
Connection cable for VA/FA series on mobile instruments, ODU / M12, 5m	0553 1503
Extension cable, 10 m	0553 0504
Calibration certificates for flow / dew point sensors:	
5 point precision calibration for flow sensors including ISO certificate	3200 0001
Precision calibration at -40°Ctd including ISO certificate	0699 3396
Pressure sensors:	± 1 % accuracy of full scale
Standard pressure sensor CS 16 from 0...16 bar	0694 1886
Standard pressure sensor CS 40 from 0...40 bar	0694 0356
Standard pressure sensor CS 1.6 from 0...1.6 bar abs.	
Standard pressure sensor CS 10 from 0...10 bar	0694 3556
Standard pressure sensor CS 100 from 0...100 bar	
Standard pressure sensor CS 250 from 0...250 bar	
Standard pressure sensor CS 400 from 0...400 bar	
Precision pressure sensor CS -1...+15 bar, ± 0.5 % accuracy of full scale	
Precision differential pressure sensor CS 400, 0...400 mbar differential pressure, 0.075% accuracy of full scale, static pressure max. 40 bar	0694 3560
Pressure calibration certificate, 5 calibration points within the measuring range	3200 0004





Suitable sensors for DS 500 mobile & DS 400 mobile

Temperature sensors:	Order No.	
Bendable temperature probe PT 100 (2-wire) class A, length: 300 mm, d=3 mm, -70°C to +500°C, connection cable PFA, 2 m with ODU-plug (8 pole) to mobile instruments	0604 0200	
Screw-in temperature probe PT 100 class A, length: 300 mm, d=6mm, with integrated transducer 4...20 mA = -50°C...+500°C (2-wire)	0604 0201	
Cross-band surface temperature probe, thermocouple Type K, with integrated transducer 4...20 mA = 0°C...+180°C, 2 m connection cable (PVC) with ODU-plug (8-pole) to mobile instruments	0604 0202	
Temperature probe PT 100 class A (4-wire) with cable, length: 300 mm, d=6 mm, -70°C to +260°C, 5 m connection cable (PFA) with open ends	0604 0205	
Temperature probe PT 100 class A (4-wire) with cable, length: 100 mm, d=6 -70°C to +260°C, 5 m connection cable (PFA) with open ends	0604 0206	
Temperature probe PT 100 class A (4-wire) with cable, length: 200 mm, d=6 -70°C to +260°C, 5 m connection cable (PFA) with open ends	0604 0207	
Surface temperature probe, magnetic, magnet dimensions 39x26x25 mm, PT 100 class B (2-wire), -30 to +180°C, 5 m connection cable (PFA) with open ends	0604 0208	
Clamp screwing 6mm; G 1/2" PTFE clamp ring pressure tight up 10 bar material: stainless steel, temperature range: max. +260°C	0554 0200	
Clamp screwing 6mm; G 1/2" stainless steel clamp ring pressure tight up to 16 bar, material: stainless steel, temperature range: max. +260°C	0554 0201	
Temperature calibration certificate 2 measuring points	0520 0180	
Connection cables for pressure sensors / temperature sensors:		
Connection cable for pressure, temperature or external sensors on mobile instruments, ODU / open ends, 5 m	0553 0501	
Connection cable for pressure, temperature or external sensors on mobile instruments, ODU / open ends, 10 m	0553 0502	
Extension cable, 10 m	0553 0504	
Mounted Odu plug for connection on mobile instruments	Z604 0104	
Clamp-on ammeters:		
Clamp-on ammeter 0...400 A TRMS incl. 5 m connection cable	0554 0511	
Clamp-on ammeter 0...1000 A TRMS incl. 5 m connection cable	0554 0519	
Calibration certificate for clamp-on ammeter	0554 3333	
CS PM 600 Current/effective power meter up to 100 A	0554 5341	
CS PM 600 Current/effective power meter up to 600 A	0554 5342	
- Mobile current/effective power meter with 3 external current transducers for big machines and plants, - External current transformers for clamping on cables (100 or 600 A), - External magnetic measuring tips for measuring the voltage, - Measures kW, kWh, cos phi, kVar, KVA, - Data transfer for DS 500 mobile / DS 400 mobile via Modbus, incl. connection cable for mobile current/effective power meter to mobile instruments, 5 m		
Current transformer 100A/1A consisting of 3 transformers for mobile instruments	Z554 0001	
Current transformer 600A/1A consisting of 3 transformers for mobile instruments	Z554 0002	
Current transformer 1000A/1A consisting of 3 transformers for mobile instruments	Z554 0003	
Optional third-party sensors connectable:		
e.g. heat meters, current meters, gas meters, water meters and so on. To the 12 freely assignable sensor inputs all our sensors can be connected as well as optional third-party sensors and counters 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), Pt 1000 (2- or 3-wire), KTY pulse outputs (e.g. of gas counters) Frequency output Modbus protocol		





CS PM 600

Mobile current/effective power meter suitable for DS 500 mobile / DS 400 mobile

Measures voltage, current and calculates:

Active power	[kW]
Apparent power	[kVA]
Reactive power	[kVar]
Active energy	[kWh]
cos phi	

All measured data are transferred digitally (Modbus) to **DS 500 mobile/ DS 400 mobile** and can be recorded there.



Example: Measurement at a compressor



Magnetic voltage measuring tips electrically isolated

Hinged current transformers

Special features:

- Magnetic voltage measuring tips for measuring the voltage during operation
- Hinged current transformers encompass the conductors of the phases L1, L2, L3. This can also be done during operation



Technical data:

Parameters:	Voltage (Volt) Current (Ampere) Cos phi Active power (kW) Apparent power (kVA) Reactive power (kVar) Active energy (kWh) Supply frequency (Hz) All parameters are transferred digital to DS 500 mobile / DS 400 mobile
Accuracy current measurement:	Threshold values for current deviation. Loss angle according to IEC 60044-1. Current deviation in % at rated current in 120 % 1 100 % 1 20 % 1,5 5 % 3
Accuracy active energy:	IEC 62053-21 Class 1
Sensor connections:	3 x current transformers (L1,L2,L3,N) 4 x voltage measurement (L1,L2,L3,N)
Interfaces:	RS 485 (Modbus protocol)
Measuring range:	Voltage measurement max. 400 Volt Current measurement max. 100 A resp. 600 A
Size current transformer:	100 A / 1 A (max. 24 mm conductor) 600 A / 1 A (max. 36 mm conductor)
Dimensions case:	270 x 225 x 156 mm (W x H x D)
Operating temperature:	- 10...+40°C

Description	Order No.
CS PM 600 current/effective power meter up to 100 A	0554 5341
CS PM 600 current/effective power meter up to 600 A	0554 5342
• Mobile current effective power meter with 3 external current transformers for big machines and plants • External current transformers for clamping around the phases (100 A or 600 A) • External magnetic measuring tip for measuring the voltage • measures kW, kWh, cos, phi, kVar, kVA • Data transfer to DS 500 mobile / DS 400 mobile via Modbus • Incl. connection cable for mobile current/effective power meter to mobile instruments, 5 m	
Current transformer 100A/1A consisting of 3 transformers for mobile instruments	Z554 0001
Current transformer 600A/1A consisting of 3 transformers for mobile instruments	Z554 0002
Current transformer 1000A/1A consisting of 3 transformers for mobile instruments	Z554 0003



CS PM 210

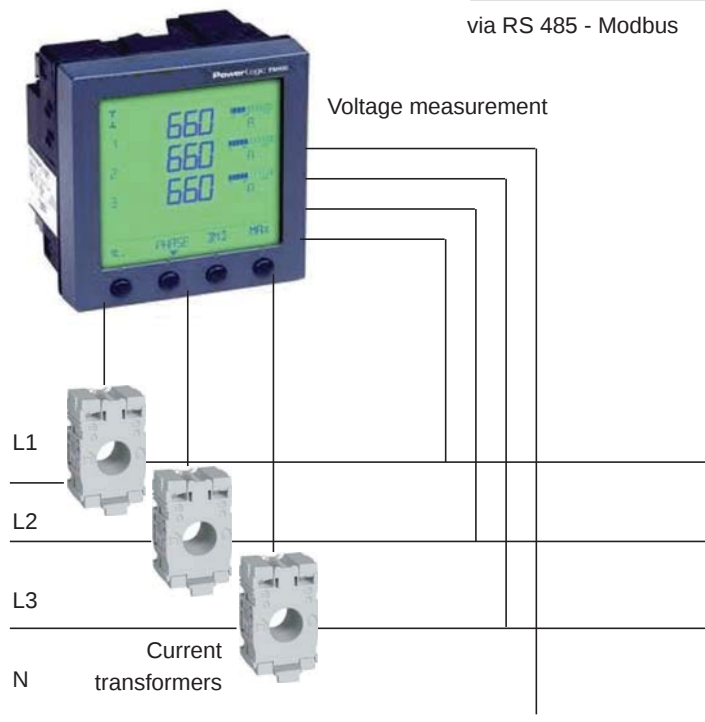
Current/ effective power meter for panel mounting

Measures voltage, current and calculates:

Active power [kW]
Apparent power [kVA]
Reactive power [kVar]
Active energy [kWh]
cos phi

All measured data are transferred digitally (Modbus) to **DS 500 mobile/ DS 400** mobile and can be recorded there.

Digital data transfer to **DS 500/ DS 400 mobile**
via RS 485 - Modbus



Description	Order No.
CS PM 210 current/effective power meter for panel mounting, current transformer from 100 A to 2000 A connectable	0554 5353
Current transformer 100/5 A connectable to current/effective power meter for panel mounting (for cables up to Ø 21 mm)	0554 5344
Current transformer 200/5 A connectable to current/effective power meter for panel mounting (for cables up to Ø 21 mm)	0554 5345
Current transformer 300/5 A connectable to current/effective power meter for panel mounting (for cables up to Ø 22 mm)	0554 5346
Current transformer 500/5 A connectable to current/effective power meter for panel mounting (for cables up to Ø 22 mm)	0554 5347
Current transformer 600/5 A connectable to current/effective power meter for panel mounting (for cables up to Ø 22 mm)	0554 5348
Current transformer 1000/5 A connectable to current/effective power meter for panel mounting (for current bar up to 65 x 32 mm)	0554 5349
Current transformer 2000/5 A connectable to current/effective power meter for panel mounting (for current bar up to 127 x 38 mm)	0554 5350
Connection cable for pressure, temperature or external sensors on mobile instruments, ODU / open ends, 5 m	0553 0501
Connection cable for pressure, temperature or external sensors on mobile instruments, ODU / open ends, 10 m	0553 0502

Technical data:

Parameters:	Voltage (Volt) Current (Ampere) Cos phi Active power (kW) Apparent power (kVA) Reactive power (kVar) Active energy (kWh) Supply frequency (Hz) All parameters are transferred digitally to DS 500 mobile/ DS 400 mobile
Accuracy current measurement:	± 0,5% of 1 to 6 A
Accuracy voltage:	± 0,5% of 50 V to 277 V
Accuracy active energy:	IEC 62053-21 Class 1
Interfaces:	RS 485 (Modbus protocol)
Measuring range:	Voltage measurement max. 480 Volt
Dimensions:	96 x 96 x 69 mm (W x H x D)
Operating temperature:	-5...+55°C



PI 500

Hand-held instrument for industry

The new PI 500 is an all-purpose hand-held measuring instrument for many applications in industry like e. g.:

- **Flow measurement**
- **Pressure/vacuum measurement**
- **Temperature measurement**
- **Moisture/dew point measurement**

The graphic indication of colored measurement curves is inimitably.

Up to 100 million measured values can be stored with date and name of measuring site. The measured values can be transferred to the computer by means of a USB stick.

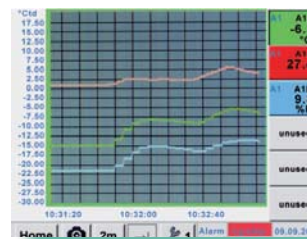
The data can be comfortably evaluated

with the CS Soft Basic software. Measured data and service reports can be issued easily and quickly. The following sensors can be connected to the freely configurable sensor input of PI 500:

- Pressure sensor (high and low pressure)
- Flow sensors, VA 500/520
- Temperature sensors Pt 100, Pt 1000 / 4...20 mA
- Dew point sensors FA 510
- Effective power meters
- Optional third-party sensors with the following signals: 0...1/10 V, 0/4...20 mA, Pt 100, Pt 1000, pulse, Modbus

Special features:

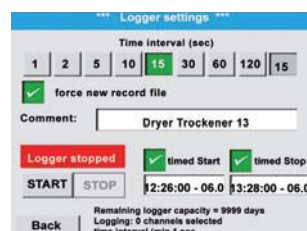
- **Universal sensor input for lots of common sensor signals**
- **Internal rechargeable Li-Ion batteries (approx. 12h continuous operation)**
- **3.5" graphic display / easy operation via touch screen**
- **Integrated data logger for storage of the measured values**
- **USB interface for reading out via USB stick**
- **International: Up to 8 languages selectable**



Measurement curves are indicated graphically and thus the user can see at a glance the behavior of the dryer since the start of the measurement.



All physical parameters of moisture measurement are calculated automatically.



It is possible to store up to 100 million measured values. Each measurement can be stored with a comment, e.g. measuring site name. The time interval can be freely determined.



PI 500

Flexible data recording and transfer via USB cable or USB stick



← integrated
USB interface



The stored measured data can be easily transferred to the computer via a USB stick or via a USB cable.

The time periods are freely selectable or you just read out the whole memory.

The data can be evaluated by means of the software CS Soft Basic in table and in graphic form.

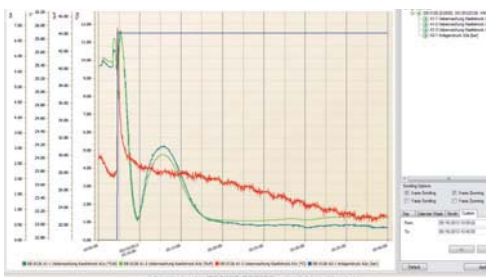
World debut screen shot key

Ideal for documentation of the measured values/measurement curves on site. Colored measurement curves can be sent by e-mail or integrated into a service report.

By means of the screen shot key the „current screen“ can be stored as an image file and printed out at the computer or edited without any additional software.

Data evaluation in 5 languages by means of CS Soft Basic

Everything at a glance: Table, graph, statistics - at the touch of a button the user gets all necessary information.



Graphic evaluation

All measurement curves are indicated in terms of color. All necessary functions such as zoom, selection/deselection of single measurement curves, freely selectable time periods, scaling of the axis, selection of colors and so on are integrated:

This view can be stored as a pdf file and sent by e-mail. Different data can be consolidated to a common file.

Time	DE-0126 (D5500) A1-1 Lieberwachung Kaelletrack A1a [°C]	DE-0126 (D5500) A1-2 Lieberwachung Kaelletrack A1a [°C]	DE-0126 (D5500) A1-3 Lieberwachung Kaelletrack A1a [°C]	DE-0126 (D5500) A1-4 Lieberwachung Kaelletrack A1a [°C]
05/16/2013 10:07:20	10.1300	37.4600	25.7200	6.7700
05/16/2013 10:07:25	9.3700	38.4600	25.3050	6.7600
05/16/2013 10:07:30	11.2000	42.0000	25.0100	6.7600
05/16/2013 10:07:35	11.5500	43.7400	24.7100	6.7600
05/16/2013 10:07:40	11.6000	44.3200	24.5500	6.7600
05/16/2013 10:07:45	11.3350	43.6600	24.4050	6.7600
05/16/2013 10:07:50	10.9200	43.0000	24.2000	6.7600

Table view

All measuring points are listed with exact time interval. The desired measuring channels with measuring site name can be selected via the diagram explorer.

Statistic Report						
Timespan: 05/16/2013 10:05-05/16/2013 10:40						
DE-0126						
DE-0126 (D5500)						
Stat	Value	Unit	Received	Unit of axis	Pos	Unit of axis
1	DE-0126 (D5500) A1-1 Lieberwachung Kaelletrack A1a	°C	11.60	°C	05/16/2013 10:07:40	05/16/2013 10:07:40
2	A1-2 Lieberwachung Kaelletrack A1a	°C	25.524	°C	05/16/2013 10:07:40	05/16/2013 10:07:40
3	A1-3 Lieberwachung Kaelletrack A1a	°C	23.551	°C	05/16/2013 10:07:40	05/16/2013 10:07:40
4	A1-4 Lieberwachung Kaelletrack A1a	°C	6.768	°C	05/16/2013 10:07:40	05/16/2013 10:07:40

Statistics

All necessary statistic data are visible at a glance.

So the user can quickly see which minimum or maximum measured values occurred at which time and for how long.



PI 500

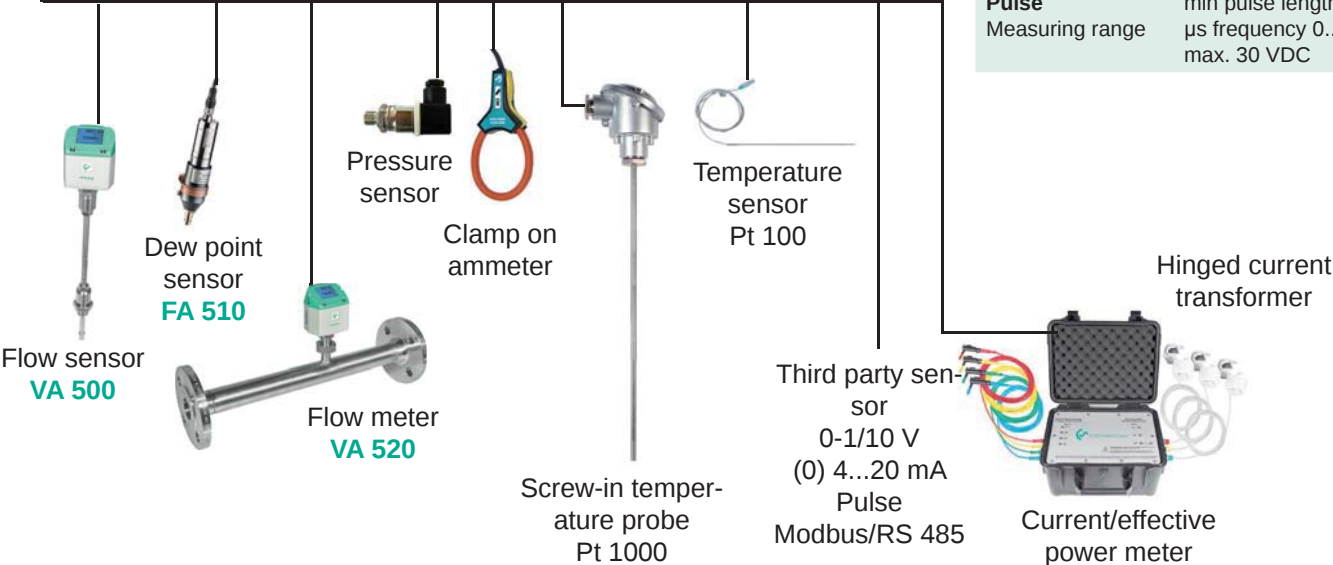
Hand-held instrument with large range of sensors



Description	Order No.
PI500 portable measuring instrument with integrated data logger, incl. power supply	0560 0511
Option for PI 500: "mathematics calculation function" for 4 freely select-able „virtual“ channels	Z500 5107
Option for PI 500: „Totalizer function for analogue signals“	Z500 5106
CS Soft Basic - data evaluation in graphic and table form - reading out of the measured data via USB	0554 7040
Transportation case	0554 6510

Technical data PI 500:	
Color screen:	3.5"-Touchpanel TFT transmissive, graphics, curves, statistics
Interfaces:	USB
Power supply for sensors:	Output voltage: 24 VDC $\pm$ 10% Output current: 120 mA continuous operation
Current supply:	Internal rechargeable Li-Ion batteries charging time approx. 4 h PI 500 operation: > 4h depending on current consumption of external sensors
Power supply unit:	100 - 240 VAC/50 - 60 Hz, 12 VDC - 1A Safety class 2, only for application in dry rooms
Dimension:	82 x 96 x 245 mm
Material:	Plastic PC/ABS
Weight:	450 g
Operating temperature:	-20...70°C measuring gas temperature 0...50°C ambient temperature
Storage temperature:	-20 to +70°C
EMC:	DIN EN 61326
Sensor inputs:	for connection of pressure sensors, temperature sensors, clamp-on ammeters, third party sensors with 4...20mA, 0-10 V, Pt 100, Pt 1000
Memory size:	4 GB - SD memory card standard

Input signals	
Current signal	(0...20mA/4...20mA)
internal or external power supply	
Measuring range	0...20 mA
Resolution	0.0001 mA
Accuracy	$\pm$ 0.03 mA $\pm$ 0.05 %
Input resistance	50 Ω
Voltage signal	(0...1 V)
Measuring range	0...1 V
Resolution	0.05 mV
Accuracy	$\pm$ 0.2 mV $\pm$ 0.05 %
Input resistance	1 M Ω
Voltage signal	(0...10 V / 30 V)
Measuring range	0...10 V
Resolution	0.5 mV
Accuracy	$\pm$ 2 mV $\pm$ 0.05 %
Input resistance	1 M Ω
RTD Pt 100	
Measuring range	-200...850°C
Resolution	0.1°C
Accuracy	$\pm$ 0.2°C (-100...400°C) $\pm$ 0.3°C (further range)
RTD Pt 1000	
Measuring range	-200...850°C
Resolution	0.1°C
Accuracy	$\pm$ 0.2° (-100...400°C)
Pulse	min pulse length 500 μ s frequency 0...1 kHz max. 30 VDC





Suitable sensors for PI 500

Flow sensors VA 500:		Order No.
Flow sensor VA 500 Max. Version (185 m/s) sensor length 220 mm, incl. 5 m cable to mobile instruments		0695 1124
Flow sensor VA 500 High-Speed Version (224 m/s), sensor length 220 mm, 5 m cable to mobile instruments		0695 1125
Options for VA 500: (see page 81)		
Flow measuring range VA 520 for compressed air: (ISO 1217: 1000 mbar, 20°C)		
Flow meter VA 520, 0,8... 90 l/min, (R 1/4" DN 8)		0695 0520
Flow meter VA 520, 0,2... 90 m³/h, (R 1/2" DN 15)		0695 0521
Flow meter VA 520, 0,3... 170 m³/h, (R 3/4" DN 20)		0695 0522
Flow meter VA 520, 0,5... 290 m³/h, (R 1" DN 25)		0695 0523
Flow meter VA 520, 0,7... 530 m³/h, (R 1 1/4" DN 32)		0695 0526
Flow meter VA 520, 1,0... 730 m³/h, (R 1 1/2" DN 40)		0695 0524
Flow meter VA 520, 2,0... 1195 m³/h, (R 2" DN 50)		0695 0525
Dew point sensors:		
FA 510 dew point sensor for mobile instruments, -80...+20°Ctd, incl. mobile measuring chamber, 5 m cable and perforated cap		0699 1510
FA 510 dew point sensor for mobile instruments, -20...+50°Ctd, incl. mobile measuring chamber, 5 m cable and perforated cap		0699 1512
Connection cable for VA/FA sensors:		
Connection cable for VA/FA series on mobile instruments, ODU / M12, 5m		0553 1503
Extension cable for mobile instruments ODU/ODU, 10m		0553 0504
Calibration certificate for flow / dew point sensors:		
5 point precision calibration with ISO certificate		3200 0001
Precision calibration at -40 °Ctd incl. ISO certificate		0699 3396
Pressure sensors:		
	± 1 % accuracy of full scale	± 0,5 % accuracy of full scale
Standard pressure sensor CS 16 from 0...16 bar	0694 1886	0694 3555
Standard pressure sensor CS 40 from 0...40 bar	0694 0356	0694 3930
Standard pressure sensor CS 1.6 from 0...1.6 bar abs.		0694 3550
Standard pressure sensor CS 10 from 0...10 bar	0694 3556	0694 3554
Standard pressure sensor CS 100 from 0...100 bar		0694 3557
Standard pressure sensor CS 250 from 0...250 bar		0694 3558
Standard pressure sensor CS 400 from 0...400 bar		0694 3559
Precision pressure sensor CS -1...+15 bar, ±0.5 % accuracy of full scale		0694 3553
Precision differential pressure sensor CS 400, 0...400 mbar differential pressure, 0.075% accuracy of full scale, static pressure max. 40 bar	0694 3560	
Calibration of pressure sensor 5 points between 0 and 10/16 bar	3200 0004	
Temperature sensors:		
Bendable temperature probe PT 100 (2-wire) class A, length: 300 mm, d=3 mm, -70°C to +500°C, connection cable PFA, 2 m with ODU-plug (8 pole) to mobile instruments	0604 0200	
Screw-in temperature probe PT 100 class A, length: 300 mm, d=6mm, with integrated transducer 4...20 mA = -50°C...+500°C (2-wire)	0604 0201	
Cross-band surface temperature probe, thermocouple Type K, with integrated transducer 4...20 mA = 0°C...+180°C, 2 m connection cable (PVC) with ODU-plug (8-pole) to mobile instruments	0604 0202	
Temperature probe PT 100 class A (4-wire) with cable, length: 300 mm, d=6 mm, -70°C to +260°C, 5 m connection cable (PFA) with open ends	0604 0205	
Temperature probe PT 100 class A (4-wire) with cable, length: 100 mm, d=6 -70°C to +260°C, 5 m connection cable (PFA) with open ends	0604 0206	
Temperature probe PT 100 class A (4-wire) with cable, length: 200 mm, d=6 -70°C to +260°C, 5 m connection cable (PFA) with open ends	0604 0207	
Surface temperature probe, magnetic, magnet dimensions 39x26x25 mm, PT 100 class B (2-wire), -30 to +180°C, 5 m connection cable (PFA) with open ends	0604 0208	
Clamp screwing 6mm; G 1/2" PTFE clamp ring pressure tight up 10 bar material: stainless steel, temperature range: max. +260°C	0554 0200	
Clamp screwing 6mm; G 1/2" stainless steel clamp ring pressure tight up to 16 bar, material: stainless steel, temperature range: max. +260°C	0554 0201	
Temperature calibration certificate 2 measuring points	0520 0180	





Suitable sensors for PI 500

Connection cables for pressure sensors / temperature sensors:	Order No.
Connection cable for pressure, temperature or external sensors on mobile instruments, ODU / open ends, 5 m	0553 0501
Connection cable for pressure, temperature or external sensors on mobile instruments, ODU / open ends, 10 m	0553 0502
Extension cable for mobile instruments, ODU / ODU, 10 m	0553 0504
Mounted Odu plug for connection on mobile instruments	Z604 0104
Clamp-on ammeters:	
Clamp-on ammeter 0...400 A TRMS incl. 5 m connection cable	0554 0511
Clamp-on ammeter 0...1000 A TRMS incl. 5 m connection cable	0554 0519
Calibration certificate for clamp-on ammeter	0554 3333
CS PM 600 Current/effective power meter up to 100 A	0554 5341
CS PM 600 Current/effective power meter up to 600 A	0554 5342
Mobile current/effective power meter with 3 external current transducers for big machines and plants xternal current transformers for clamping on cables (100 or 600 A) External magnetic measuring tips for measuring the voltage Measures kW, kWh, cos phi, kVar, kVA Data transfer to PI 500 via Modbus Incl. connection cable for mobile current/effective power meter to mobile instruments, 5 m	
Current transformer 100A/1A consisting of 3 transformers for mobile instruments	Z554 0001
Current transformer 600A/1A consisting of 3 transformers for mobile instruments	Z554 0002
Current transformer 1000A/1A consisting of 3 transformers for mobile instruments	Z554 0003
Optional third-party sensors connectable:	
e.g. heat meters, current meters, gas meters, water meters and so on. To the freely assignable sensor input all our sensors can be connected as well as optional third-party sensors and counters with the following signal outputs: 4-20 mA, 0-20 mA I 0-1 V / 0-10 V / 0-30 V I Pt100 (2- or 3-wire), Pt 1000 (2- or 3-wire), KTY I pulse outputs (e.g. of gas counters) I Frequency output I Modbus protocol	



Application: **Portable flow measurement** in production in front of machines and plants





Set for dryer monitoring



° Ctd

bar

°C

1 PI 500 portable measuring instrument with integrated data logger, incl. power supply	0560 0511
2 FA 510 dew point sensor for mobile instruments, -80...+20°Ctd incl. mobile measuring chamber, 5 m cable	0699 1510
3 Standard Pressure sensor CS 16 from 0...16 bar, ± 1 % accuracy of full scale	0694 1886
4 Connection cable for pressure, temperature or external sensors to portable instruments, ODU / open ends, 5 m	0553 0501
5 Bendable temperature probe Pt100 Class B, length 300 mm, Ø 3 mm, -70...+500°C, 2 m probe connection cable glass fibre/stainless steel with ODU plug 8 pole for portable instruments	0604 0200
6 CS Soft Basic - data evaluation in graphic and table form - reading out of the measured data via USB	0554 7040
7 Transportation case	0554 6510

Set for portable flow measurement



m³/h

1 PI 500 portable measuring instrument with integrated data logger, incl. power supply	0560 0511
2 Flow meter VA 520, 0,3... 170 m³/h, (R3/4" DN 20)	0695 0522
3 Connection cable for VA/FA Series on mobile instruments, ODU / M12, 5 m	0553 1503
4 CS Soft Basic - data evaluation in graphic and table form - reading out of the measured data via USB	0554 7040
5 Transportation case	0554 6510



Chart recorder

Standard set compressed air



m³/h

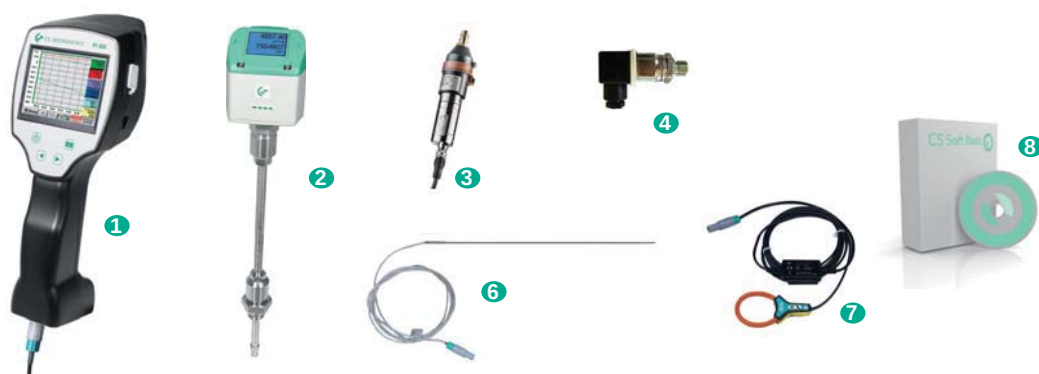
°Ctd

bar

°C

1 PI 500 portable measuring instrument with integrated data logger, incl. power supply	0560 0511
2 Flow sensor VA 500 Max. Version (185 m/s) sensor length 220 mm, incl. 5 m cable to portable instruments	0695 1124
3 FA 510 dew point sensor for mobile instruments, -80...+20°Ctd incl. mobile measuring chamber, 5 m cable	0699 1510
4 Standard Pressure sensor CS 16 from 0...16 bar, ± 1 % accuracy of full scale	0694 1886
5 Connection cable for pressure, temperature or external sensors to portable instruments, ODU / open ends, 5 m	0553 0501
6 Bendable temperature probe Pt100 Class B, length 300 mm, ø 3 mm, -70...+500°C, 2 m probe connection cable glass fibre/stainless steel with ODU plug 8 pole for portable instruments	0604 0200
7 CS Soft Basic - data evaluation in graphic and table form - reading out of the measured data via USB	0554 7040
8 Transportation case	0554 6510

Professional set compressed air



m³/h

°Ctd

bar

°C

A

1 PI 500 portable measuring instrument with integrated data logger, incl. power supply	0560 0511
2 Flow sensor VA 500 Max. Version (185 m/s) sensor length 220 mm, incl. 5 m cable to portable instruments	0695 1124
3 FA 510 dew point sensor for mobile instruments, -80...+20°Ctd incl. mobile measuring chamber, 5 m cable	0699 1510
4 Standard Pressure sensor CS 16 from 0...16 bar, ± 1 % accuracy of full scale	0694 1886
5 Connection cable for pressure, temperature or external sensors to portable instruments, ODU / open ends, 5 m	0553 0501
6 Bendable temperature probe Pt100 Class B, length 300 mm, ø 3 mm, -70...+500°C, 2 m probe connection cable glass fibre/stainless steel with ODU plug 8 pole for portable instruments	0604 0200
7 Clamp-on ammeter 0...400 A RMS 10-30 VDC for portable instruments, 3 m cable, ODU 8 pol.	0554 0511
8 CS Soft Basic - data evaluation in graphic and table form - reading out of the measured data via USB	0554 7040
9 Transportation case	0554 6510

[illegible]



Energy analysis – flow measurement - leakage calculation

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 case of well operated and maintained plants. For sure this also applies to your compressed air plant! Which actual costs per generated m³ 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?

Although compressed air is one of the most expensive energy resources companies often experience enormous energy losses in this sector.

They are mainly caused by the following factors:

- Disuse of the waste heat
- Leakages of up to 50%
- Missing compressor control systems
- Pressure losses

Lots of plants are not adapted to the actual demand or they are in need of repair. Leak curing programs could save up to about 1.7 million tons of emissions of carbon dioxide per year. (Source: Fraunhofer Institut, Karlsruhe). So there is a considerable amount of possible energy savings slumbering in the compressed air lines of lots of enterprises. In order to open this up the waste heat which occurs during compressed air generation should be used for heating rooms or for hot water generation. Furthermore, it is important to optimize the control of compressed air stations because this will lead to considerable energy savings in any case. Also the restoration of an ailing or no longer suitable compressed air supply will pay off already after a short period of time. Losses due to leakages within the pipe work can cause extreme costs.

This table shows the annual energy costs caused by leakages:

Hole diameter mm	Air loss at:		Energy loss at:		Costs involved at:	
	6 bar (l/s)	12 bar (l/s)	6 bar (kWh)	12 bar (kWh)	6 bar (€)	12 bar (€)
1	1.2	1.8	0.3	1.0	144	480
3	11.1	20.8	3.1	12.7	1,488	6,096
5	30.9	58.5	8.3	33.7	3,984	16,176
10	123.8	235.2	33.0	132.0	15,840	63,360

(Source: Druckluft-Effizient, kW x 0.06 € x 8000 working hours per year)

Energy resources like electricity, water and gas are usually monitored and therefore the costs are transparent. Water consumption, for example, is measured with consumption meters and a water leak is usually found quickly due to the visibility of the leak. Compressed air leaks on the other hand are often not noticed and can „silently“ cause a lot of unnecessary costs, even during production downtime or over the weekend.

It is not unusual to have the compressors running continuously in order to establish a constant pressure within the system. In case of compressed air systems which have grown during the years the leakage rate can be between 25 and 35 %. They are the busiest consumers of compressed air, working all around, 365 days a year.

Not included are the hidden costs of producing clean and dry air. Refrigeration and desiccant driers are producing dry air with high running costs involved. Air that is then later lost through leaks within the system.

At constantly rising energy costs these potential energy savings have to be implemented in order to stay competitive within the market. Only if the consumption of single machines and plants becomes known and transparent for all it is possible to make use of possible savings. When introducing an energy management system according to DIN EN 16001 in the first step all consumers have to be recorded. So the user obtains a survey on

the single consumptions. Only this transparency enables a targeted action and a saving of energy.

For compressed air systems this means in the first step to detect leakages and to remove them.

Especially for the complete monitoring and consumption analysis of compressor stations and compressed air lines we developed a portable measuring system, the DS 500 mobile.

DS 500 mobile meets with all requirements for analyzing a compressed air system.

In addition to the evaluation of standard sensors like for example flow, pressure dew point, pressure, differential pressure, absolute pressure and temperature sensors, also the connection of all kinds of third-party sensors like e. g. PT100, PT1000, 0/4...20 mA, 0-1/10 V, pulse, RS 485 Modbus etc. is possible.

One of the main advantages of DS 500 mobile is the possibility to connect not only clamp-on ammeters but also external current meters, water meters or heat meters. So the current costs can be included very accurately in the analysis.

Determination of typical key figures of a compressed air station.



Chart recorder

DS 500 mobile enables an intelligent energy analysis in a quick and easy way. The data will be indicated immediately in the display.

For this purpose just the costs in € per kWh (please consider day and night tariff) have to be entered.

- **By means of a mathematical function typical calculations can be carried out like for example**
- **Costs in € per generated m³ of compressed air**
- **Specific output in kWh/m³**
- **Consumption of single compressed air lines including summation**
- **Indication of Min-Max values, average value**

If the minimum values rise continuously over the years this is a clear signal that the leakage rate increases. This can easily be determined by carrying out the measurements in regular intervals.

Consumption analysis including statistics at the touch of a button

Besides the compressed air also all other energy costs like current, water, vapor etc. can be recorded in this evaluation. This creates transparency.

So all energy and flow meters for compressed air, gas, water, vapor and so on can be recorded and evaluated. The customer gets the costs in Euro. On the big 7" color display with touch panel all information are visible at a glance. By means of the evaluation software CS Soft Basic all data can be evaluated online at the PC via a USB stick or Ethernet. Additionally to the consumption analysis as daily/ weekly or monthly report an alarm can be sent by e-mail or SMS in case of an exceeding of the threshold values. The measured data can be retrieved all over the world via the webserver, GSM module. **How**

is this done in practice?

Step 1: 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: Analysis

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 a 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, specific energy in kWh/m³, costs for 1 m³ in €.

2.2) System analysis (current measurement and real flow 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 flow sensor VA 500.

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

2.3) Leakage calculation

The leakage calculation is done during the production free time (shutdown, weekend, holidays). The flow sensor VA 500 measures the supplied quantity of air. During the down time the compressor delivers compressed air in order to keep a constant pressure.

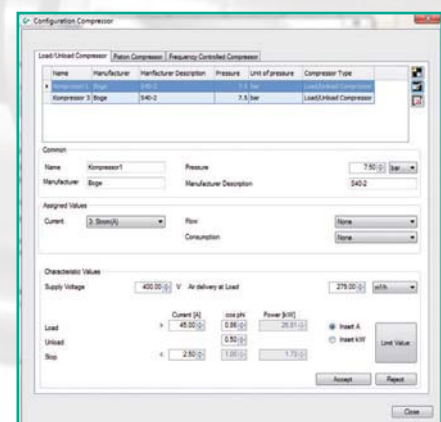
According to statistics even if production is carried out day and night there is at least one short period of time during which all load is switched off. By means of this data the software defines a leakage rate and calculates the incurred leakage costs in €.

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 1 kWh**





3.2) Graphic evaluation with day view and week view

Everything at a glance: The user gets a day and 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 cross lines function peak values can be determined.



3.3) Compressed air costs in €

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

- Energy costs
- Compressed air costs
- Leakage costs in €
- Compressor data with load/unload time
- Specific energy in kWh/m³
- Costs per m³ in €

Timeperiod:	1/12/2010 10:30 AM - 1/13/2010 9:44 AM	Tariff(s):	0.00 kWh - 0.00 kWh
Timeperiod in hours:	307.5	Tariff(s):	0.00 kWh - 0.00 kWh
Total flow value:	Sum of selected compressors	Tariff(s):	0.00 kWh - 0.00 kWh
Leakage of leakage:	120.00	Tariff(s):	0.00 kWh - 0.00 kWh

Compressor	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750	751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768	769	770	771	772	773	774	775	776	777	778	779	780	781	782	783	784	785	786	787	788	789	790	791	792	793	794	795	796	797	798	799	800	801	802	803	804	805	806	807	808	809	810	811	812	813	814	815	816	817	818	819	820	821	822	823	824	825	826	827	828	829	830	831	832	833	834	835	836	837	838	839	840	841	842	843	844	845	846	847	848	849	850	851	852	853	854	855	856	857	858	859	860	861	862	863	864	865	866	867	868	869	870	871	872	873	874	875	876	877	878	879	880	881	882	883	884	885	886	887	888	889	890	891	892	893	894	895	896	897	898	899	900	901	902	903	904	905	906	907	908	909	910	911	912	913	914	915	916	917	918	919	920	921	922	923	924	925	926	927	928	929	930	931	932	933	934	935	936	937	938	939	940	941	942	943	944	945	946	947	948	949	950	951	952	953	954	955	956	957	958	959	960	961	962	963	964	965	966	967	968	969	970	971	972	973	974	975	976	977	978	979	980	981	982	983	984	985	986	987	988	989	990	991	992	993	994	995	996	997	998	999	1000	1001	1002	1003	1004	1005	1006	1007	1008	1009	1010	1011	1012	1013	1014	1015	1016	1017	1018	1019	1020	1021	1022	1023	1024	1025	1026	1027	1028	1029	1030	1031	1032	1033	1034	1035	1036	1037	1038	1039	1040	1041	1042	1043	1044	1045	1046	1047	1048	1049	1050	1051	1052	1053	1054	1055	1056	1057	1058	1059	1060	1061	1062	1063	1064	1065	1066	1067	1068	1069	1070	1071	1072	1073	1074	1075	1076	1077	1078	1079	1080	1081	1082	1083	1084	1085	1086	1087	1088	1089	1090	1091	1092	1093	1094	1095	1096	1097	1098	1099	1100	1101	1102	1103	1104	1105	1106	1107	1108	1109	1110	1111	1112	1113	1114	1115	1116	1117	1118	1119	1120	1121	1122	1123	1124	1125	1126	1127	1128	1129	1130	1131	1132	1133	1134	1135	1136	1137	1138	1139	1140	1141	1142	1143	1144	1145	1146	1147	1148	1149	1150	1151	1152	1153	1154	1155	1156	1157	1158	1159	1160	1161	1162	1163	1164	1165	1166	1167	1168	1169	1170	1171	1172	1173	1174	1175	1176	1177	1178	1179	1180	1181	1182	1183	1184	1185	1186	1187	1188	1189	1190	1191	1192	1193	1194	1195	1196	1197	1198	1199	1200	1201	1202	1203	1204	1205	1206	1207	1208	1209	1210	1211	1212	1213	1214	1215	1216	1217	1218	1219	1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