



## 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



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

#### 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 m<sup>3</sup> air
- kWh/m<sup>3</sup> generated air
- flow of single lines including summation



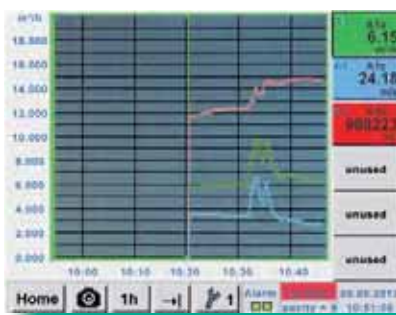
## Easy operation via touch screen



### 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“ of 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 m<sup>3</sup>/h DS 400 mobile shows further parameters like the total flow in m<sup>3</sup> and the velocity in m/s

### Technical data DS 400 mobile

|                                    |   |
|------------------------------------|---|
| <b>Dimensions:</b>                 | 270 x 225 x 156 mm (W x H x D)  |
| <b>Weight:</b>                     | 2.2 kg  |
| <b>Inputs:</b>                     | 2 x 2 sensor inputs for digital or analogue sensor signals  |
| <b>Interface:</b>                  | USB (standard), Ethernet (optional)   |
| <b>Power supply:</b>               | Internal rechargeable Li-Ion batteries, approx 8 h continuous operation, 4 h charging time  |
| <b>Options</b>                     |   |
| <b>Data logger:</b>                | 100 million measuring values start/stop time, measuring rate freely adjustable  |
| <b>2 additional sensor inputs:</b> | 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

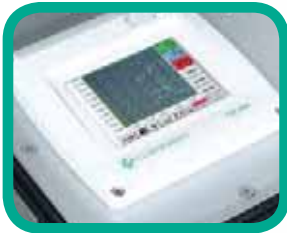
|                       |   |
|-----------------------|---|
| <b>Current signal</b> | (0...20mA/4...20mA) internal or external power supply   |
| Measuring range       | 0...20 mA   |
| Resolution            | 0.0001 mA   |
| Accuracy              | ± 0.03 mA ± 0.05 %                                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



## 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.                      |                                |              |
|--|--------------------------------|--------------------------------|--------------|
|  | <b>2 sensor inputs board 1</b> | <b>2 sensor inputs board 2</b> |              |
| DS 400 - Mobile chart recorder with graphic display touch screen and integrated data logger  | 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 |
| <b>Options</b>   |                                |                                |              |
| 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                      |                                |              |
| <b>Further accessories</b>   |                                |                                |              |
| 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/effectiv power meter   | 0553 0506                      |                                |              |
| Case of all sensors (dimensions: 500 x 360 x 120 x mm)   | 0554 6006                      |                                |              |

| Digital                           | Digital          | Digital        | Digital                         |
|-----------------------------------|------------------|----------------|---------------------------------|
| m <sup>3</sup> /h, m <sup>3</sup> | °Ctd             | A, kW/h        | optional                        |
|                                   |                  |                |                                 |
| Flow sensor                       | Dew point sensor | Current meters | Third-party sensors with RS 485 |

| Analogue        | Analogue         | Analogue           | Analogue                            |
|-----------------|------------------|--------------------|-------------------------------------|
| bar             | A                | °C                 | °C                                  |
|                 |                  |                    |                                     |
| 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, CO<sub>2</sub>, 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



## 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 400 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 400 mobile** via Modbus



## 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 CS Instruments 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 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.

**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 €.



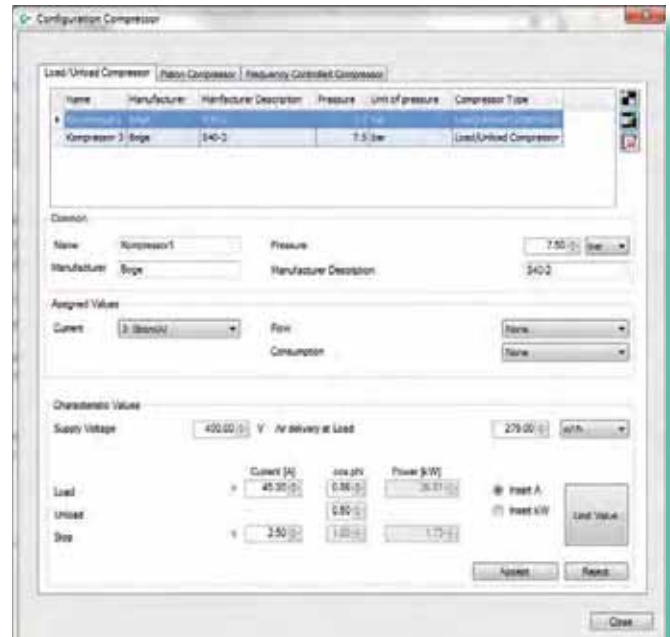
## Step 3:

Evaluation at the PC with graphics and statistics

### 3.1 Entry of necessary parameters

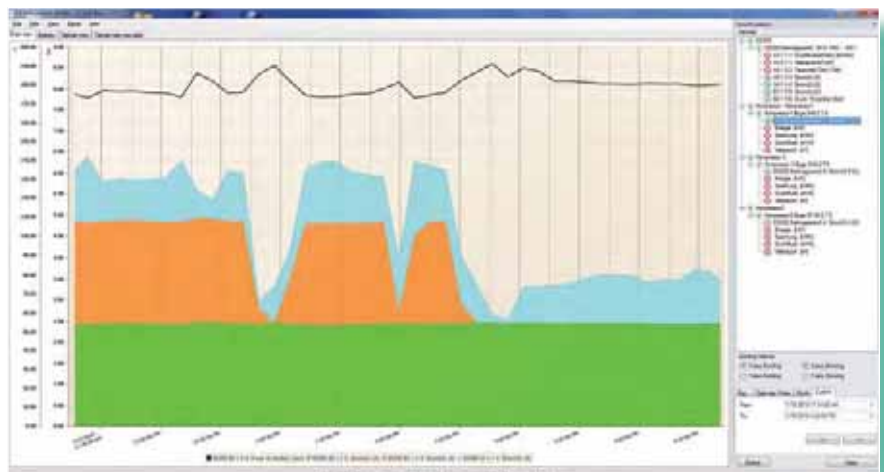
Specific data have to be entered before the analysis is carried out:

- 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 crosslines function peak values can be determined.



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

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

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

**Analysis of Compressor-Energy and -Costs**

Timespan: 1/12/2010 10:39 AM - 1/19/2010 9:44 AM      Tariff1: 6:00 AM - 7:59 PM  
 Timespan in hours: 167.1      0.13 Euro  
 Total flow rate: Sum of selected compressors      Tariff2: 8:00 PM - 6:00 AM  
 Limit of leakage: 129.00      0.11 Euro

| Compressor          | Security (S) |        | Switches | Pressure     |                |              |              | Flow |         | Costs (Euro) |        |                         |              | Leakage     |             |      |        |      |      |        |
|---------------------|--------------|--------|----------|--------------|----------------|--------------|--------------|------|---------|--------------|--------|-------------------------|--------------|-------------|-------------|------|--------|------|------|--------|
|                     | Load         | Unload |          | Flow (l/min) | Unload (l/min) | Flow (l/min) | Flow (l/min) | Load | Unload  | Flow         | Cost   | Cost per m <sup>3</sup> | Flow (l/min) | Cost (Euro) | Cost (Euro) |      |        |      |      |        |
| CS-Atomcompressor 1 | 38.8         | 0.1    | 100.2    | 11           | 14             | 995.0        | 1.98         | 0.08 | 995.0   | 0.08         | 11.44  | 276.00                  | 140.00       | 141.10      | 0.20        | 0.01 | 141.90 | 0.16 | ---  | ---    |
| CS-Atomcompressor 2 | 34.0         | 0.1    | 101.4    | 11           | 57             | 1460.27      | 1.46         | 0.14 | 1460.27 | 0.14         | 16.95  | 270.00                  | 1700.00      | 141.10      | 0.15        | 0.01 | 140.18 | 0.02 | ---  | ---    |
| CS-Atomcompressor 3 | 128.0        | 0.2    | 121.5    | 48           | 48             | 2207.28      | 2.20         | 0.22 | 2207.27 | 0.22         | 101.44 | 414.11                  | 1600.00      | 121.10      | 0.20        | 0.01 | 120.90 | 0.01 | ---  | ---    |
| Summary             | 200.8        | 1.4    | 199.0    | 112          | 115            | 4942.54      | 4.70         | 0.47 | 4942.54 | 0.47         | 301.79 | 970.00                  | 3741.00      | 263.30      | 0.24        | 0.02 | 263.50 | 0.04 | 0.04 | 144.44 |



## 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                           |   |
| <b>Option for VA 500:</b>   |  |                                     |   |
| Sensor length 120 mm  |  | ZSL 0120                            |   |
| Sensor length 160 mm  |  | ZSL 0160                            |   |
| Sensor length 300 mm  |  | ZSL 0300                            |   |
| Sensor length 400 mm  |  | ZSL 0400                            |   |
| <b>Flow measuring range VA 520 for compressed air:(ISO 1217: 1000 mbar, 20°C)</b>   |  |                                     |   |
| 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                           |   |
| <b>Dew point sensors:</b>   |  |                                     |   |
| 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                           |   |
| <b>Connection cable for VA/FA sensors:</b>  |  |                                     |   |
| Connection cable for VA/FA series on mobile instruments, ODU / M12, 5m  |  | 0553 1503                           |   |
| Extension cable, 10 m   |  | 0553 0504                           |   |
| <b>Calibration certificates for flow / dew point sensors:</b>   |  |                                     |   |
| 5 point precision calibration for flow sensors including ISO certificate  |  | 3200 0001                           |   |
| Precision calibration at -40°Ctd including ISO certificate  |  | 0699 3396                           |   |
| <b>Pressure sensors:</b>  |  | <b>± 1 % accuracy of full scale</b> | <b>± 0,5 % accuracy of full scale</b>   |
| 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                           |   |
| Precision differential pressure sensor for further measuring ranges, e.g. 0...75 mbar, 0...2 bar, 0...8 bar, 0...21 bar, 0...70 bar, 0...200 bar, 0...420 bar |  | on request                          |   |
| 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 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 mobile instruments   | 0604 0106 |  |
| 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) (Please order additional the connection cable 0553 0501)  | 0693 0002 |  |
| Temperature probe cable Pt 100, Class A, length: 300 mm, Ø 6 mm, -50...+180°C, with 5 m connection cable with open ends (Please order additional the ODU plug Z604 0104)   | 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 (Please order additional the ODU plug Z604 0104)   | 0604 0100 |  |
| Mini temperature probe cable Pt100 Class A, length 25 mm, Ø 4 mm 50°C to +180°C, 5 m probe connection cable with open ends (Please order additional the ODU plug Z604 0104)  | 0604 0105 |  |
| Clamp screwing 6 mm, G 1/2", VA clamping, pressure-tight up to 10 bar  | 0554 6004 |  |
| 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.<br>To the 12 freely assignable sensor inputs all sensors of CS Instruments 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 I pulse outputs (e.g. of gas counters)   Frequency output   Modbus protocol         |           |  |

