CAMILLE BAUER

APPLICATION OPTIONS WITH CENTRAX

INDIVIDUALISABLE STANDARD DEVICE

APPLICATIONS AND SOLUTIONS

TIME AND COST OPTIMISING BY INTELLIGENT INSTRUMENTATION

Classical automation processes usually follow the system shown in Figure 1. The most varied measuring devices collect data on the field level and forward it for processing to the control level. Depending on the requirements, control tasks are derived from the measured data or the data is sent to the next higher level for visualising or analysis. This separation of functionalities causes a not inconsiderable input of devices, installation, know-how and time even for the most insignificant control tasks. Especially for the highly precise measurement of all variables in the power grid and the diversity of control and regulating tasks occuring in this respect, Camille Bauer Metrawatt AG offers an innovative solution.

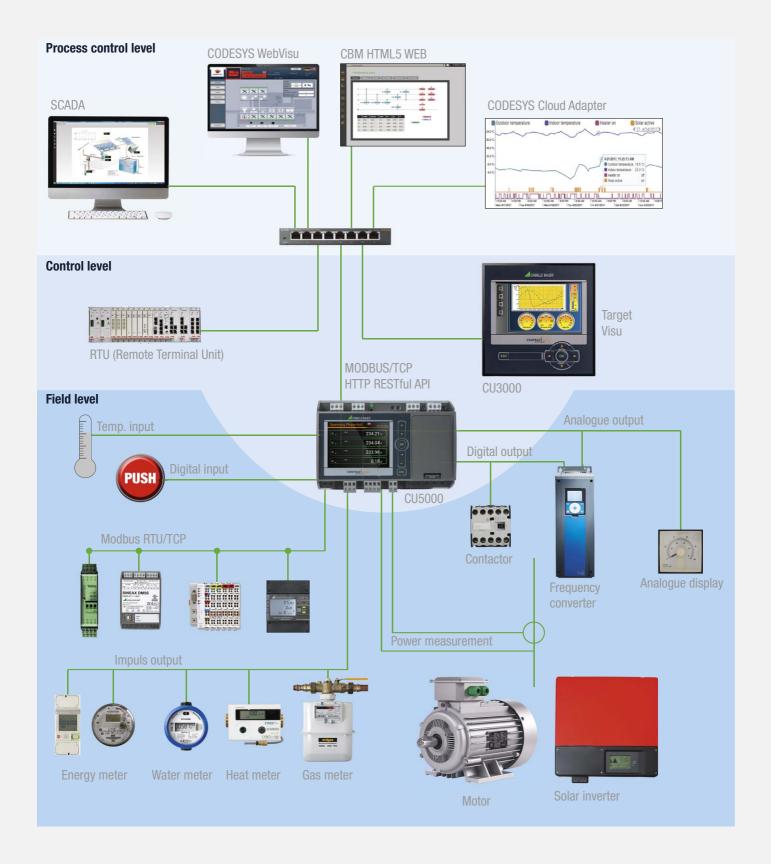## Classical instrumentation

Figure 1: Automation pyramid according to ISA-85/DIN EN 62264-1

CENTRAX CU3000 / CU5000 combines the functionality of a highly precise measuring device for power applications with the possibilities of a freely programmable soft PLC. In many cases, this dispenses with the requirement of a separate control, a control system, a separate display or an additional data collector.
The measuring part of the device determines more than 1500 status, energy consumption and power quality details in high quality. The control application is based on CODESYS and can now process this data logically, use it in regulating algorithms or interact with the energy generation or consumers in accordance with any given situation. The device can communicate with the process environment via freely selectable I/Os and Modbus interfaces. In addition, the ADVANCED and PROFESSIONAL versions provide the possibility of feeding also the measured data of other field devices into the control application via the Modbus interface and to process it there.

CENTRAX may thus be used for autarkic solutions in the areas of energy management, regulating and optimising of the energy consumption, equipment monitoring and other general automation and control tasks. A connection to higher-ranking systems is possible at any time.

CENTRAX –
INDIVIDUAL STANDARD DEVICE

Process control level

CODESYS WebVisu

CBM HTML5 WEB

SCADA

CODESYS Cloud Adapter

Control level

RTU (Remote Terminal Unit)

Target Visu

MODBUS/TCP
HTTP RESTful API

CU3000

Field level

Temp. input

Analogue output

Digital output

Digital input

CU5000

Modbus RTU/TCP

Contactor

Frequency converter

Analogue display

Power measurement

Impuls output

Energy meter　　Water meter　　Heat meter　　Gas meter

Motor

Solar inverter

MODULAR PERFORMANCE

CENTRAX CU3000 and CU5000 are available in three performance classes. Every device comprises the complete measuring functionality for all power variables irrespective of the control functionalities of the individual performance classes.

- **BASIC:** Flexible processing of the measuring data of the measuring instrument with full use of the I/O functionality
- **ADVANCED:** In addition, the possibility to read and use data from other measuring instruments via Modbus RTU/TCP, as well as to trigger time-depending processes
- **PROFESSIONAL:** To create your own web visualization and to use the local display for self-defined visualizations

CENTRAX CU3000

CODESYS

CENTRAX CU5000

PERFORMANCE CLASS «BASIC»

- Logical data pre-processing (AND, OR, XOR etc.)
- Mathematical data pre-processing (ADD, SUB, MUL, DIV, LT, GT, SIN, COS etc.
- All measurements of the measurement unit can be used
- Direct access to all analog and digital outputs
- Time / calendar functions, scheduler for controlling time-related processes
- Additional Modbus addresses for user data (4 data types, 16 data points each)
- Device search and identification by blinking
- Start-up projects available in all 5 standardized IEC61131-3 languages

PERFORMANCE CLASS «ADVANCED»

- All features of the "BASIC" version
- Extended data collection
    - Modbus/RTU master + Modbus/TCP master
    - Read data of any Modbus slave/server (meters, transducers, CBM devices)
    - Comprehensive library of pre-defined devices
    - Extended user-defined Modbus image (data format conversion, gateway etc.)

PERFORMANCE CLASS «PROFESSIONAL»

- All features of "BASIC" + "ADVANCED"
- User defined Webpages (WebVisu)
- User defined on-site displays (TargetVisu)
- Non-volatile data storage (logger functionality)
- Implementation of user-defined functions on request

MANY FUNCTIONS – ONE DEVICE

Standard languages

CODESYS
Development environment

Preparation of individual control using standard languages according to IEC61131-3:

- KOP   Contact plan
- AWL   Instruction list
- FUP   Function component
- AS   Sequential function chart
- ST   Structured text
- CFS   Signal flow plan

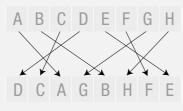## Preconfigured devices

GOSSEN METRAWATT

CAMILLE BAUER

The devices of Camille Bauer and Gossen Metrawatt are already preconfigured and may be selected in CENTRAX on the CODESYS level.

Conversion of different data types

float32

REAL64

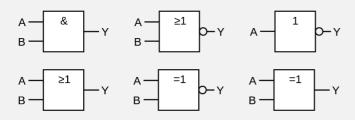INT32   REAL32

A B C D E F G H

D C A G B H F E

Byte order

Converting the most varied data types to one is an enormous advantage for a structured communication to a higher-ranking system. The most varied formats, e.g. INT32, REAL32 or REAL64, but also quite different byte orders may be read and converted into a desired format.

Logic functions

CENTRAX provides logic functions for any desired linking, e.g. with measured values, limit values or calculation results.
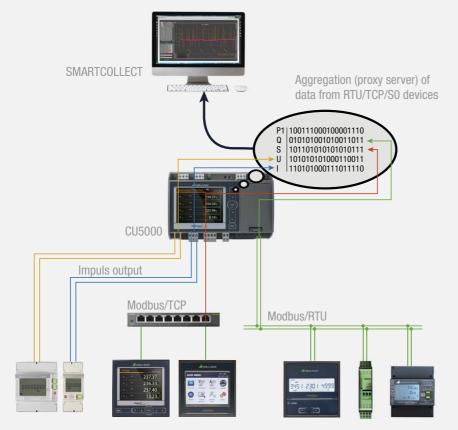
Calculation

$$W_{ab} = -Q \int_a^b \vec{E} \cdot \mathrm{d}\vec{s}$$

$$Q = m * c_p * \Delta t$$

$$Q = V * \rho * c_p * \Delta t$$

$$E = \frac{1}{2} \cdot L \cdot I^2$$

$$Q(t) = Q(t_0) + \int_{t_0}^{t} I(t)\,\mathrm{d}t$$

$$p = u \cdot i$$

$$I = I_{\mathrm{ph}} - I_{\mathrm{b}} - I_{\mathrm{S1}}\left[\mathrm{e}^{\frac{U + R_{\mathrm{s}} \cdot I}{n_1 \cdot U_{\mathrm{T}}}} - 1\right] - I_{\mathrm{S2}}\left[\mathrm{e}^{\frac{U + R_{\mathrm{s}} \cdot I}{n_2 \cdot U_{\mathrm{T}}}} - 1\right] - \frac{U + R_{\mathrm{s}} \cdot I}{R_{\mathrm{p}}}$$

All measured values may be processed with other parameters as desired and displayed, stored, forwarded or used as a basis for further calculations.

INTELLIGENT SUMMATION UNIT

SMARTCOLLECT

Aggregation (proxy server) of
data from RTU/TCP/S0 devices

P1 | 100111000100001110
Q | 010101001010011011
S | 101101010101010111
U | 101010101000110011
I | 110101000111011110

CU5000

Impuls output

Modbus/TCP

Modbus/RTU

CENTRAX finds a wide range of applications as
an intelligent summator. The device collects freely
selectable data from the most varied devices via
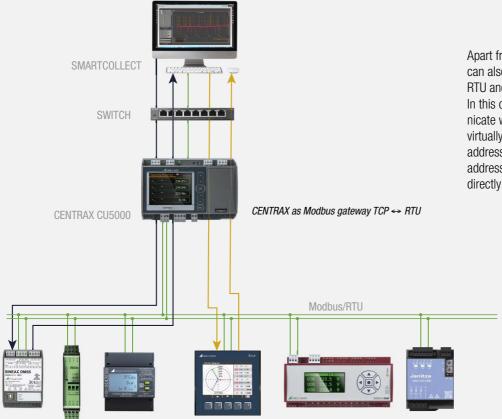Modbus/TCP, Modbus/RTU or also via energy meter
impulses.
The data may be stored, combined to individual
packages and communicated to a higher-ranking
system. A newly combined data package can thus
be called up with only one CENTRAX query.

Collection from
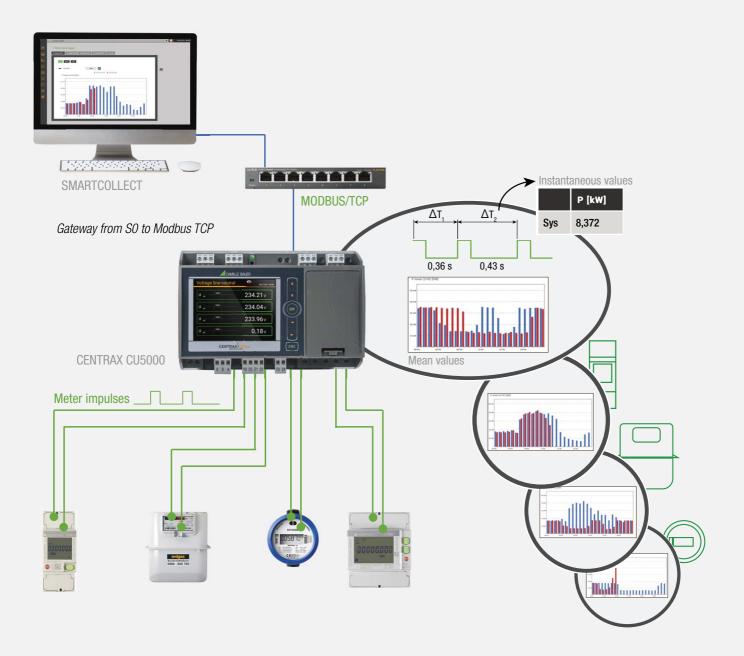*- TCP devices*
- RTU devices
- S0 devices

SUBMETERING, GATEWAY

SMARTCOLLECT

SWITCH

CENTRAX CU5000

CENTRAX as Modbus gateway TCP ↔ RTU

Modbus/RTU

Apart from measuring in the power grid, CENTRAX
can also be used as a gateway between Modbus/
RTU and Modbus/TCP.
In this case, the higher-ranking system can commu-
nicate with the connected Modbus/RTU field devices
virtually through CENTRAX. Via the CENTRAX IP-
address, every device is identified using its device
address. RTU devices can thus be called and reply
directly.

DATA COLLECTION, LOGGING AND ANALYSIS

SMARTCOLLECT

Gateway from S0 to Modbus TCP

MODBUS/TCP

Instantaneous values

	P [kW]
Sys	8,372

ΔT_1 ΔT_2

0,36 s   0,43 s

Mean values

CENTRAX CU5000

Meter impulses

Example:

Meter constant: $K = 1000 \ \dfrac{1}{kWh}$ (Number of impulses per kWh)

Number of impulses: $n = 4387$ Impulses per 15 min.

Energy: $E = \dfrac{n}{K} = \dfrac{4387}{1000} = 4.387$ kWh

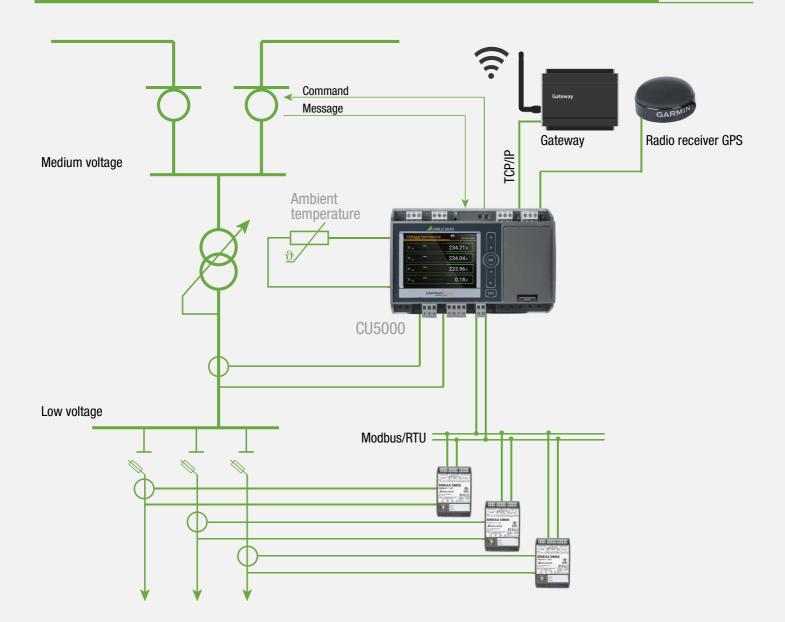Mean power value: $\overline{P} = \dfrac{n}{K \cdot 1/4h} = \dfrac{4 \cdot 4387}{1000} = 17.548$ kW

Instantaneous power value : $P_2 = \dfrac{1}{K \cdot \Delta T_2} = \dfrac{1 \cdot 3600 \ s}{1000 \cdot 0.43 \ s} = 8.372$ kW

CENTRAX finds a large range of applications in energy acquisition.
Up to 16 meters can be connected to CENTRAX via impulse output (S0) . If the meter constant is known, the energy and power can be directly calculated from impulses and time. In this way, even the simplest meters become smart meters.

MONITORING AND CONTROL OF LOCAL NETWORK STATIONS

Medium voltage

Command
Message

Ambient
temperature

TCP/IP

Gateway

Radio receiver GPS

GARMIN

CU5000

234.21 v
234.04 v
233.96 v
0.18 v

Voltage line-neutral

CENTRAX

Low voltage

Modbus/RTU

SINEAX DM5S
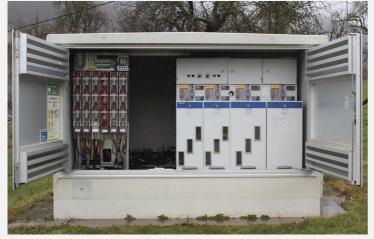
SINEAX DM5S

SINEAX DM5S

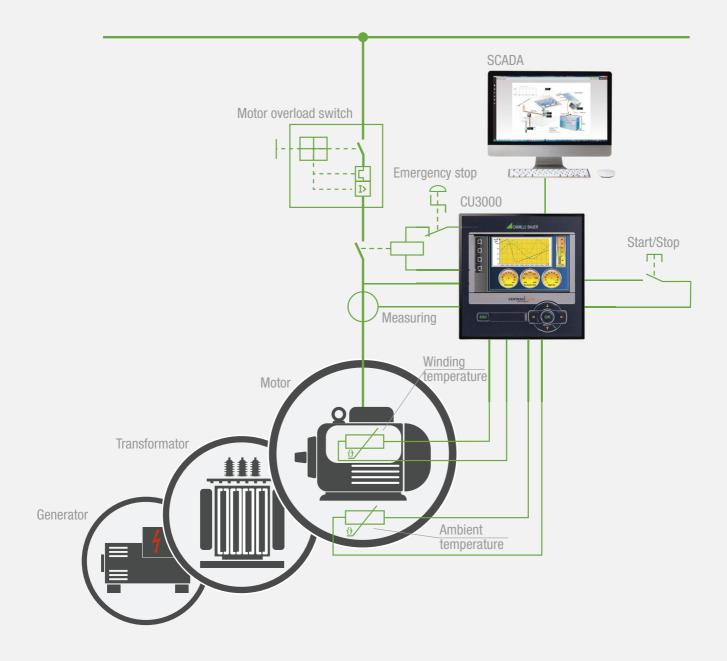

Photo: IDS-Group Holding GmbH

Grids are currently subjected to substantial changes. Due to the considerably growing number of decentralised grid contributors, predominantly volatile energy sources like photovoltaics, wind parks and biogas plants, the challenges of medium and low voltage grids are continually rising.

This takes many distribution systems to their capacity limits since they were designed for unidirectional energy flow and are equipped with conventional transformers.

Avoiding or reducing the consequences of this capacity overload, which causes increasingly more frequent supply failures with increasingly longer down times, requires comprehensive monitoring and control of grids at all sensitive points.

In this respect, CENTRAX can be adapted to individual requirements on site in an optimum fashion and, simultaneously, act as an interface to the control system or to other measuring points.
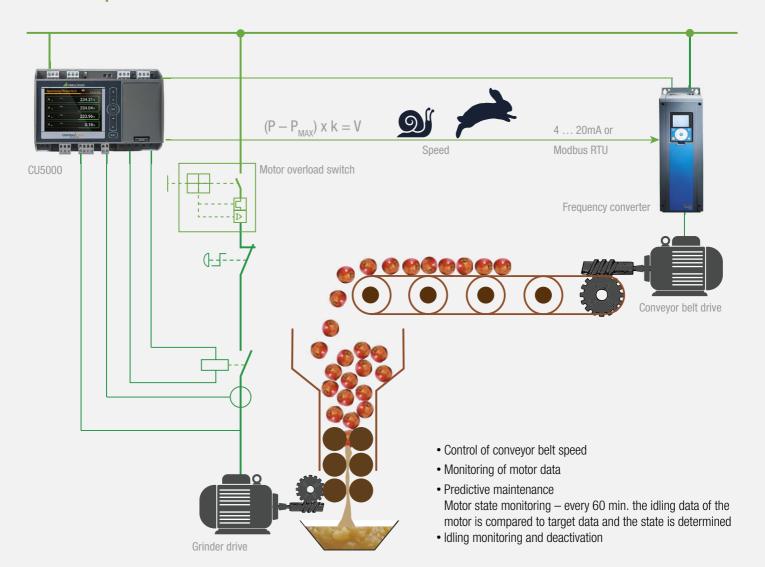
PREDICTIVE UNIT MONITORING

SCADA

Motor overload switch

Emergency stop

CU3000

Start/Stop

Measuring

Motor

Winding temperature

Transformator

Generator

Ambient temperature

- Permanent monitoring of the entire machine data
- Requirement-dependent control of motors (alternating)
- Imbalance analysis → equipment protection
- Harmonics analysis → evaluation of thermal load
- Acquisition of room and machine temperature (delta/target-ACTUAL comparison)
- Comparison of target and actual data (power, current, temperature, etc.)
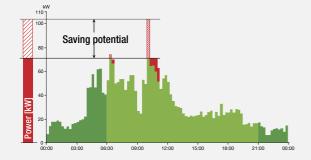   → Predictive maintenance

OPTIMISING AND MONITORING

Controllable processes

CU5000

$$(P - P_{MAX}) \times k = V$$

Speed

4 … 20mA or
Modbus RTU

Motor overload switch

Frequency converter

Conveyor belt drive

Grinder drive

- Control of conveyor belt speed
- Monitoring of motor data
- Predictive maintenance
  Motor state monitoring – every 60 min. the idling data of the motor is compared to target data and the state is determined
- Idling monitoring and deactivation

Peak load control

kW
110
100
80
60
40
20
0

Saving potential

Power [kW]

00:00 03:00 06:00 09:00 12:00 15:00 18:00 21:00 00:00

In load optimising, the activation instant of high-demand electrical equipment is shifted by a few minutes in dependence on the overall load without impairing the operation. This considerably reduces energy costs. With CENTRAX, the peak load control can be individually adapted to any ambient conditions in an optimum fashion.
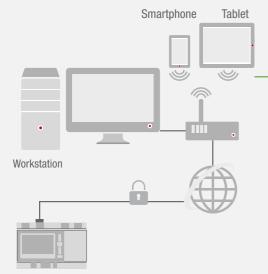
INDIVIDUAL VISUALISATION

CODESYS WebVisu

Service and diagnosis by access world-wide

The web-based display variant of CODESYS visualisation facilitates remote access, remote monitoring as well as service and diagnosis of equipment via the Internet. A standard web browser communicates by JavaScript (optionally with SSL encryption) with the web server in the control and visualises using HTML5. This technology is supported on almost all browsers and is thus also available on terminals with iOS or Android.
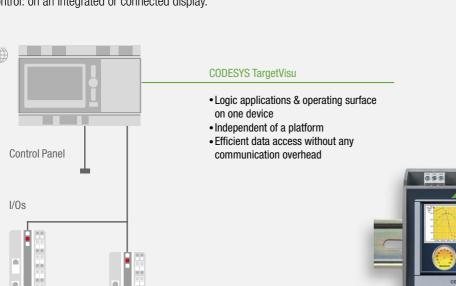

Smartphone   Tablet

Workstation

CODESYS WebVisu

- Remote access with standard browser
- Based on HTML5 + JavaScript: runs on all common smartphones and tablets
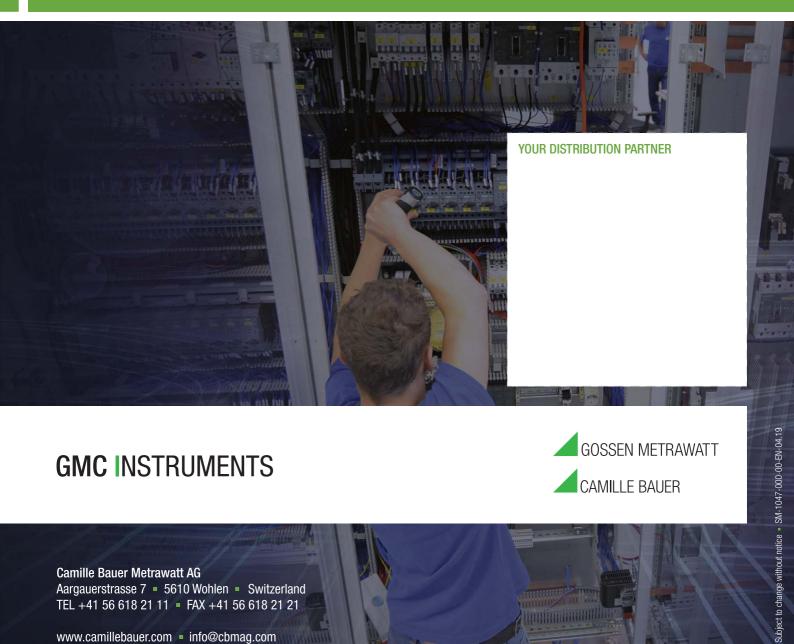- CODESYS WebServer locally on the control

CODESYS TargetVisu

Machine and equipment operation on site

This variant is independent of a platform and shows the operating surfaces directly on the control: on an integrated or connected display.

This combines control and visualisation in one device – ideal for the operation and observation of machines and equipment.

Control Panel

I/Os

CODESYS TargetVisu

- Logic applications & operating surface on one device
- Independent of a platform
- Efficient data access without any communication overhead

GMC INSTRUMENTS

GOSSEN METRAWATT

CAMILLE BAUER