



DS 400 Flow station for compressed air and gases



Chart recorder DS 400

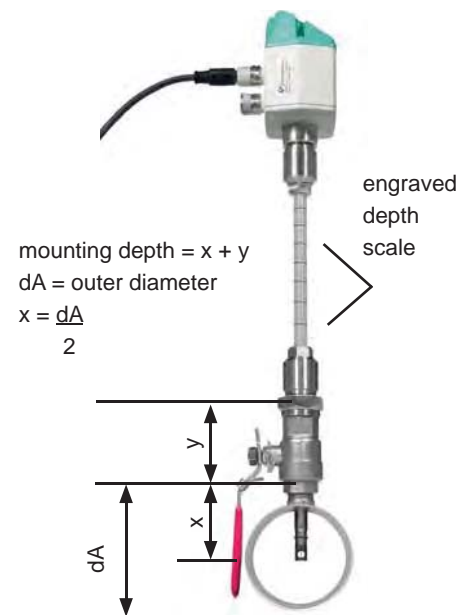
- 3.5" graphic display with touch screen - shows the progression of the measured values in graphic form
- 2 sensor inputs for flow sensors/ dew point sensors
- USB interface for reading out the data logger via USB stick
- 2 additional sensor inputs for pressure sensors, current meters and so on
- Option: Data logger for 100 million measured values (2 GB SD card)
- Option: Ethernet and RS 485 interface (Modbus protocol)
- Option: Webserver
- Option: CS Soft Basic - comfortable evaluation of the measured data

Flow sensor VA 500

- Easy installation and removal under pressure via 1/2" ball valve
- Several gas types - freely adjustable at DS 400
- Usable from 1/2" to 12" DN 300
- Diameter freely adjustable at DS 400
- Output for 4...20 mA for m³/h
- Pulse output for m³ (total flow)

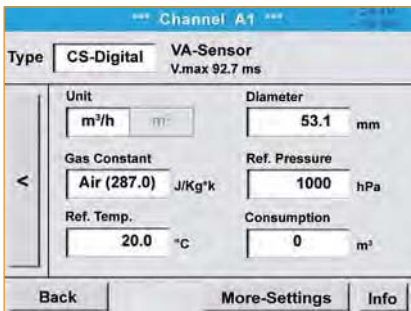
Flow measuring ranges VA 500 for compressed air (ISO 1217:1000 mbar, 20 °C)					
Inner diameter of pipe			VA 500 Standard (92.7 m/s)	VA 500 Max. (185.0 m/s)	VA 500 HighSpeed (224.0 m/s)
Inch	mm		Measuring range from to	Measuring range from to	Measuring range from to
1/2"	16.1	DN 15	2.5...760 l/min	3.5...1516 l/min	6.0...1836 l/min
3/4"	21.7	DN 20	0.3...89 m ³ /h	0.4...178 m ³ /h	0.7...215 m ³ /h
1"	27.3	DN 25	0.5...148 m ³ /h	0.6...295 m ³ /h	1.1...357 m ³ /h
1 1/4"	36.0	DN 32	0.9...280 m ³ /h	1.2...531 m ³ /h	2.5...644 m ³ /h
1 1/2"	41.9	DN 40	1.2...365 m ³ /h	1.5...728 m ³ /h	3.0...886 m ³ /h
2"	53.1	DN 50	2...600 m ³ /h	2.5...1198 m ³ /h	4.6...1450 m ³ /h
2 1/2"	71.1	DN 65	3.5...1096 m ³ /h	5...2187 m ³ /h	7...2648 m ³ /h
3"	84.9	DN 80	5...1570 m ³ /h	7...3133 m ³ /h	12...3794 m ³ /h
4"	110.0	DN 100	9...2645 m ³ /h	12...5279 m ³ /h	16...6391 m ³ /h
5"	133.7	DN 125	13...3912 m ³ /h	18...7808 m ³ /h	24...9453 m ³ /h
6"	159.3	DN 150	18...5560 m ³ /h	25...11097 m ³ /h	43...13436 m ³ /h
8"	200.0	DN 200	26...8786 m ³ /h	33...17533 m ³ /h	50...21230 m ³ /h
10"	250.0	DN 250	40...13744 m ³ /h	52...27429 m ³ /h	80...33211 m ³ /h
12"	300.0	DN 300	60...19815 m ³ /h	80...39544 m ³ /h	100...47881 m ³ /h

Description	Order No.
Flow measurement DS 400 for installation into existing pipelines consisting of: Chart recorder DS 400 and flow sensor VA 500 in basic version, Standard (92,7 m/s), sensor length 220 mm	0601 4006
Options for DS 400	
Option: Integrated data logger for 100 million measured values	Z500 4002
Option: Integrated Ethernet and RS 485 interface	Z500 4004
Option: 2 additional sensor inputs for analogue sensors (pressure sensors, temperature sensors etc.)	Z500 4001
Option: Integrated webserver	Z500 4005
Options for flow sensor VA 500	
Max. version (185 m/s)	Z695 5003
HighSpeed version (224 m/s)	Z695 5002
Option 1 % Accuracy of m.v. ± 0,3 % of f.s.	Z695 5005
Sensor length 120 mm	ZSL 0120
Sensor length 160 mm	ZSL 0160
Sensor length 300 mm	ZSL 0300
Sensor length 400 mm	ZSL 0400
Further accessories	
CS Soft Basic - data evaluation in graphic and table form - reading out of measured data via USB or Ethernet	0554 7040
Calibration	
5 point precision calibration including ISO certificate	3200 0001





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.

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 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. Readout 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 shows further parameters like the total flow in m³ and the velocity in m/s.

Technical data VA 500

Parameters:	m ³ /h, l/min (1000 mbar, 20°C) in case of compressed air resp. Nm ³ /h, NI/min (1013 mbar, 0°C) in case of gases
Units adjustable via keys at display:	m ³ /h, m ³ /min, l/min, l/s, ft/min, cfm, m/s, kg/h, kg/min
Adjustable via keypad:	diameter for volume flow calculation, counter resettable
Meas. principle:	calorimetric measurement
Sensor:	Thermal mass flow sensor
Meas. medium:	air, gases
Gas types adjustable via external device DS 400, DS 500, PI 500	air, nitrogen, argon, nitrous oxide, CO ₂ , oxygen
Accuracy: (m.v.: of meas. value) (f.s.: of full scale)	± 1.5 % of m.v. ± 0.3 % of f.s. on request ± 1.0 % of m.v. ± 0.3 % of f.s.
Operating temp.:	-30...110 °C probe tube -30...80 °C housing
Operating pressure:	up to 50 bar
Digital output:	RS 485 interface, Modbus RTU
Analogue output:	4...20 mA for m ³ /h resp. l/min; on request: scaling for cfm, m ³ /min, l/min, l/s, ft/min, m/s
Pulse output:	1 pulse per m ³ resp. per liter galvanically separated
Power supply:	18...36 VDC, 5 W
Burden:	< 500 Ω
Housing:	polycarbonate
Probe tube:	stainless steel, 1.4301 mounting length 220 mm, Ø 10 mm
Mounting thread:	G 1/2"

Technical data DS 400

Dimensions:	118 x 115 x 98 mm IP 54 (wall housing) 92 x 92 x 75 mm (panel mounting)
Inputs:	2 digital inputs for VA 500/520
Interface:	USB
Power supply:	100...240 VAC, 50-60 Hz
Accuracy:	please see VA 500
Alarm outputs:	2 relays, (pot.-free)
Options:	
Data logger:	100 million measuring values start/stop time, measuring rate freely adjustable
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, Pt 100, Pt 1000



DS 400 - chart recorder

for all relevant parameters of compressed air

Software options:

- Integrated webserver
- Mathematic calculation function
- Totalizer function

Hardware options:

- Integrated data logger
- Ethernet / RS 485 interface
- additional sensor inputs (digital or analogue) selectable



Standard equipment:

- USB interface
- 3.5" graphic display with touch screen
- Integrated mains unit for supply of the sensors
- 4...20 mA output of all connected active sensors
- Pulse output (for total consumption) in case of flow sensors
- 2 alarm relays (pot.-free switch-over contacts, max. 230 V, 3 A)

The 2 sensor inputs board 1 and 2 can be selected according to the required sensors:

Digital	Digital	Digital	Digital	Analogue	Analogue	Analogue	Analogue
m ³ /h, m ³	°Ctd	A, kW/h	optional	bar	A	°C	°C



4...20 mA
0...20 mA
0...10 V
Pulse
Pt 100
Pt 1000

Flow sensor	Dew point sensor	Current meters	Third-party sensors with RS 485	Pressure sensor	Clamp-on ammeter	Temperature sensor	Third-party sensors analogue output

Description	Order No.		
DS 400 - Mobile chart recorder with graphic display and touch screen	2 sensor inputs board 1	2 sensor inputs board 2	
	Digital (Z500 4003)	-----	0500 4000 D
	Digital (Z500 4003)	Digital (Z500 4003)	0500 4000 DD
	Digital (Z500 4003)	Analogue (Z500 4001)	0500 4000 DA
	Analogue (Z500 4001)	-----	0500 4000 A
	Analogue (Z500 4001)	Analogue (Z500 4001)	0500 4000 AA

Options	Order No.
Option: Integrated data logger for 100 million measured values	Z500 4002
Option: Integrated Ethernet and RS 485 interface	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
External Gateway Profibus	Z500 3008

Further accessories	Order No.
CS Soft Basic - data evaluation in graphic and table form - reading out of the measured data of DS 400 via USB or Ethernet	0554 7040
CS Soft Network - Database Client/Server Solution (up to 5 DS 400) - database (MySQL) to Server - data evaluation via Client-Software	0554 7041
CS Soft Network - Database Client/Server Solution (up to 10 DS 400) - database (MySQL) to Server - data evaluation via Client-Software	0554 7042
CS Soft Network - Database Client/Server Solution (up to 20 DS 400) - database (MySQL) to Server - data evaluation via Client-Software	0554 7043
CS Soft Network - Database Client/Server Solution (>20 DS 400) - database (MySQL) to Server - data evaluation via Client-Software	0554 7044

Technical data DS 400

Dimensions:	118 x 115 x 98 mm IP 54 (wall housing) 92 x 92 x 75 mm (panel mounting)
Inputs:	2 digital inputs for FA 510 resp. VA 500/520
Interface:	USB
Power supply:	100...240 VAC, 50-60 Hz
Accuracy:	please see VA 500
Alarm outputs:	2 relays, (pot.-free)
Options:	
Data logger:	100 million measuring values start/stop time, measuring rate freely adjustable
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, Pt 100, Pt 1000

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° (-100...400°C)
Pulse	
Measuring range	min pulse length 500 µs frequency 0...1 kHz max. 30 VDC



Suitable probes from the CS Instruments 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	
Option for VA 500:		
Max. version (185 m/s)	Z695 5003	
High Speed version (224 m/s)	Z695 5002	
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 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: (further pressure sensors please see page 9)		
Standard pressure sensor CS 16 from 0...16 bar, ± 1 % accuracy of full scale	0694 1886	
Standard pressure sensor CS 40 from 0...40 bar, ± 1 % accuracy of full scale	0694 0356	
Temperature sensors:		
Bendable temperature probe, Pt100 Class B, length 300 mm, 2 m probe connection cable glass fibre/stainless steel open end wires	0604 0107	
Screw-in temperature probe Pt 100 Class A, length: 300 mm with measuring transducer 4 to 20 mA = -50 to +500 °C (2-wire technology)	0693 0002	
Indoor/outdoor temperature probe -50...+100°C	0604 0101	
Temperature probe cable Pt 100, Class A, length: 300 mm, Ø 6 mm, -50...+180°C, with 5 m connection cable with open ends	0604 0102	
Temperature probe cable Pt 100, Class A, length: 150 mm, Ø 6 mm, +50...+180°C with 5 m connection cable with open ends	0604 0100	
Clamp screwing 6 mm, G 1/2", PTFE clamping, pressure-tight up to 6 bar	0554 6003	
Clamp screwing 6 mm, G 1/2", VA clamping, pressure-tight up to 10 bar	0554 6004	
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	
Optional third-party sensors 0/4...20 mA, 0...1/10/30 V, Pt 100 / Pt 1000, KTY, pulse, RS 485 Modbus connectable.		
Current / effective power meter (Further Current transformer please find on page 9)		
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 500/5 A connectable to current/effective power meter for panel mounting (for cables up to Ø 21 mm)	0554 5347	
Connection cable to DS 400, 5 m, with open ends	0553 0108	
Connection cable to DS 400, 10 m, with open ends	0553 0109	

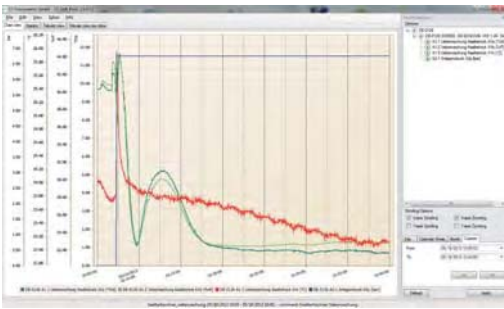


CS Soft Basic - evaluation of measured data for single computers



The measured data stored in the data logger integrated in DS 400 can be read-out via USB stick.

If DS 400 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 colours. All necessary functions like free zoom, selection/deselection of single measured curves, free selection of time periods, scaling of the axis, selection of colours 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.

This screenshot shows the 'Table view' of the software. It displays a multi-column table where each row represents a specific measurement point. The columns include time intervals and corresponding measured values for various channels.

- • • **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.

This screenshot shows a 'Statistic Report' window. It includes a title bar with the report name and time range. Below is a summary table with columns for 'Statistic', 'Value', 'Unit', 'Time', and 'Date'. The table lists various statistical metrics for the selected data period.

- • • **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.

This screenshot shows the 'Energy and flow evaluation' view. It features a table with columns for 'Energy', 'Flow', and 'Time'. The table provides a detailed breakdown of energy and flow measurements over a specific period, including sub-totals and overall averages.

- • • **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.

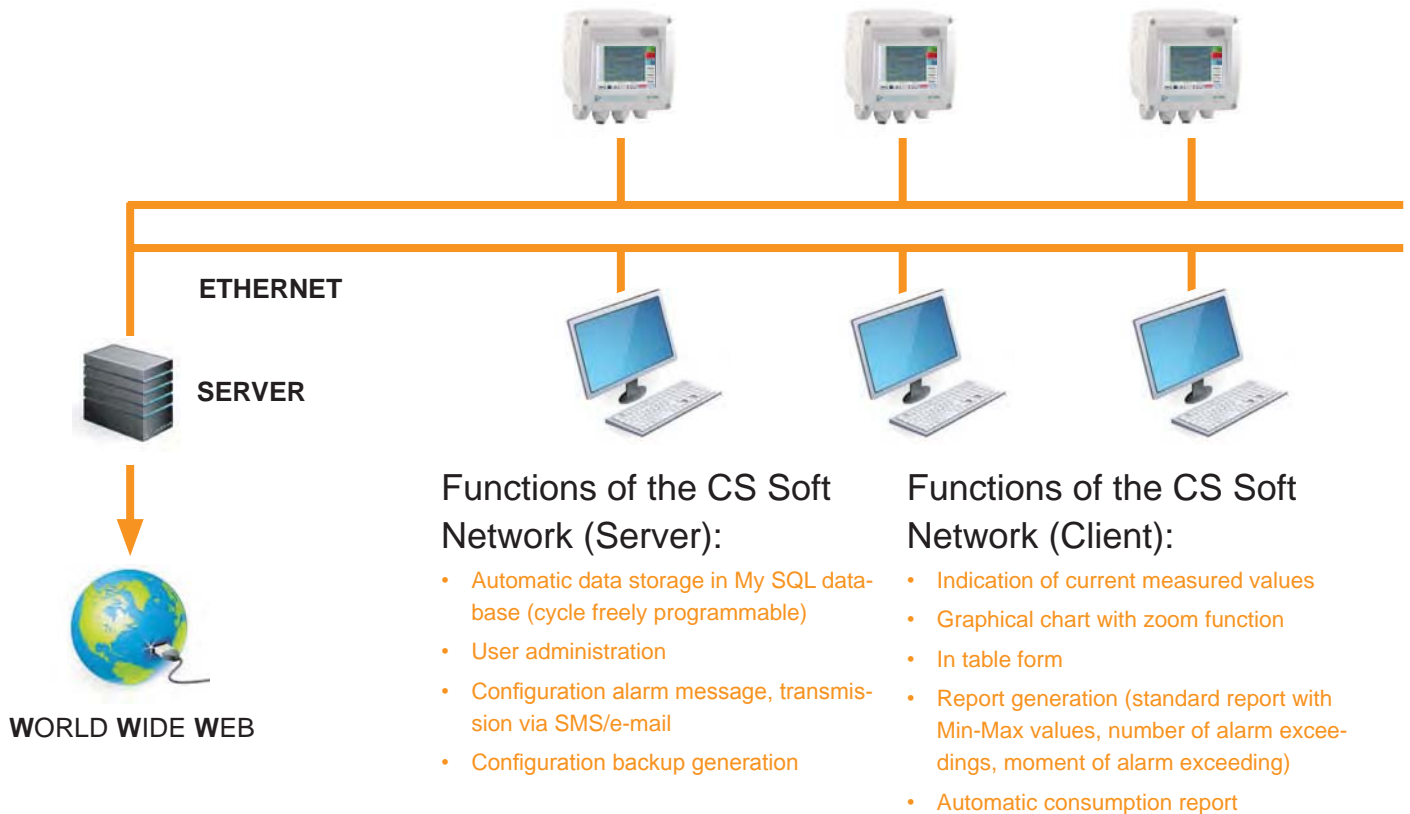


CS Soft Network - evaluation of the measured data for several computers in the network

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.



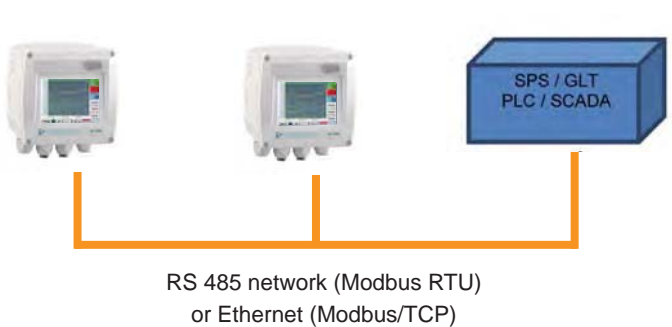
Access to the measured values via the webservice



With the option „Webservice“ (order no. Z500 4005) DS 400 can be contacted without any special software from each web browser (e.g. Mozilla Firefox®, Microsoft Internet Explorer®).

The access can also be done via the World Wide Web. The web-server indicates the actual measured values of all sensors as well as the status of the alarm relays and the logger status in the web browser.

Connection to Bus system

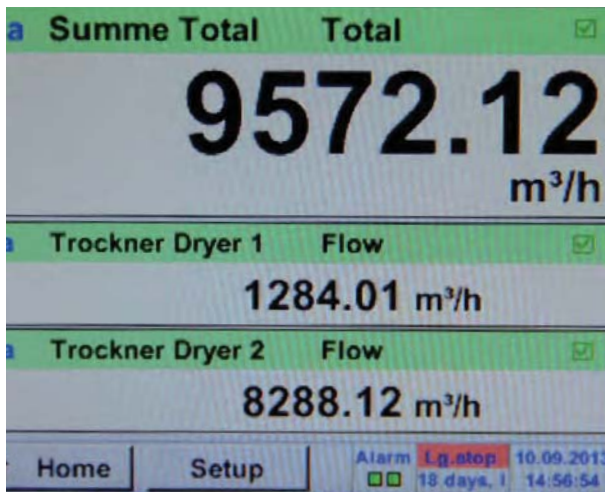


With the option „Ethernet / RS 485 - interface“ (order no. Z500 4004) DS 400 can be connected to customer-owned Bus system (e.g. PLC, building management system BMS, central control system, SCADA,...).

The measured values of all sensors can be retrieved via Modbus protocol. A detailed protocol description is enclosed with each DS 400 instrument. When using the Ethernet interface the IP address at DS 400 can be freely adjusted. As an alternative DS 400 waits for the address allocation by a DHCP server.



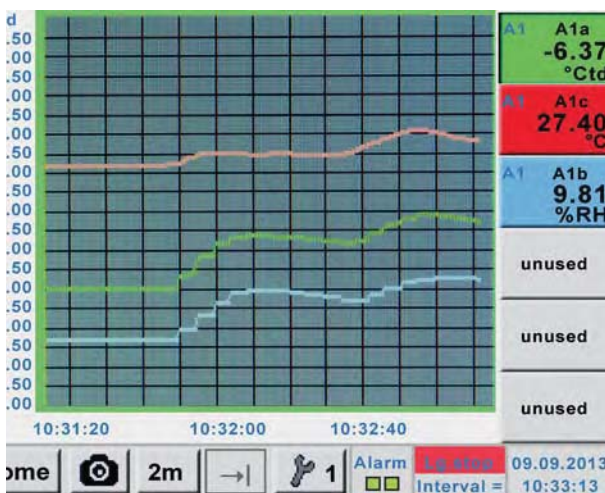
Innovations



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Summation of several flow sensors

By means of the option „mathematics calculation function“ (order no. Z500 4007) it is possible to calculate mathematically the sum of several connected flow sensors. Of course the new „virtual“ value „sum of all sensors“ can also be indicated graphically and stored in the data logger.

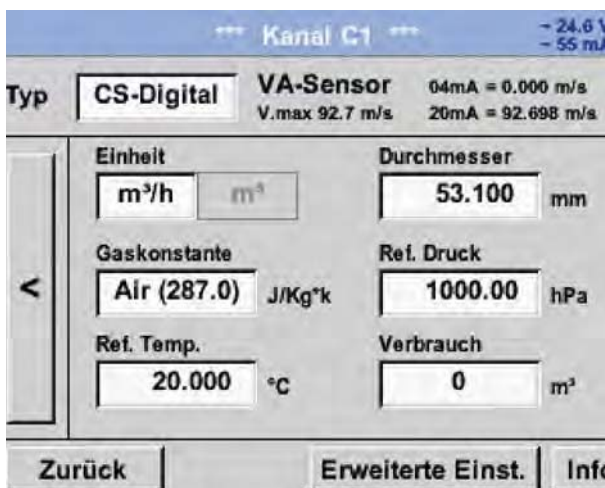


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Screen-shot function

By means of the print key it is possible to store the actual screen as an image file onto the internal SD card or on a USB stick and print it out at the PC without any additional software.

This is ideal for documentation of the measured values/ measured curves on-site. Coloured measured curves can be sent as image files by e-mail or integrated into a service report.



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Totalizer function

Lots of low-priced flow sensors which are available on the market just have a 4...20 mA analogue output for the current flow in liters/min or m³/h. An output signal for the recording of total flow readings is not integrated.

By means of the option „totalizer function“ DS 400 can integrate the analogue signal and generate a total flow reading in m³ or liters from the measured actual flow. The total flow reading can be set to zero in the user menu at any time.



Consumption and flow measurement

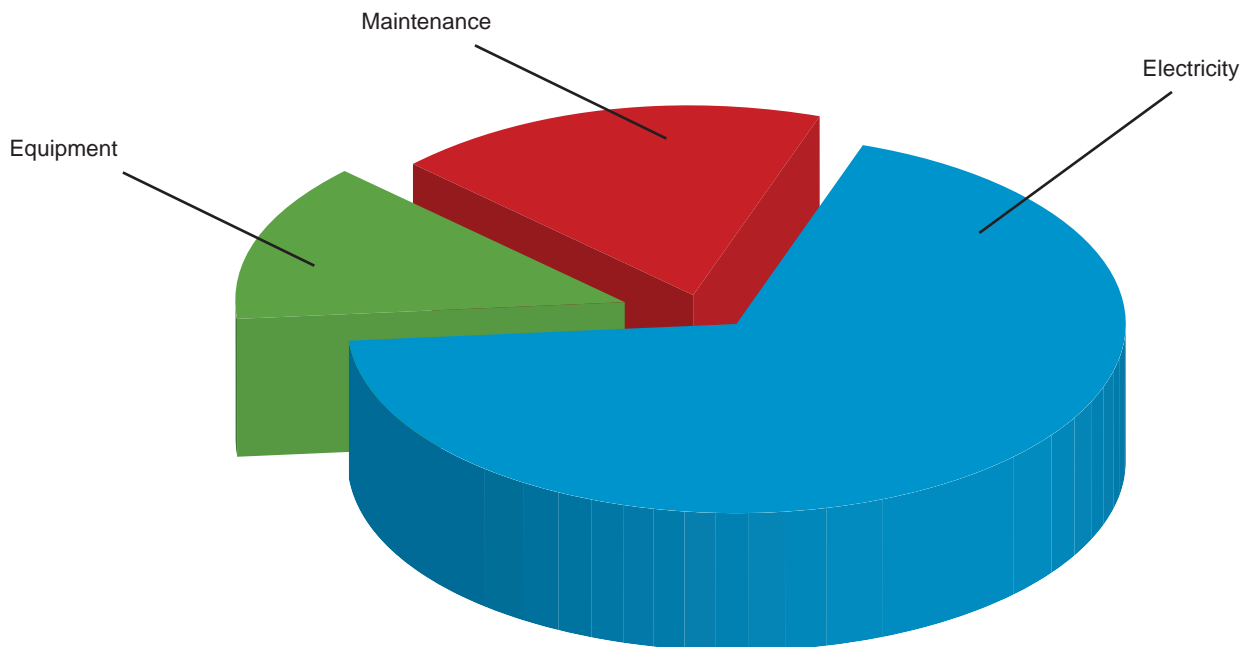
Cost saving

In Germany 60,000 compressed air plants use 14,000,000,000 kWh electrical energy per year. 15 to 20 % could be easily saved (Peter Radgen, Fraunhofer Institut, Karlsruhe). Most of these costs are caused by leakages in the compressed air system.

The air „escapes“ unused. **1 leak with a diameter of 1 mm causes costs of approximately 270 EUR/year**

The leak detector LD 400 of CS Instruments GmbH will be paid off after 4 leakages (please see page 94-95)

Cost distribution in compressed air systems:



Example for a calculation of leakage costs at different pressure:

Leak Ø (mm)	Air loss at 6 bar (l/s)	Air los at 12 bar (l/s)	Energy loss kWh at 6 bar	Energy loss kWh at 12 bar	Costs € p.a. at 6 bar	Costs € p.a. at 12 bar
1	1.2	1.8	0.3	1.0	144	480
3	11.1	20.8	3.1	12.7	1,488	6,960
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

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