WOODWARD

*Combined Protection and Control System*

***CSP2-F*** *Feeder Protection*

***CSP2-L*** *Cable-/Line Differential Protection*

***CSP2-T*** *Transformer Differential Protection*

## Content

# 1 Introduction

The top-quality digital protection and control system of the *SYSTEM LINE* fulfils all demands and needs for protection and control at medium-voltage level.

The combined protection and control system *CSP2* is a feeder management system for the medium-voltage requirements. The system complies with state of the art modern digital protection technology.

Development work focuses primarily on the following goals:

- User-friendly operation,
- Flexibility,
- Ease of integration with the switchboards,
- Freely selectable functions,
- A wide range of applications and
- Standardised communication.

⇒ Cost optimisation at medium-voltage level!

The systems comprise of two separate devices:

- the base unit *CSP2* and
- the operating/display unit *CMP1*:

All protection and control functions are completely integrated into the self-operating *CSP2*. The base unit is installed into the low-voltage niche (mounted on mounting plate). The wide-range of power parts also allows connection to all auxiliary voltage equipment commonly used in MV systems.

⇒ One system for all switchgears and applications!

The compact operating/display unit *CMP1* is decentralised and installed in the front door of the circuit breaker field. The simple, menu-guided operation, the large display with illuminated background as well as the ergonomically designed surface ensures that the operator of the system receives fast and comprehensive information at all times. A single bus/line has replaced the conventional cable

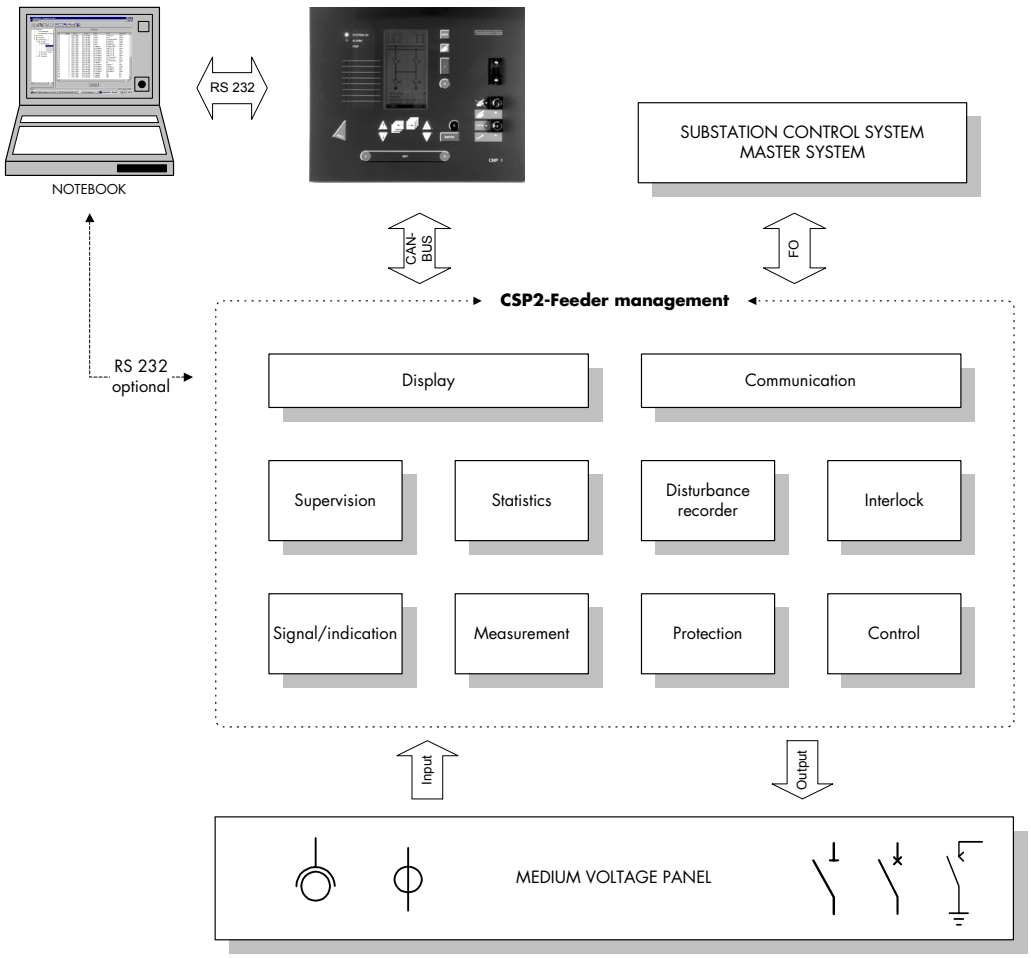


*Figure 1.1: CSP2 as field management system*

# 2 Central and intelligent Protection and Control system *CSP2*

The self-operating base module *CSP2* offers complete protection and control functions.

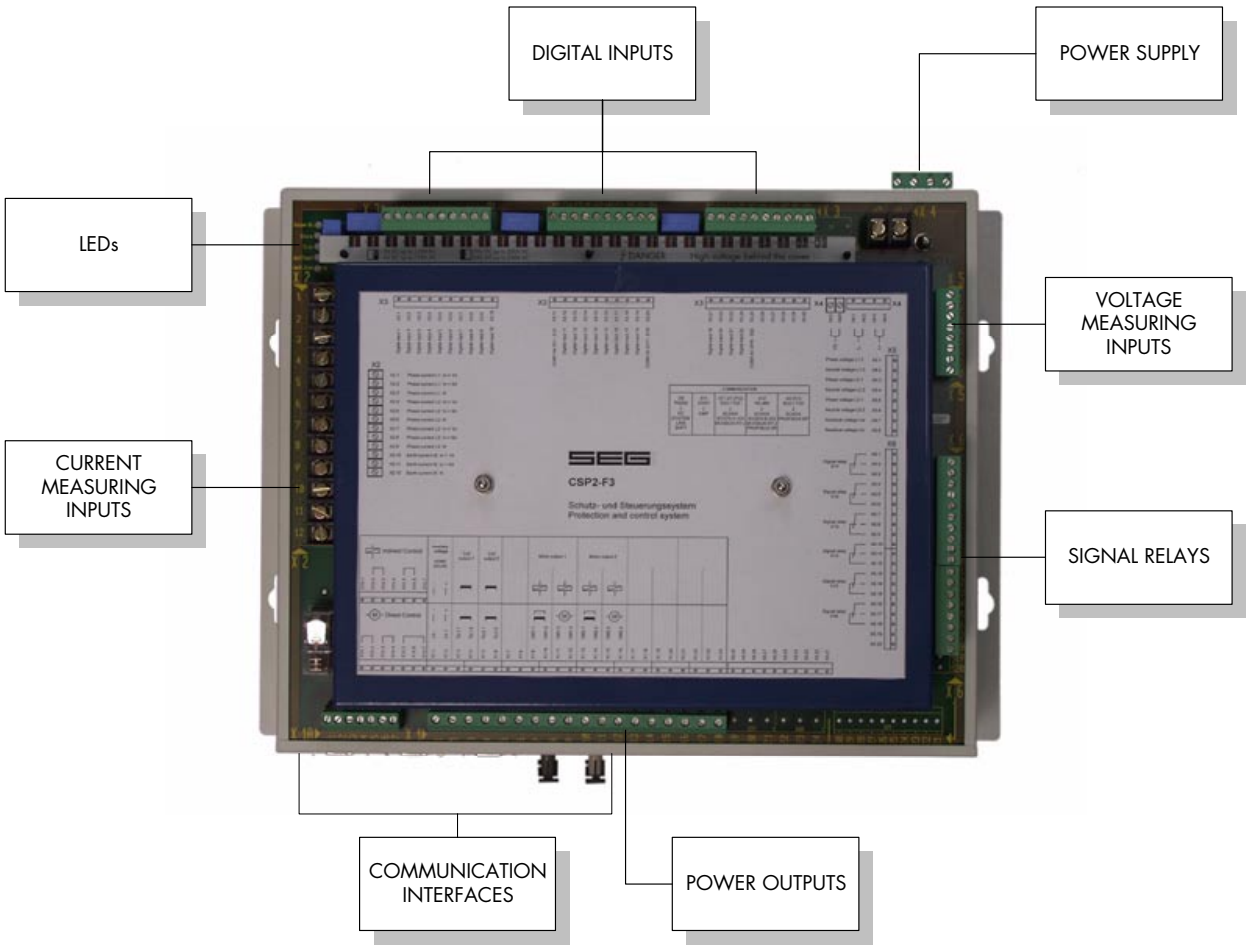


*Figure 2.1: Terminals and interfaces of the CSP2-F5*

## 2.1 Capabilities and functions

The base unit *CSP2* has the following special features:

- Compact design, with a robust synthetic housing in accordance with protection class IP50,
- Wide ranging power supply (AC and DC),
- Wide ranging power supply for digital inputs (AC and DC),
- Wide ranging power supply for control (DC),
- High/low voltage levels for digital inputs,
- A wide range of protection and control functions,
- Flexible management of inputs and outputs,
- Galvanically decoupled power outputs,
- Stand-alone operating mode of *CSP2,*
- Power outputs directly or indirectly driving the switch elements (circuit breakers, isolators, earth switches),
- Communication with SCADA systems via various protocol types and optional interfaces (electrical or fibre-optic),
- Various communication interfaces: CAN-Bus for communication to multiple devices and RS232 for connection to a PC/laptop.
- Highly efficient fault recording function (extended memory is optional, non-volatile.)
- Comprehensive self-monitoring (hardware and software),
- Two power categories of *CSP2* as standard and
- Maintenance free.

## 2.2 Applications

The *CSP2* is to be provided for various applications, each with two different power categories as standard version.

- *CSP2-F3/L*: This reasonably priced improved systems starter are predominantly used for simple feeder protection and is also used for the control of a circiut breaker, as well as two other switching devices, (disconnector and earth isolator). It is possible to recognize up to 5 switchgears.

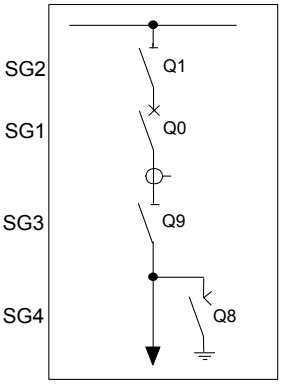


*Figure 2.2: Application example CSP2-F3 or CSP2-L*

- Further applications of the *CSP2-F3/L* include meshed electrical grids for selective direction protection and for the control of other switching devices.

- *CSP2-F5:* This highly performing feeder management system is able to recognize and control up to five switching devices. According to higher requirements the *CSP2-F5* provides a larger number of digital inputs and signal relays. The number of measuring inputs is the same as with the *CSP2-F3*.

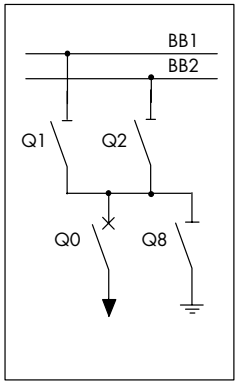


*Figure 2.3: Application example CSP2-F5*

- *CSP2-T25:* This device is used for complexe protection and control in the application field of transformer differential protection.
  The CSP2-T25 is especially developed for two-winding transformers and is able to switch up to 5 switchgears.

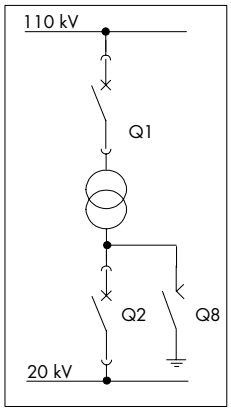


*Figure 2.4: Application example CSP2-F3 or CSP2-L*

All *CSP2* have a highly efficient disturbance recorder function. Optionally, it is possible to store the disturbance records fail-safe on an extended memory.

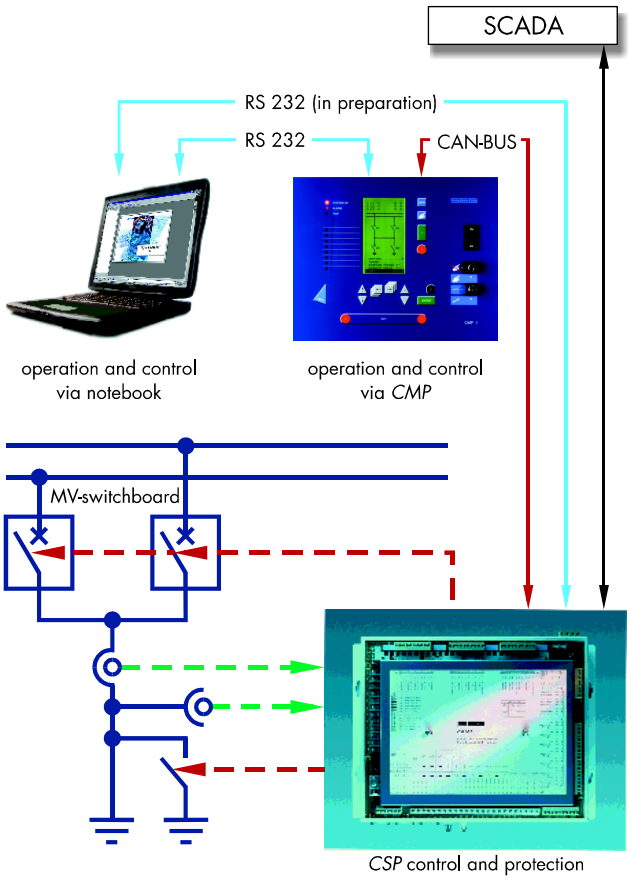


*Figure 2.5: CSP2-F Feeder protection*

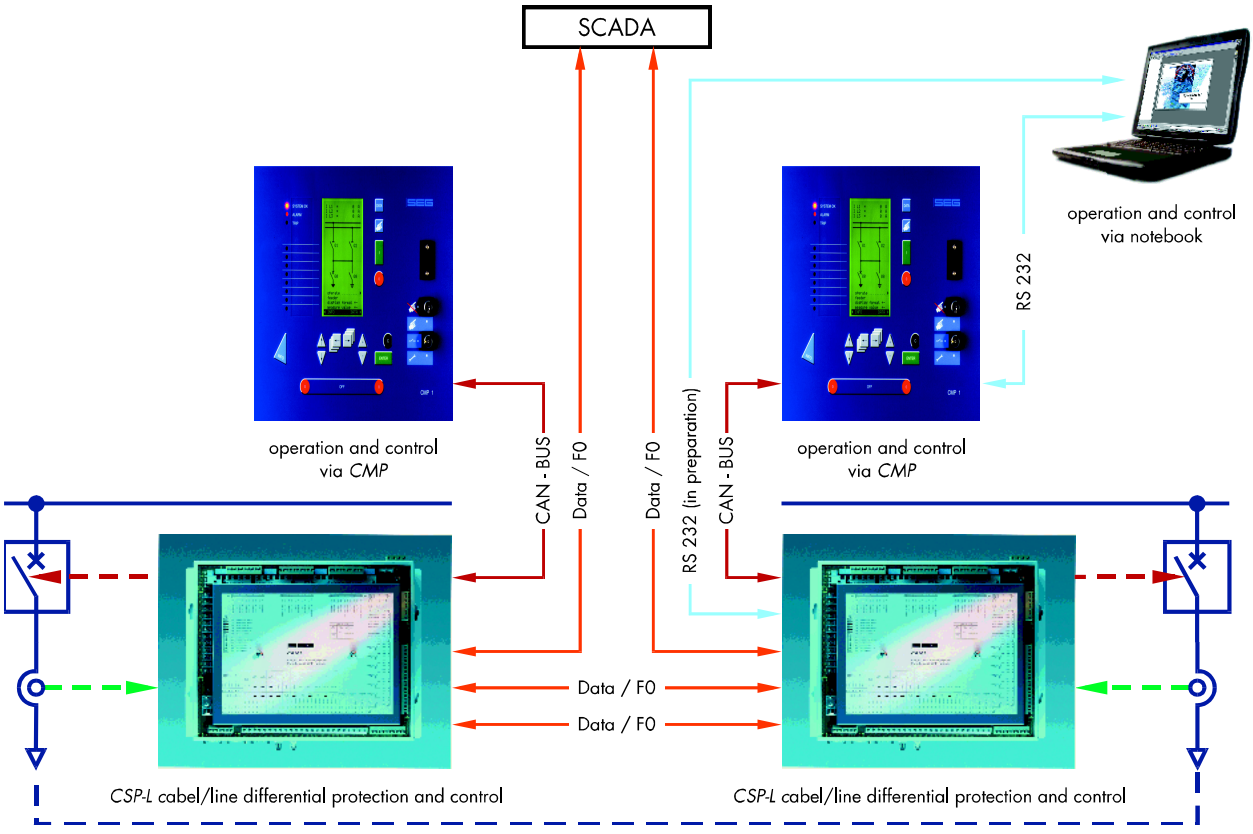


*Figure 2.6: CSP2-L Cable/line differential protection and control*

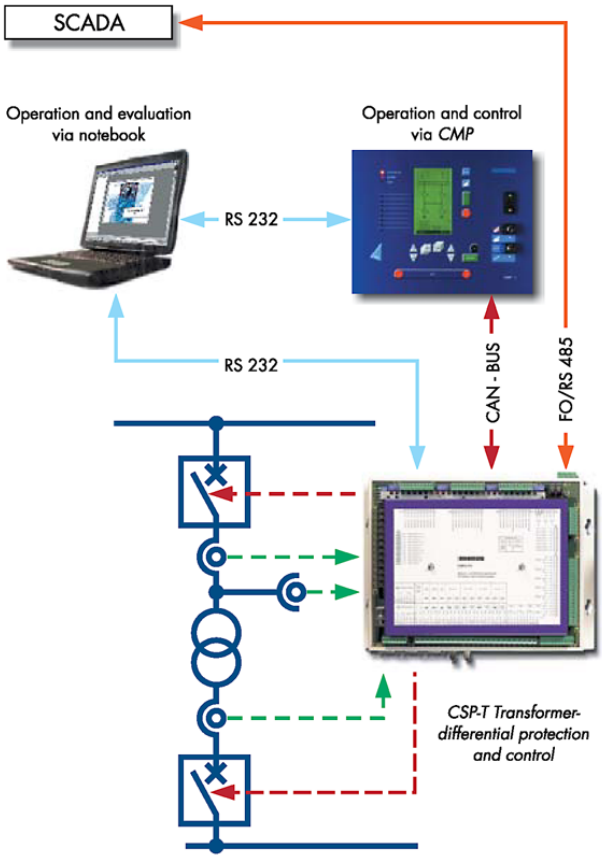


*Figure 2.7: CSP2-T25 transformer differential protection and control*

## 2.3 Design

The compact *CSP2* incorporates all components necessary for:

- Measured value recording and evaluation,
- Signal and command output,
- Entry and evaluation of binary signals,
- Data transmission and storage and
- Auxiliary power supply.

The housing of the *CSP2* housing is made of very robust synthetic material, which will withstand environmental perturbations such as vibration, shock, dirt, etc.

The upper circuit board tightly seals the housing, and at the same time, serves as a connection. Mounted on this board are all connections for the transformers, digital inputs, signal relays, as well as the control outputs. Below the cover of this board are the internal current and voltage transformers, opto-couplers and relays.

The housing is designed in such a way to guarantee a specific protection (i.e. Protection Classifiation IP50).

The base unit *CSP2* is fitted with internal measuring transformers, which are supplied with analogous inputs signals from the main current and voltage transformers. The internal measuring transformers are galvanically decoupled, analogously filtered and finally transmitted to the analog/digital converter.

The *CSP2* is equipped with a 24-Bit signal processor for the protection functions and a high-power 16-Bit controller for processing the control and communication functions. Thanks to the digital signal processing, the influences of higher frequency compensation processes and DC components are suppressed.

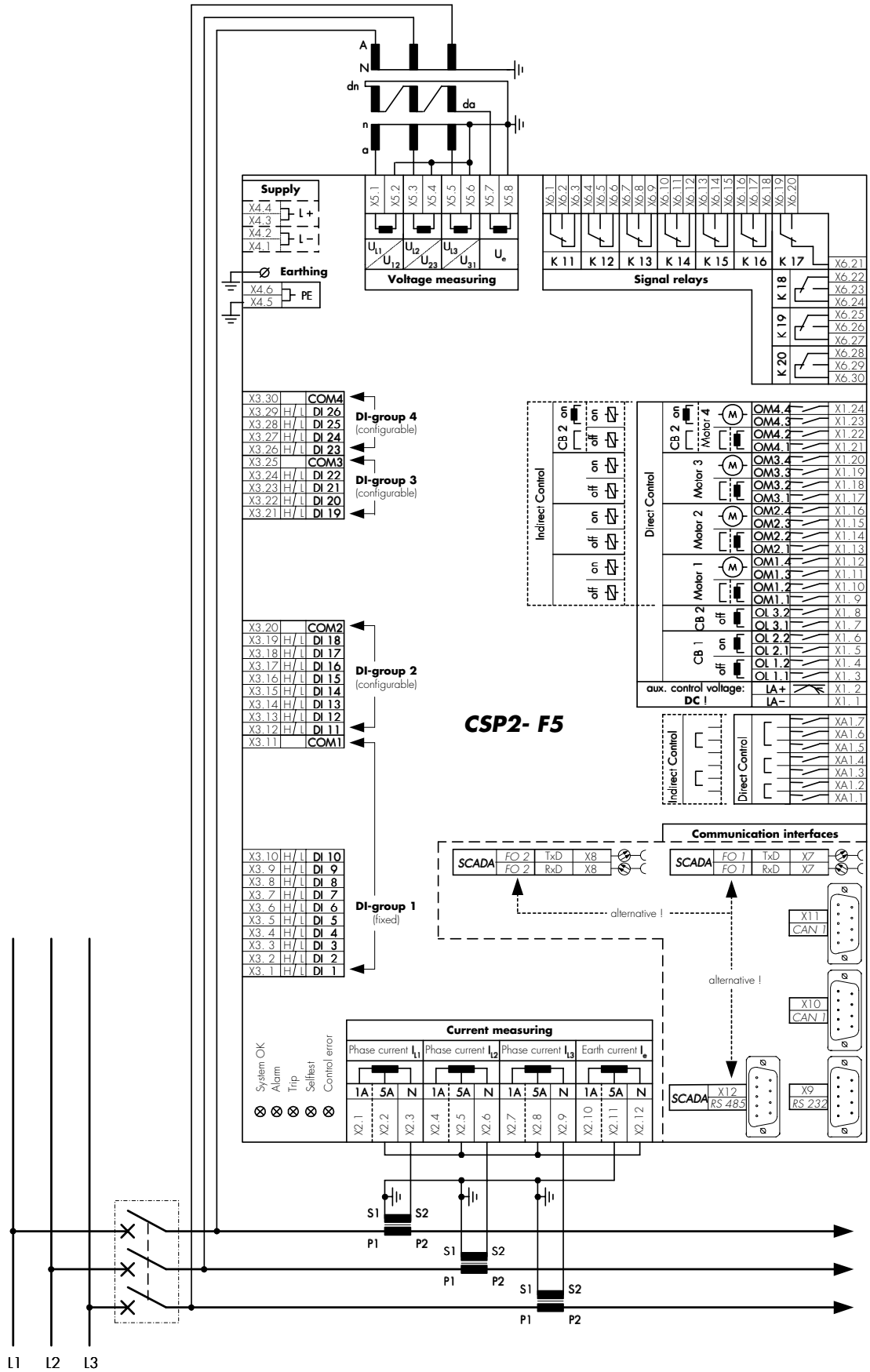


*Figure 2.8: Connection diagram CSP2-F5*

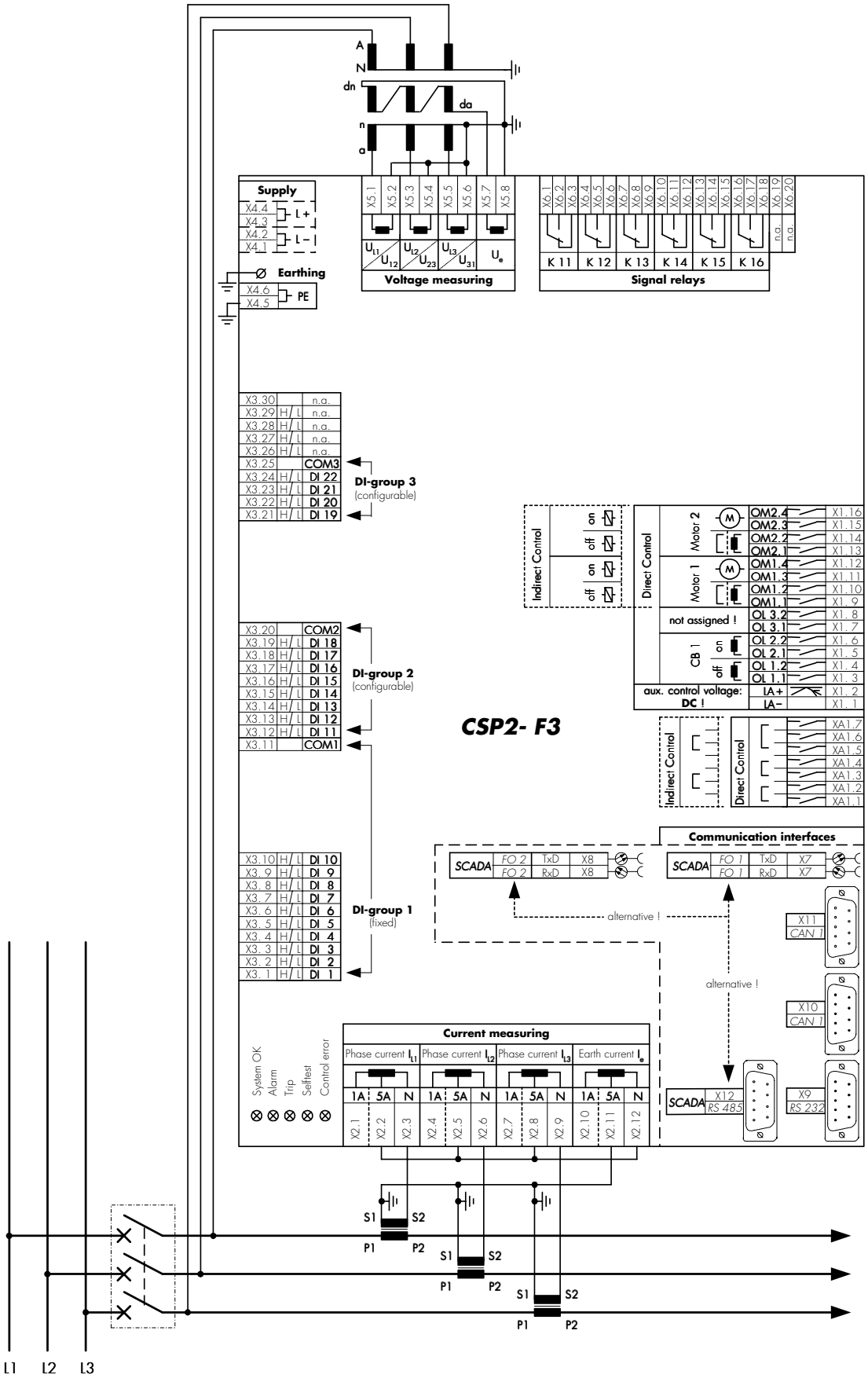


*Figure 2.9: Connection diagram CSP2-F3*

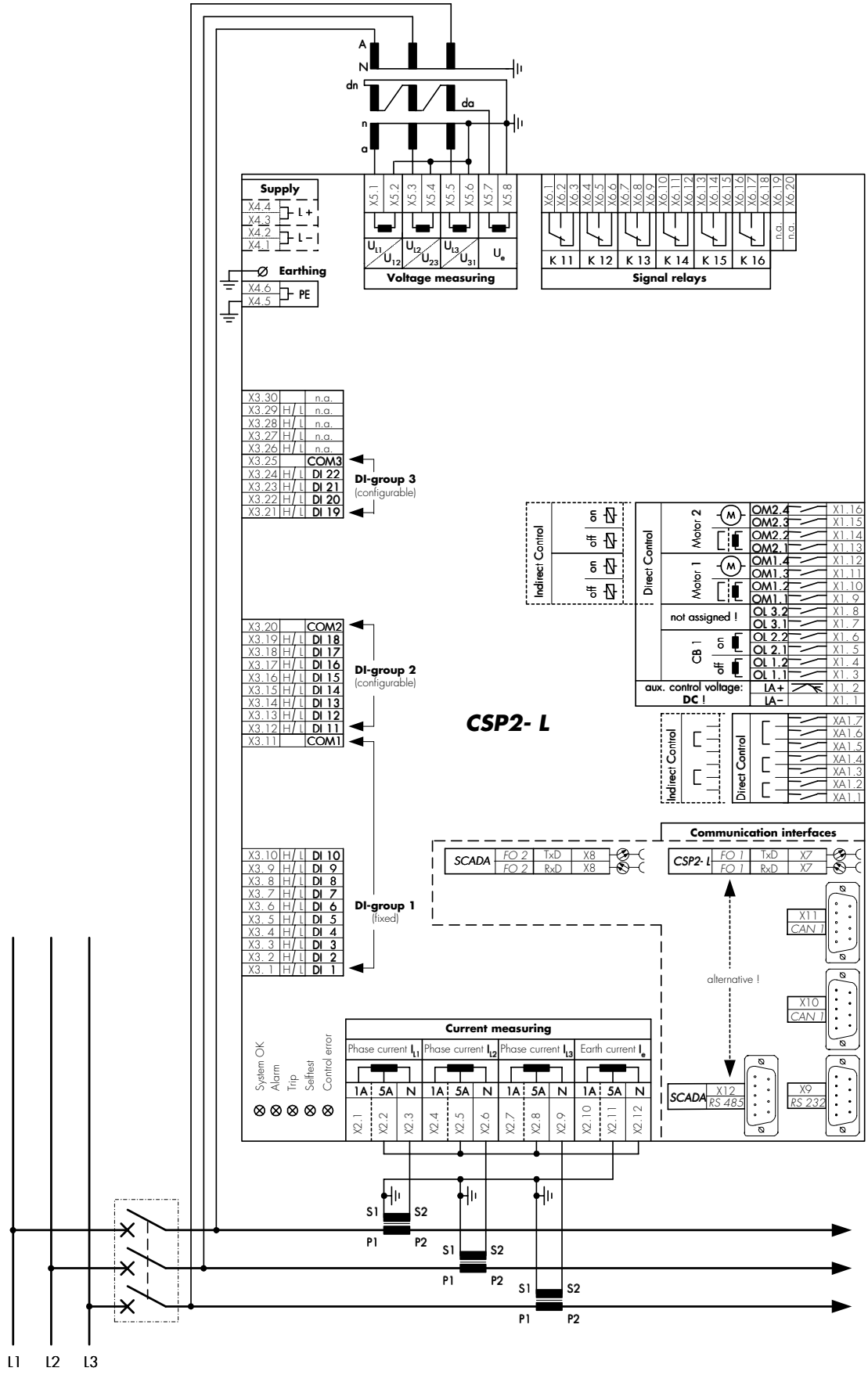


*Figure 2.10: Connection diagram CSP2-L*

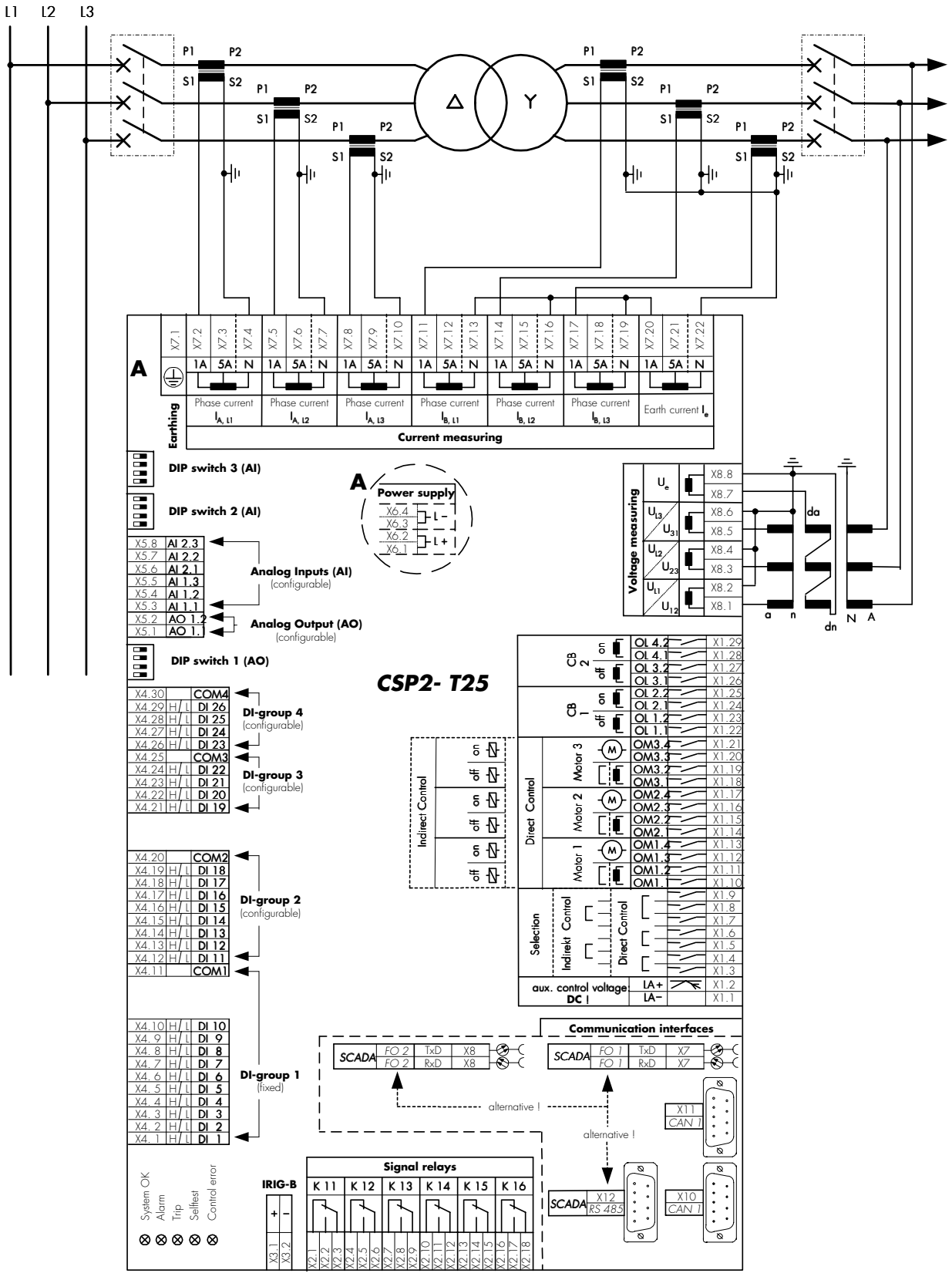


*Figure 2.11: Connection diagram CSP2-T*

## 2.4 Protection functions

The combined protection and control system *CSP2* is equipped with a great number of protection functions which cover nearly all protection tasks in the medium-voltage range.

All protection functions are fully available to the operator and can be activated as desired. Parameter setting of the protection functions can either be done by using the operating/display unit *CMP1* or by PC/Laptop via the operating software *SL-SOFT*.

The *CSP2* provides four protection parameter sets. Each set includes all the available protection functions. The protection parameter sets can be switched over in the following way:

- Local parameter setting via CMP1
- Through digital input or
- By SCADA system (Datatelegram of the available protocol type).

To connect external protection devices for monitoring and controlling, the *CSP2* is equipped with multiple functions.

| No. | Protection functions | ANSI | CSP2-F3 | CSP2-F5 | CSP2-L1 | CSP2-L2 | CSP2-T25 |
|---|---|---|---|---|---|---|---|
| 1 | Overcurrent directional/non-directional | 51/67 | ● | ● | ● | ● | ● |
| 2 | Short-circuit current directional/non-directional | 50/67 | ● | ● | ● | ● | ● |
| 3 | Earth current directional/non-directional | 50N/51N/67N | ● | ● | ● | ● | ● |
| 4 | Restricted Earth Fault | 64REF | - | - | - | - | ● |
| 5 | Differential | 87 | - | - | Cable | Cable | Transformer |
| 6 | Overload protection with thermal replica | 49 | ● | ● | ● | ● | ● |
| 7 | Residual voltage | 59N | ● | ● | ● | ● | ● |
| 8 | Over-/Undervoltage | 27/59 | ● | ● | ● | ● | ● |
| 9 | Over-/Underfrequency | 81 | ● | ● | - | - | - |
| 10 | Automatic Reclosing (AR) | 79 | ● | ● | ● | ● | ● |
| 11 | Power/Reverse Power | 32F/B | ● | ● | - | - | * |
| 12 | Negative phase sequence current ($I_2$) | 46 | ● | ● | - | - | - |
| 13 | Control circuit supervision (incl. trip circuit) | 74TC | ● | ● | ● | ● | ● |
| 14 | Circuit breaker failure (CBF) | 50/62BF | ● | ● | ● | ● | ● |
| 15 | Lock out function | 86 | ● | ● | ● | ● | ● |
| 16 | Reverse interlocking | - | ● | ● | ● | ● | ● |
| 17 | Voltage transformer supervision (fuse failure) | - | ● | ● | ● | ● | ● |
| 18 | Switch on to fault (SOTF) | - | ● | ● | ● | ● | ● |
| 19 | AR fast trip | - | ● | ● | ● | ● | ● |
| 20 | AR-Start by Non-Corresponding of CB | - | ● | ● | ● | ● | ● |
| 21 | Programmable protection logic (i.e. function/blocking/trip blocking) | - | ● | ● | ● | ● | ● |
| 22 | Parameter switch | - | ● | ● | ● | ● | ● |
| 23 | Disturbace recorder (Optionally with extended memory | - | ● | ● | ● | ● | ● |

*Table 2.1: Outline CSP2-protection functions* * *in preparation*

## 2.5 Control and Monitoring

For control and monitoring tasks the *CSP2/CMP1* system is equipped with the following functions:

- Graphic display of the status of the switching devices on *CMP1*,
- the switching devices can be controlled via the operating keys, digital inputs or a SCADA system via the serial interface,
- direct control of the circuit breaker coils,
- direct or indirect control of motor-drives,
- interlocking of different switching devices at feeder level,
- interlocking of different switching devices at station level (e.g. by SCADA system) and
- protocolling of switching operations and changes of switch positions (event recorder).

The switching device positions are recorded by *CSP2* via two opto-decoupled digital inputs. One is for »OFF position«, the other is for »ON position«. The position signals of the various switching devices (up to 5) are shown on the LC graphic display of the *CMP1* in the form of a single line diagram.
Fault and differential positions are shown by according symbols of the switching devices.

The single line diagram is configurated at the factory in accordance with customer requirements.

In addition to status recognition it is possible to record, protocol and transmit external protection signals, monitoring messages, external control commands and interlocking functions with varying functionalities via the configurable digital inputs.

In addition to the functional assignments, it is also possible to set parameters for rebouncing time and signal logics for each input.

By using signal relays equipped with potential-free contacts it is possible to transmit binary signals for protection and monitoring (e.g. CB failure, backward interlocking).

CB = Circuit Breaker

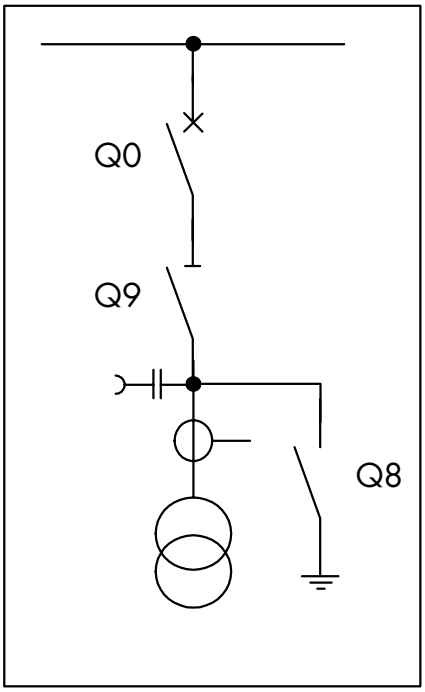


*Figure 2.12: Configuration example (single line diagram)*

| ***No.*** | ***Control functions*** | ***CSP2-F3*** | ***CSP2-F5*** | ***CSP2-L1*** | ***CSP2-L2*** | ***CSP2-T25*** |
|---|---|---|---|---|---|---|
| 1 | No. of controllable switching devices | 3 | 5 | 3 | 3 | 5 |
| 2 | No. of switching devices that can be shown on the graphic display | 5 | 5 | 5 | 5 | 5 |
| 3 | No. of power outputs for control of circiut breakers (Contol coils of circuit breakers) | 2 | 3 (4) | 2 | 2 | 4 |
| 4 | No. of power outputs for control of motor-driven switching devices (i.e earthing isolators and disconectors) | 2 | 4 (3) | 2 | 2 | 3 |
| 5 | No. of signal relays | 6 | 10 | 6 | 6 | 6 |
| 6 | No. of configurable digital inputs | 22 | 26 | 22 | 22 | 26 |
| 7 | Command outputs with defined switching and operation times | ● | ● | ● | ● | ● |
| ***No.*** | ***Supervision functions*** | ***CSP2-F3*** | ***CSP2-F5*** | ***CSP2-L1*** | ***CSP2-L2*** | ***CSP2-T25*** |
| 1 | Fault/differential position | ● | ● | ● | ● | ● |
| 2 | Withdrawal of the circuit breaker | ● | ● | ● | ● | ● |
| 3 | Spring charged | ● | ● | ● | ● | ● |
| 4 | Programmable interlocking conditions at feeder level | ● | ● | ● | ● | ● |
| 5 | Interlocking of switching devices at station level by SCADA system | ● | ● | ● | ● | ● |
| ***No.*** | ***Progammable logic functions*** | ***CSP2-F3*** | ***CSP2-F5*** | ***CSP2-L1*** | ***CSP2-L2*** | ***CSP2-T25*** |
| 1 | 32 programmable logic equations | ● | ● | ● | ● | ● |
| 2 | 32 input variables per logic function | ● | ● | ● | ● | ● |
| 3 | 1 time element per logic output | ● | ● | ● | ● | ● |

*Table 2.2: Outline CSP2 control, monitoring and programmable logic functions*

## 2.6 Measuring functions

In addition to the recorded measuring values for both current and voltage, further measuring values such as active and reactive power etc. are calculated and displayed as primary values. The periodically measured values can be read by the *CMP1*, a PC/notebook, or by SCADA system.
The measuring error rate, when in normal operation is less than1%, and with a short-circuit, up to 40 x $I_N$, it is less than 2.5%.

| ***Measure value*** | | | | | | | Available with ***CSP2-*** | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| *Measuring value (displayed)* | *Description* | *Measuring range* | *Unit* | *Recording* | | *Remark* | ***L*** | ***F3*** | ***F5*** | ***T25*** |
| | | | | *Direct measuring* | *Calculation* | | | | | |
| IL1 (A) | Phase currents | | A | | | Momentary rms values | ● | ● | ● | ● |
| IL2 (A) | | | A | | | | | | | |
| IL3 (A) | | | A | | | | | | | |
| IL1 (B) | | | A | | | | | | | |
| IL2 (B) | | | A | | | | | | | |
| IL3 (B) | | | A | | | | | | | |
| Ie | Earth current | | A | ● | - | Momentary rms values | ● | ● | ● | ● |
| I2 | Negative phase sequence current ($I_2$) | | A | | ● | Momentary rms values of negative sequence system | - | ● | ● | - |
| UL1 | Phase-to-neutral voltage (LN) | | V | ● | - | Momentary rms values | ● | ● | ● | ● |
| UL2 | | | V | | | | | | | |
| UL3 | | | V | | | | | | | |
| U12 | Phase-to-phase voltage (LL) | | V | ● | ● | Momentary rms values | ● | ● | ● | ● |
| U23 | | | V | | | | | | | |
| U31 | | | V | | | | | | | |
| Ue | Residual voltage | | V | ● | ● | Momentary rms values | ● | ● | ● | ● |
| f | Frequency | | Hz | - | ● | Momentary values | ● | ● | ● | ● |
| P | Active power | | kW | - | ● | Momentary rms values | - | ● | ● | * |
| Q | Reactive power | | kvar | - | ● | Momentary rms values | - | ● | ● | * |
| cos φ | Power factor | –1…+1 | - | - | ● | Momentary values | - | ● | ● | * |
| Wp+ | Energy active part - positive | | kWh | - | ● | Counting value | - | ● | ● | * |
| Wp– | Energy active part - negative | | kvarh | - | ● | Counting value | - | ● | ● | * |
| Wq+ | Energy reactive part - positive | | kWh | - | ● | Counting value | - | ● | ● | * |
| Wq– | Energy reactive part - negative | | kvarh | - | ● | Counting value | - | ● | ● | * |
| ϑ | Thermal capacity | 0…200% | % | | ● | Momentary value | ● | ● | ● | ● |
| tϑ | Time until protection trip of the function ϑ> | | s | | ● | Momentary value | ● | ● | ● | ● |
| ϑ1 | Temp.- measurement: analog | | °C/F | ● | | Momentary value | - | - | - | ● |
| ϑ2 | | | °C/F | ● | | | - | - | - | ● |
| $I_d$L1 | Differential current | | A | | ● | Momentary rms value | ● | - | - | ● |
| $I_d$L2 | | | A | | ● | | ● | - | - | ● |
| $I_d$L3 | | | A | | ● | | ● | - | - | ● |
| $I_s$L1 | Stabilisation currents | | A | | ● | Momentary rms value | ● | - | - | ● |
| $I_s$L2 | | | A | | ● | | ● | - | - | ● |
| $I_s$L3 | | | A | | ● | | ● | - | - | ● |
| mL1 | Transient stabilisation factor | | - | | ● | Momentary values | ● | - | - | - |
| mL2 | | | - | | ● | | ● | - | - | - |
| mL3 | | | - | | ● | | ● | - | - | - |

*Table 2.3: Outline CSP2 measuring values* ** in preparation*

## 2.7 Statistical measuring values

The *CSP2* not only records measuring values but also offers statistical data. Maximum and average values as well as counting values can be retrieved by the *CSP2*.

The maximum and average values are to be generated within a variable time window. The counting values such as operating hours or switching cycle counter are resetable.

| ***Statistical Data*** | | | | Available with ***CSP2-*** | | | |
|---|---|---|---|---|---|---|---|
| *Statistical value* | *Description* | *Unit* | *Calculation (Actualisation)* | ***L*** | ***F3*** | ***F5*** | ***T25*** |
| IL1max | Max. value of current in phase L1 | A | *cyclically each „Δt" and at „moment of synchronization"* | ● | ● | ● | ● |
| IL2max | Max. value of current value in phase in L2 | A | | ● | ● | ● | ● |
| IL3max | Max. value of current value in phase in L3 | A | | ● | ● | ● | ● |
| IL1avg | Mean value of current value in phase L1 | A | | ● | ● | ● | ● |
| IL2avg | Mean value of current value in phase L2 | A | | ● | ● | ● | ● |
| IL3 avg | Mean value of current value in phase L3 | A | | ● | ● | ● | ● |
| UL1max | Max. value of phase-to-neutral voltage L1-N | V | | ● | ● | ● | ● |
| UL2max | Max. value of phase -to-neutral voltage L2-N | V | | ● | ● | ● | ● |
| UL3max | Max. value of phase -to-neutral voltage L3-N | V | | ● | ● | ● | ● |
| UL1avg | Mean value of phase -to-neutral voltage L1-N | V | | ● | ● | ● | ● |
| UL2avg | Mean value of phase -to-neutral voltage L2-N | V | | ● | ● | ● | ● |
| UL3avg | Mean value of phase -to-neutral voltage L3-N | V | | ● | ● | ● | ● |
| U12max | Max. value of phase -to-phase voltage L1-L2 | V | | ● | ● | ● | ● |
| U23max | Max. value of phase -to-phase L2-L3 | V | | ● | ● | ● | ● |
| U31max | Max. value of phase -to-phase L3-L1 | V | | ● | ● | ● | ● |
| U12avg | Mean value of phase -to-phase L1-L2 | V | | ● | ● | ● | ● |
| U23avg | Mean value of phase -to-phase L2-L3 | V | | ● | ● | ● | ● |
| U31avg | Mean value of phase -to-phase L3-L1 | V | | ● | ● | ● | ● |
| fmax | Max. value of frequency | Hz | | ● | ● | ● | ● |
| favg | Mean value of frequency | Hz | | ● | ● | ● | ● |
| Pmax + | Max. value of pos. active power | kW | | - | ● | ● | * |
| Pmax - | Max. value of neg. active power | kW | | - | ● | ● | * |
| Pavg + | Mean value of pos. active power | kW | | - | ● | ● | * |
| Pavg - | Mean value of neg. active power | kW | | - | ● | ● | * |
| Qmax + | Max. value of pos. reactive power | kvar | | - | ● | ● | * |
| Qmax - | Max. value of neg. reactive power | kvar | | - | ● | ● | * |
| Qavg + | Mean value of pos. reactive power | kvar | | - | ● | ● | * |
| Qavg - | Mean value of neg. reactive power | kvar | | - | ● | ● | * |
| $I_d$L1max | Max. value of differential current in phase L1 | A | | ● | - | - | ● |
| $I_d$L2max | Max. value of differential current in phase L2 | A | | ● | - | - | ● |
| $I_d$L3max | Max. value of differential current in phase L3 | A | | ● | - | - | ● |
| $I_s$L1max | Max. value of stabilisation current in phase L1 | A | | ● | - | - | ● |
| $I_s$L2 max | Max. value of stabilisation current in phase L2 | A | | ● | - | - | ● |
| $I_s$L3max | Max. value of stabilisation current in phase L3 | A | | ● | - | - | ● |
| mL1max | Max. value of harmonic stabilisation factor in phase L1 | - | | ● | - | - | - |
| mL2max | Max. value of harmonic stabilisation factor in phase L2 | - | | ● | - | - | - |
| mL3max | Max. value of harmonic stabilisation factor in phase L3 | - | | ● | - | - | - |

*Table 2.4: Outline CSP2-statistical data*

** in preparation*

## 2.8 Data recording

The *CSP2* offers various protocolling and recording methods for events, fault values and fault records. Such information is stored in the *CSP2* and can be retrieved by the *CMP1*, a PC/notebook or the serial interface to a SCADA system. In this way, the operator has at his disposal all the necessary data for fault analysis and fault elimination.

### 2.8.1 Event recorder

The event recorder protocols and stores the last 50 events in the *CSP2*. The recorded messages are saved in the fail-safe, non-volatile memory of the device, and are given consecutive numbers and time stamp. Each event is stored with date, time, cause, and information with a resolution of 5 ms. This includes all messages which are related to protection, control, the configurable digital inputs, parameter setting and internal self-supervision of the device. In case of a fault, the protection messages are additionally marked with a clear and definite failure case number.

### 2.8.2 Fault recorder

The fault recorder stores the last 5 faults fail-safe in the *CSP2*, in accordance with the failure case number. In addition to trip events, all effective measuring values are stored and displayed as primary values. Therefore if the *CSP2* is damaged, evaluation and analysis at a later date is possible due to the protection messages, which are stored in the event recorder.

### 2.8.3 Disturbance recorder (optional)

To allow evaluation of the mains interferences, the analogous and digital information is stored in the disturbance recorder. Up to 8 digitalized measuring values (phase currents, earth current, voltages, residual voltage) are recorded. At the same time binary input and output signals can also be recorded. The maximum recording time for the *CSP2-F* is 10000 ms and for the *CSP2-L* 3500 ms. A pre- and post-running time can be adjusted in accordance to the trigger event. The measured values are recorded in momentary values.
The capacity to save more disturbance recorder data is obtainable when such information is stored in a non-volatile memory.
Optionally an increased non-volatile memory is available, which allows more storage for disturbance recorder data.

# 3 Display/Operating unit *CMP1*

The *CMP1* is easy to operate and ergonomically designed. The *CMP1* is installed in the front door of the medium-voltage compartment as a separate operating and control unit (MMI). Generally the display shows the phase current values and the single line diagram of the feeder.
The required communication with the base unit *CSP2* is realised by a CAN-fieldbus. A single CAN-cable creates the connection to the base unit *CSP2* and therefore replaces the conventional cable tree. This CAN-cable can be easily joined to the auxiliary voltage supply cable.

*Figure 3.1: CMP1*

The most important features of the *CMP1* include:

- Flat, compact design,
- Wide ranging power supply,
- Large, automatic LC graphic display with illuminated background (128 x 240 Pixel):
  - Representation of the configurated single line diagram,
  - Display of switch positions, measuring values and pop-up messages,
  - Protocolling of events including time stamps,
  - Protocolling of fault events including fault values as effective values,
  - Extensive commissioning support and
  - various test functions.
- Front operating panel as per protection class IP54,
- Multi-coloured function keys for menu guidance, control and Danger-OFF function,
- Two key switches for fixing the switching authorizations:
  - Local/remote operation mode and
  - Normal operation/Parameter setting mode.
- 11 multi-coloured LEDs (configurable),
- Integrated signal relay for system fault message,
- CAN interface for communication with *CSP2,*
- Two RS232 interfaces for parameter setting and the evaluation of data via PC/laptop.

## 3.1 Operating the *CMP1*

The control of the medium-voltage feeder and parameter setting can be carried out by the *CMP1.* All inputting of information can be made with the front operating panel. Check-back signals and the status of the devices are shown on the large graphic display, which has a illuminated background. The switch positions are shown graphically, messages as texts and parameters/measured values are in table form.

## 3.2 Operating elements of the *CMP1*

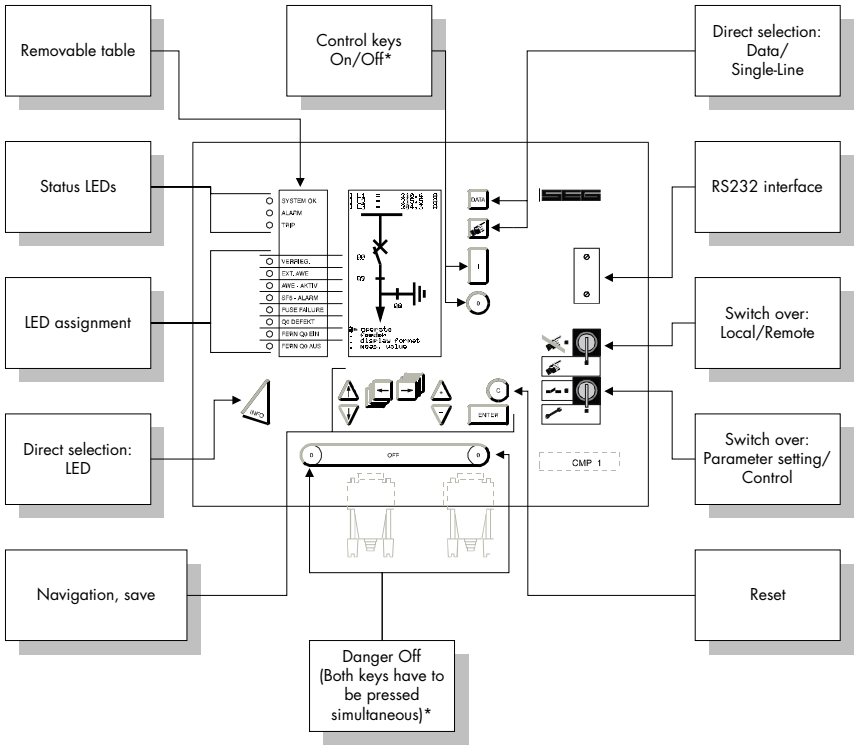


*Figure 3.2: Operating elements of the CMP1*

## 3.3 Functions of the operating elements

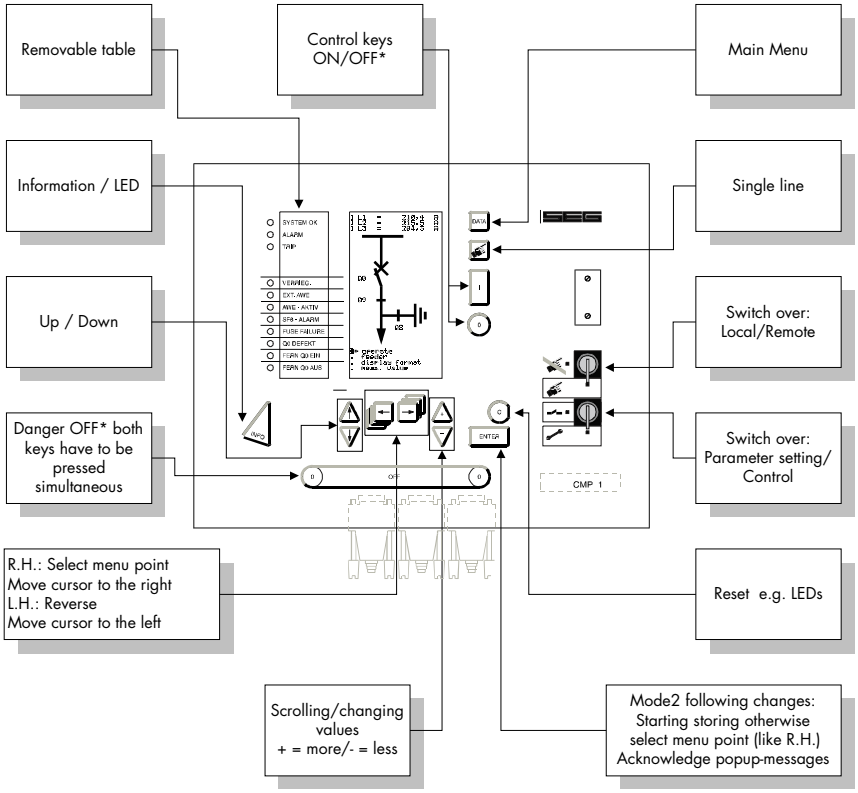


*Figure 3.3: Functions of operating elements*

## 3.4 The operating modes

Two key switches allow for various switch authorisations to be set:

- MODUS 1: Local operating/control,
- MODUS 2: Local operating/parameter setting and
- MODUS 3: Remote control.

Depending on their position, the switches will either allow the control or parameter setting of the *CSP2*.

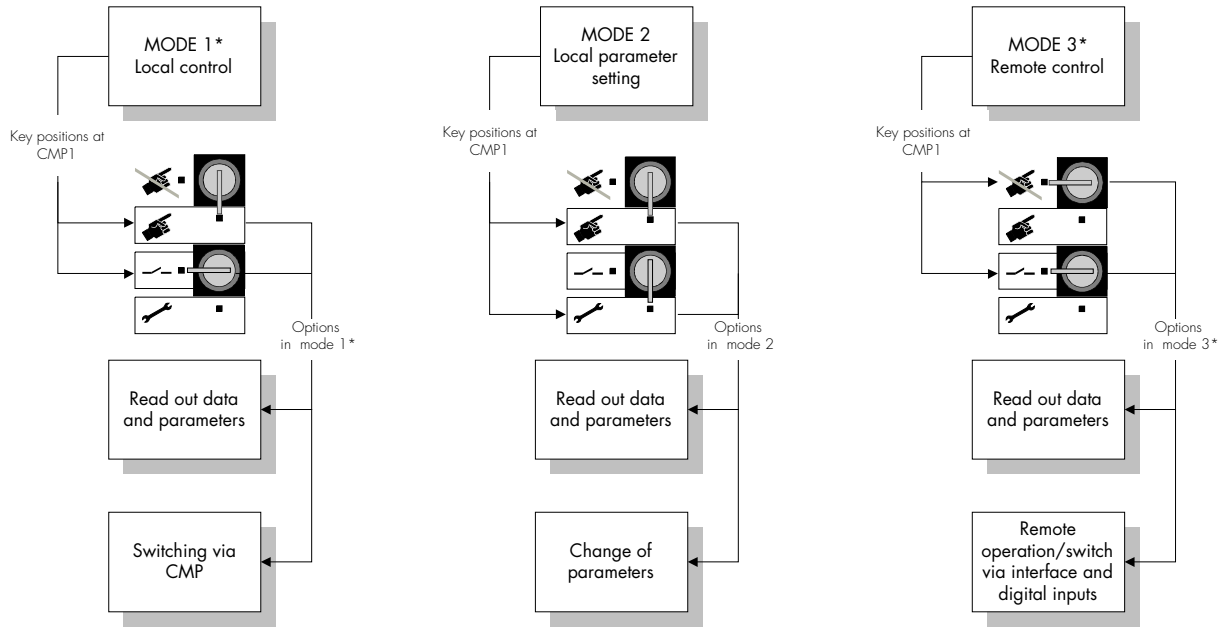


*Figure 3.4: The operating modes*

## 3.5 Control of switching devices

The switching devices shown in the single line diagram can be selected and controlled by the operating unit *CMP1.* Every control command that is given, is first checked by the internal, as well as external pre-programmed interlocking logics before being carried out. Switching operations via the *CMP1* can only be carried out in MODUS 1 – Local operating/control.

The positions of the switching devices, e.g. those of the circuit breakers, are recorded and monitored via it's auxiliary contacts. In this procedure the contact bounce of the auxiliary switch is suppressed via software.
The integrated control logic evaluates and processes the available switch positions as well as the readiness of the switch (spring charged). It then issues the »OFF« or »ON« command, only if the pre-programmed interlocking conditions have been scrutinized.

The switch-on and switch-off coils of the circuit breaker and the motors-drives of the switching devices are to be controlled by the power outputs of the *CSP2*.
By simple wire bridges there is a choice between

- direct control (with change of polarity) and
- indirect control (without change of polarity)

of motor driven switching devices.

A switch-on command will only take place if the switch-off position has been clearly signalled beforehand, and vice versa.
Switching actions are carried out sequentially. All control commands issued have a time limit. If the control commands are not carried out within a specified time, the *CSP2* will give a fault signal.
Monitoring of the check-back signals of the controlled switching device is carried out by the maximum control and reaction times of the switching device.

## 3.6 Programming & Parameter Setting

In principle the data sets of the *CSP2* consist of 2 files sets, which are device configured based in respect to their use:

- "sline.sl" and
- "parameter.csp"

On one hand, the file "sline.sl" contains data of the single line diagram which represents the feeder configuration and is to be displayed on the *CMP1* graphically. On the other hand it contains data for the feeder interlocking conditions, which are fixed by the internal interlocking matrix.

With the file "parameter.csp", there are 4 parameter sets available for the protection functions and one parameter set for system parameters, which are attached to one parameter file. This parameter file is dependent on the type of device used,( e.g. *CSP2-F3*, *CSP2-F5*, *CSP2-L or CSP2-T25*) as well as the software version of the *CSP2* device.

The storing of a parameter file in an non-compatible device will be hindered by a Plausibility Control.

There are 4 complete protection parameter sets available for the protection functions. One of the four parameter sets is always in operation.
Each parameter set can be edited in the background and then stored. This action will not influence the actively operating protection and control functions.
A modified parameter set, even if only one single parameter has been changed, will only become active upon confirmation of being stored (acknowledgement).
At any time, the four protection parameter sets can be changed to the active set.

The system parameter set contains the initial configuration of the device such as, i.e. rated feeder data, control times, configuration of the inputs and outputs and communication.
The parameter setting of the *CSP2* can either be done locally using the menu buttons on the front of the *CMP1* or remotely by PC via the serial interface.

# 4 Application software *SL-SOFT*

*Operating and Evaluation Programme/Functions*

The *SL-SOFT* ("System-Line-Soft") allows evaluation and parameter setting of the ***CSP-2*** device. The software will work with PC operating systems Windows 95/98/ME or Windows NT/2000/XP. Communication takes place via the RS232 interface or via the internal CAN-BUS. It also allows operation with a mouse (Windows surface) and has a user-guided window technique. The *SL-SOFT* is easy to install, allows ONLINE or OFFLINE parameter setting and provides menu commands in both German or English.

## 4.1 Scope of functions and performance

- Available for all SYSTEM LINE ***CSP2*** devices
- Online/Offline mode
- Integrated change of languages,(German/English)
- Selection of devices to enable single or multiple device communication.
- Easy to use window technology to obtain operating and status performance information
- Menu-led surface
- Evaluation of all available data
- Cyclical reading of measured values
- Testing of inputs and outputs
- Parameter setting of all device-specific data
- Plausibility controls
- Editing, copying or erasing data sets
- Preparation of data set in offline mode
- Archiving of data sets
- Printing out of data sets with different print options
- Further working out of measured values (recording, displaying),
- Commissioning support (e.g. differential and stability values with *CSP2-L and CSP2-T25*), functioning support
- Initiation of test fault records, (manual triggering)
- Time synchronisation from the PC
- Programming the logic functions (SL-LOGIC)

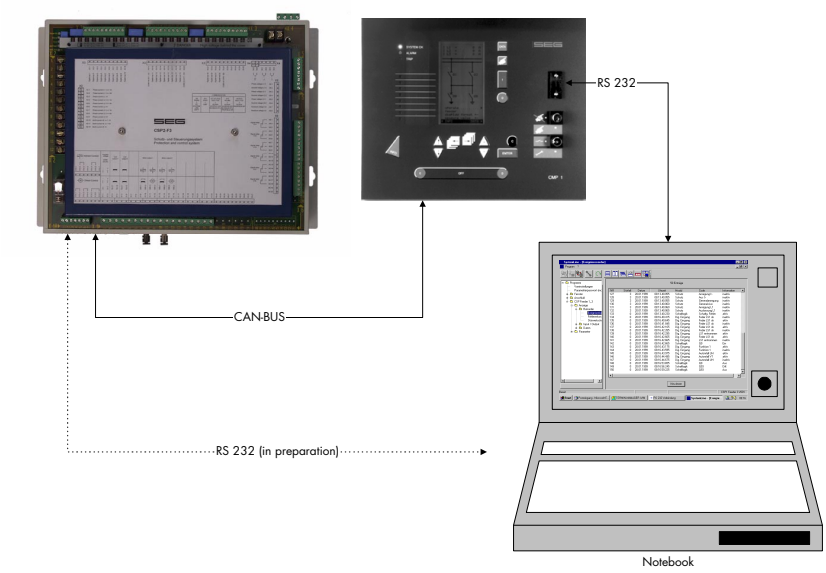


*Figure 4.1: Connection Example CSP2/CMP1 to PC via RS 232*

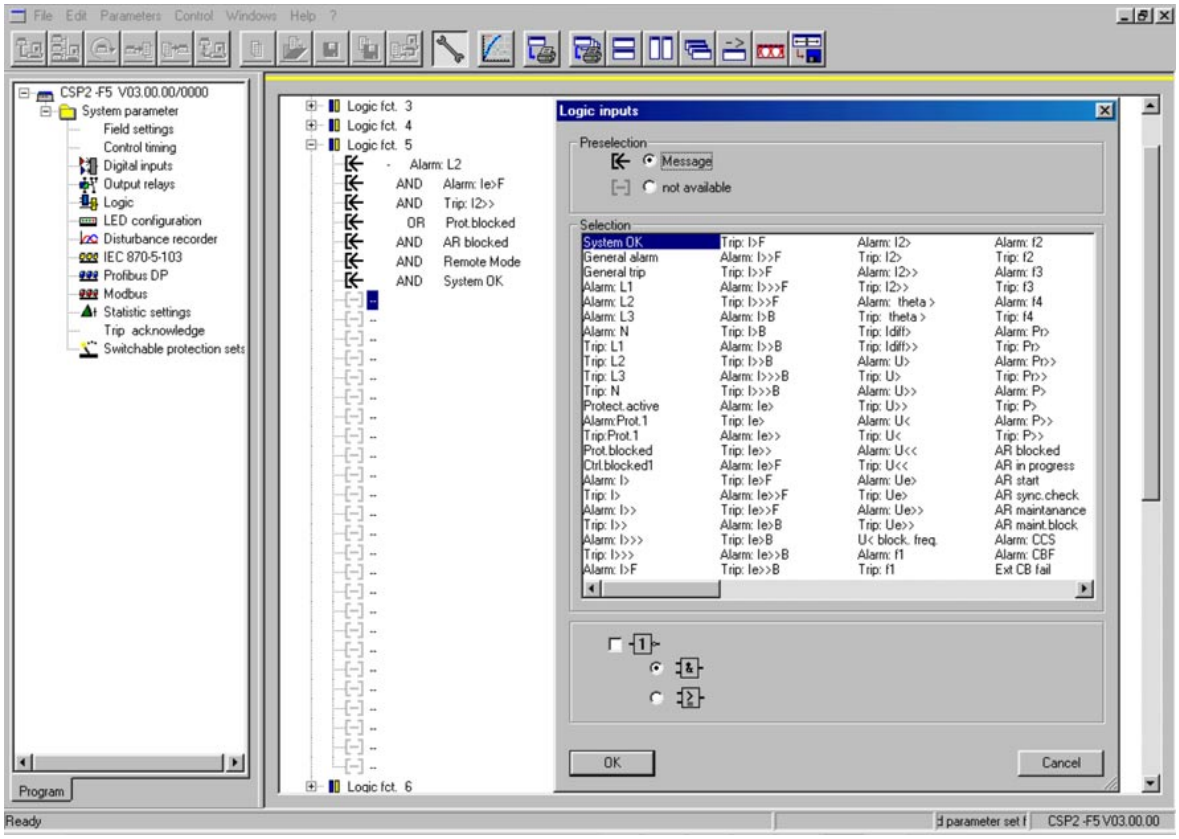


*Figure 4.2: Overview in online mode, (Example: Menu "Logic inputs")*

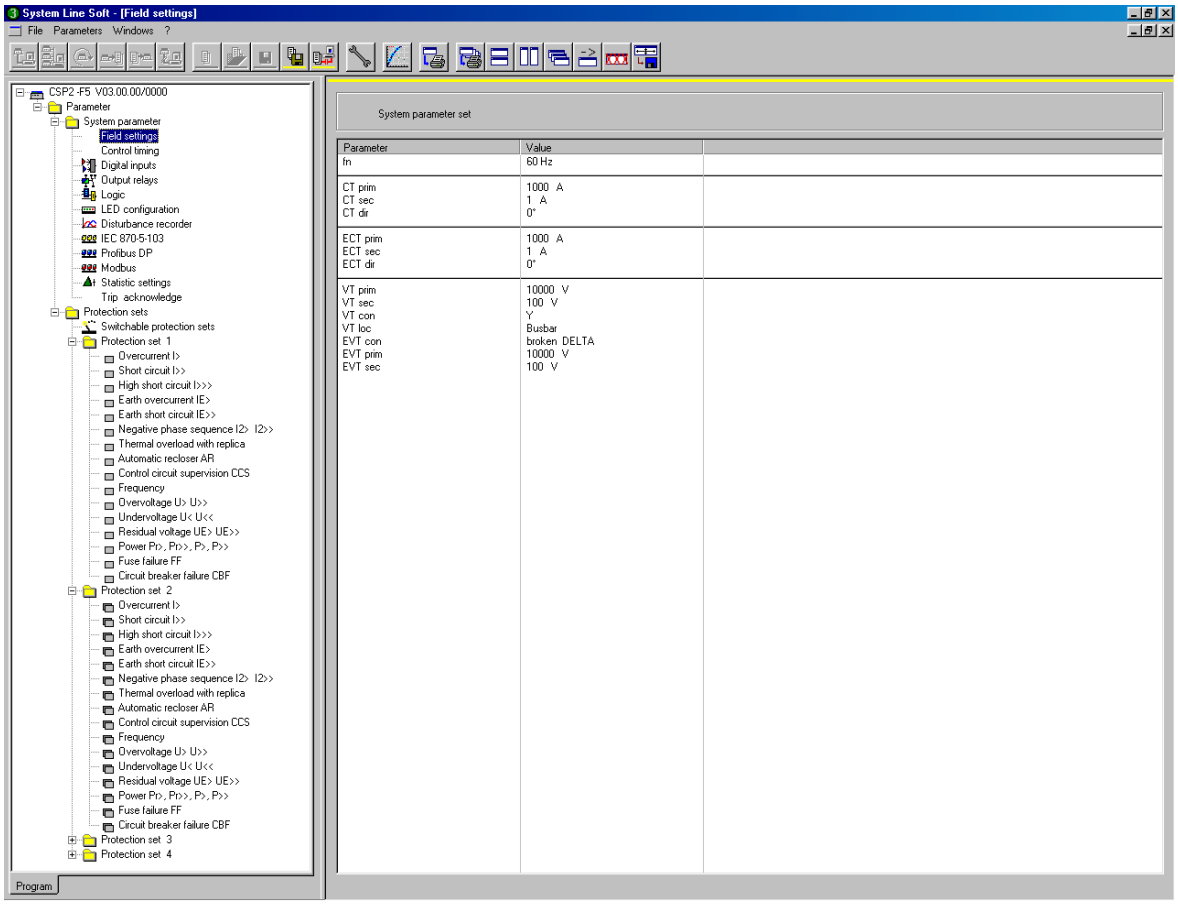


*Figure 4.3: Overview in offline mode (Example: Menu „ Field settings" of system parameter set)*

# 5 Communication

## 5.1 Communication with SCADA system

The *CSP2* is a high value digital protection and control system for many applications within the medium-voltage range.

In addition to the numerous protection functions, the device offers measuring, supervision as well as the control of switching devices in one system.

All relevant information from the medium-voltage cells are processed by the *CSP2/CMP1-System* and are made available through a serial interface of a higher level SCADA system.

The SCADA system represents the central part of the system technology and takes over the station-level functions such as:

- Control,
- Interlocking,
- Measurement, Display,
- Reporting,
- Operating hours etc.

| ***Communication options of the CSP2/CMP1 systems*** | | |
|---|---|---|
| *Protocol type* | *Physical connection (serial interface)* | *Use* |
| IEC 60870-5-103 | FO | SCADA communication |
| | RS485 | |
| PROFIBUS DP | FO | SCADA communication |
| | RS485 | |
| MODBUS RTU* | FO | SCADA communication |
| | RS485 | |
| DNP 3.0* | FO | SCADA communication |
| | RS485 | |
| CAN-BUS | CAN1 | Single communication CSP2 – CMP1 |
| | CAN1: Variant 1 | Multi device communication: one CMP1 – several CSP2 |
| | CAN1: Variant 2 | Multi device communication: several CMP1 – several CSP2 |

*Table 5.1: Outline of communication options*

* in preparation

## 5.2 *CSP2*- multiple device communication

Operation software for single and multiple device communication, (secondary communication level).

Due to a limited capacity to transfer information to the SCADA system, e.g. via IEC 60870-5-103 or PROFIBUS-DP), often a second information level is offered by the protection device producers to make an additional evaluation of the device possible.

This additional evaluation is made possible by *CSP2* through the use of the operating software *SL-SOFT*.

The necessary communication path between the PC/Laptop and *CMP/CSP* System can either be carried out as a single or multiple device communication.

By connecting the PC/laptop to the internal CAN-BUS the user will have access to the second level communication.

The concept "multiple device communication" represents the connection of more *CSP2/CMP1*-systems together over a communication bus. This makes the operating of each individual *CSP2* device (slaves) from a central location possible (PC/CMP1).

In principle, there are two variations of the multiple device communication with *CSP2/CMP1*-system possible, which offers the user adaptation flexibility.

To enable a variant of a multiple device communication, specific prerequisites must be fulfilled:

- the construction of the communication path,
- device configuration

in order to achieve a bus- communication.
During the phase of technical clarification as a part of the project engineering, in general the *CSP2/CMP1*-systems will be configured and described prior to dispatch, so that the system can be installed and commissioned without problems.

Through the use of converters or modems, remote communication will be established. Therefore remote parameter setting of each individual *CSP2/CMP1*-System is possible.

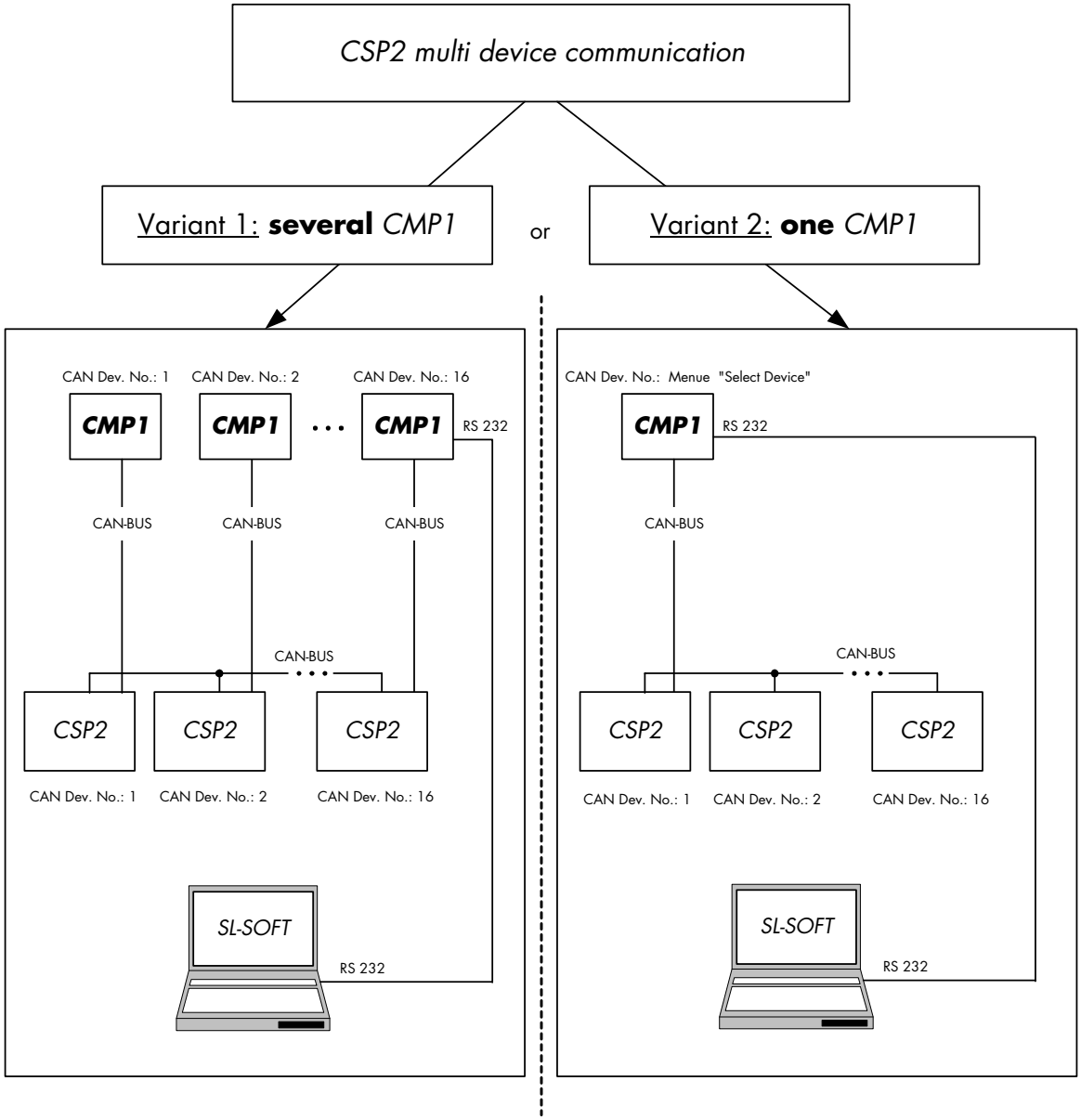


*Figure 5.1: Variants of CSP2 multi device communication*

# 6 Technical Data

## 6.1 Auxiliary voltage

Fixed auxiliary voltages (EN 60255-6):

*Direct circuit (DC)*: 24 V, 48 V, 60 V, 110 V, 220 V
*Alternating circuit (AC)*: 24 V, 100 V, 110 V, 230 V

Furthermore the power supply covers the following commonly used auxiliary voltages (among others in the UK) with limited tolerance ranges:

240 V AC with tolerance range between –20%/+15%
254 V AC with tolerance range between –20%/+10%

The permissible voltage deviations refer to the fixed aux. voltages.

### 6.1.1 Power supply *CMP1*

| *Voltage ranges of power supply* | *Power consumption in idle state* | *Max. power consumption* |
|---|---|---|
| 19 - 395 V DC | 5 W | 8 W |
| 22 - 280 V AC<br>(Frequency range*: 40 - 70 Hz*) | 5 VA | 8 VA |

### 6.1.2 Power supply *CSP2*

Voltage supply *CSP2-F*/L/T

| *Voltage ranges of power supply* | *Power consumption in idle state* | *Max. power consumption* |
|---|---|---|
| 19 - 395 V DC | 19 W | 27 W |
| 22 - 280 V AC<br>(Frequency range*: 40 - 70 Hz*) | 19 VA | 27 VA |

Buffering the power supply

*Minimum buffering time*: $t \geq 50$ *ms*, to Ue < Uemin,
When a power supply failure occurs, the function of the device is guaranteed for at least 50 milliseconds.

## 6.2 Measuring inputs

### 6.2.1 Current measuring

| | | |
|---|---|---|
| *Quantity* | | |
| *CSP2-F/-L:* | 3 x phase currents,<br>1 x summing current (for earth, e.g. ring core type CT) | |
| *CSP2-T25:* | 6 x phase currents,<br>1 x summing current (for earth, e.g. ring core type CT) | |
| *Measuring method:* | *conventional CT-technique (other sensors in preparation)* | |
| *Rated currents* | 1 A and 5 A | (configurable) |
| *Measuring ranges* | | |
| Phase currents IL1, IL2, IL3: | 0 ... 40 x $I_N$ | (only AC), |
| Summing current Ie: | 0 ... 20 x $I_N$ | (only AC) |
| *Power consumption in the power path:* | ≤0,1 VA | (for I = $I_N$) |
| *Thermal load capacity* | | |
| Rated peak short circuit current: | 250 x $I_N$ | (dynamic half period of sine oscillation) |
| Rated short-term current: | 100 x $I_N$ | (for 1 s) |
| Permanent load capacity: | 4 x $I_N$ | |

### 6.2.2 Voltage measuring

| | | |
|---|---|---|
| *Quantity* | 3 × phase voltage (measuring LL or LN)<br>1 × residual voltage | |
| *Measuring method:* | *conventional PT-technique (other sensors in preparation)* | |
| *Rated voltages*: | 100, 110 V AC | |
| *Measuring ranges:* | 0...230 V AC | |
| *Power consumption*: | ≤0,1 VA | (for U = $U_N$) |
| *Thermal load capacity* | | |
| Permanent load capacity: | 2 x $U_N$ | |
| *Rated frequencies*: | 50Hz; 60Hz | (configurable) |

### 6.2.3 Measuring precision

*Phase current measuring (for rated frequency)*
0,1 to 1,5 x $I_N$: <0,5% of $I_N$
1,5 to 40 x $I_N$: <1,0% of measured value

*Earth current measuring (for rated frequency)*
0,05 to 0,5 x $I_N$: <5,0% of measured value
0,5 to 20 x $I_N$: <2,5% of measured value

*Voltage measuring (for rated frequency)*
10 to 50 V AC: <1% of $U_N$
50 to 220 V AC: <1% of Messwert

*Frequency influence*
Current/voltage measuring: <2,0% / Hz

*Frequency measuring*
40 bis 70 Hz: <0,05% von $f_N$

*Power measuring (active power)*
P: <3,0% of $P_N$ (rated power $P_N$ results from the field settings of*„CT pri"* and *„VTpri"*)

## 6.3 Digital Inputs

*Performance*: Opto-decoupler inputs

*Quantity*
*CSP2-F5/-T25*: 26
*CSP2-F3/-L*: 22

*Input voltage range*: 0 to 350 V DC / 0 to 270 V AC

*Threshold value recognition*

| | | | | |
|---|---|---|---|---|
| *Low set range* (code plug plugged in): | $U_L$ | = | 19 to 110 V DC / | 19 to 110 V AC |
| | $U_{L\,ein}$ | ≥ | 16 V DC / | 19 V AC |
| | $U_{L\,aus}$ | ≤ | 12 V DC / | 16 V AC |
| *High set range* (code plug plugged out): | $U_H$ | = | 70 to 300 V DC / | 80 to 250 V AC |
| | $U_{H\,ein}$ | ≥ | 62 V DC / | 75 V AC |
| | $U_{H\,aus}$ | ≤ | 50 V DC / | 60 V AC |

*Input current (depending on input voltage)*

| | | | | |
|---|---|---|---|---|
| *Low set range* (code plug plugged in): | $I_{Low}$ | < | 4 mA DC / | 6 mA AC |
| *High set range* (code plug plugged out): | $I_{High}$ | < | 4 mA DC / | 14 mA AC |

*Rebouncing time (configurable):* 10 ... 60000 ms (per digital input)

## 6.4 Outputs

### 6.4.1 Power outputs

*Quantitiy of power outputs*

| *Type of power putput* | *CSP2-F5* | *CSP2-F3* | *CSP2-L* |
|---|---|---|---|
| Control coils (OL) | 3 (4) | 2 | 2 |
| Motor drive (OM) | 4 (3) | 2 | 2 |

*CSP2-F/-L*

*Power outputs OM und OL refer to following data*

| | |
|---|---|
| Switching voltage (aux. control voltage): | 18 to 280 V DC |
| Max. permissible permanent current: | 17 A continiously |
| Rated peak connection current: | 35 A (for 1 s) |
| Max. shutdown power (depends on switching voltage): | 17 A, with load shedding measures (idle current circuit) |
| Current resistance: | short-circuit resistant |

*CSP2-T25*

*Power outputs OM und OL refer to following data*

| | |
|---|---|
| Switching voltage (aux. control voltage): | 18 to 280 V DC |
| Max. permissible permanent current: | 8 A continiously |
| Rated peak connection current: | 20 A (for 1 s) |
| Max. shutdown power (depends on switching voltage): | 8 A, with load shedding measures (idle current circuit) |
| Current resistance: | short-circuit resistant |

### 6.4.2 Signal relays

*Quantity*

| | |
|---|---|
| *CSP2-F3/-L/-T25*: | 6 |
| *CSP2-F5*: | 10 |

*Switching voltages:*

| | | | |
|---|---|---|---|
| Max. voltage (AC): | 250 V AC | | |
| Max. voltage (DC): | 220 V DC | and: $I_{max}$ = 0,2 A | ohmic |
| | | and: $I_{max}$ = 0,1 A | inductive charge: L/R < 50 ms |
| Voltage (DC): | 24 V DC | and: $I_{max}$ = 5,0 A | inductive charge |

*Switching power*

| | | | |
|---|---|---|---|
| Ohmic: | 1250 VA AC | / | 120 W DC |
| Inductive: | 500 VA AC | / | 75 W DC |

*Min. switching load:* 18 V/2 mA

*Max. rated current:* 5 A

*Switching current:* 20 A (for 16 ms)

*Insulation:* 4 kV

Contact material: AgNi + Au

*Contact service life:* mechanical: 100 x 10^6 operating cycles

## 6.5 Communication interfaces of *CSP2*

*PC interface (in preparation)*

| | |
|---|---|
| Quantity: | 1 |
| Type: | RS232 |
| Term: | X9 |
| Use: | device configuration by PC/Laptop (SL-SOFT) |
| Data transmission rate: | 19200 Baud (fixed) |
| Physical connection: | Electrical |
| Plug type: | 9-pin SUB-D (plug) |
| Characteristic: | Galvanically decoupled by opto-coupler (2,5 kV) |

*System interfaces*

| | |
|---|---|
| Quantity: | 2 |
| Type: | CAN-BUS |
| Terms: | X10/CAN 1 (plug),<br>X11/CAN 1 (socket) |
| Verwendung: | *CMP1/CSP2* communication and *CSP2* multi device communication |
| Basis–Datenprotokoll: | CAN specification V2.0 part B (extended frame) |
| Processor type: | Siemens 80C167C on chip CAN-module |
| Physical connection: | Electrical |
| Plug type: | 9-pin SUB-D |
| Characteristic: | Galvanically decoupled by opto-coupler (2,5 kV) |

*Optional fibre optic (FO) interface (operating range ca. 2 km)*

| | |
|---|---|
| Quantity: | 1 |
| Type: | Serial communication interface |
| Terms: | X7(RxD)/X7(TxD) or X8(RxD)/X8(TxD) |
| Use: | *CSP2-F/T*: SCADA communication,<br>*CSP2-L*: SCI communication to opposite device (*CSP2-L*) |
| Protocol types: | *CSP2-F/T*: IEC 60870-5-103, PROFIBUS DP or MODBUS RTU,<br>*CSP2-L*: Woodward- protocol (SCI-communication) |
| Data transmission rates: | IEC 60870-5-103: 9600 oder 19200 Baud (configurable),<br>PROFIBUS DP: max. 5 MBaud (automatic recognition),<br>MODBUS RTU: 9600 oder 19200 Baud (configurable) |
| Physical connection: | Fibre optic (FO) |
| Plug type: | BFOC 2,5 (ST®) |
| Phase type: | Multimode/multi gradient fibre |
| Quantity of fibres: | 2 fibres (Transmitt [T]/Receive [R]) |
| Core diameter: | 62,5 µm |
| Sleeve diameter: | 125,0 µm |
| Wave length: | 820-860 nm |
| max. dampening: | 10 dB (refered to total dampening) |
| max. length of fibre: | ca. 2 km (depends on fibre dampening between stations) |

*Optional fibre optic (FO) interface (operating range ca. 20 km)*

| | |
|---|---|
| Quantity: | 1 |
| Type: | Serial communication interface |
| Terms: | X7(RxD)/X7(TxD) or X8(RxD)/X8(TxD) |
| Use: | *CSP2-L*: SCI communication to opposite device (*CSP2-L*) |
| Protocol type: | *CSP2-L*: Woodward-protocol (SCI-communication) |
| Physical connection: | Fibre optic (FO) |
| Plug type: | BFOC 2,5 (ST®) |
| Phase type: | Monomode fibre |
| Quantity of fibres: | 2 fibres (Transmitt [T]/Receive [R]) |
| Core diameter: | 9 µm |
| Sleeve diameter: | 125 µm |
| Wave length: | 1300 nm |
| max. dampening: | 9 dB (refered to total dampening) |
| max. lenth of fibre: | ca. 20 km (depends on fibre dampening between stations) |

*Optional SCADA interface*

| | |
|---|---|
| Quantity: | 1 |
| Type: | RS485 |
| Terms: | X12 |
| Use: | SCADA communication |
| Protocol types: | IEC 60870-5-103, PROFIBUS DP or MODBUS RTU |
| Data transmission rates: | IEC 60870-5-103: 9600 or 19200 Baud (configurable),<br>PROFIBUS DP: max. 12 MBaud (automatic recognition),<br>MODBUS RTU: 9600 or 19200 Baud (configurable) |
| Physical connection: | Electrical |
| Plug type: | 9-pin, SUB-D (socket) |
| Characteristic: | Galvanically decoupled by opto-coupler (2,5 kV) |

## 6.6 Standards

### 6.6.1 General regulations

| | | | |
|---|---|---|---|
| *Generic standard* | DIN EN 61000-6-2 [08.02]<br>DIN EN 61000-6-3 [08.02] | *Product standard* | DIN EN 60255-6 [11.94]<br>DIN EN 60255-3 [07.98]<br>DIN EN 50178 [04.98] |

### 6.6.2 High-voltage tests (EN 60255-6 [11.94])

| | | |
|---|---|---|
| *Insulation Voltage test* | | |
| IEC 60255-5 [12/00]<br>DIN EN 50178 [04.98] | All electric circuits against other electric circuits and touchable surfaces | 2,5 kV (eff.)/50 Hz, 1 min. |
| *Impulse voltage test* | | |
| IEC 60255-5 [12/00] | | 5 kV/0,5 J, 1.2/50 µs |
| *High-frequency interference test* | | |
| DIN EN 60255-22-1 [05.91] | Within an electric circuit | 1 kV/2 s |
| Class 3 | Electric circuit against earth | 2,5 kV/2 s |
| | Electric circuit against electric circuit | 2,5 kV/2 s |

### 6.6.3 EMC Immunity tests

| | | |
|---|---|---|
| *Fast transient disturbance immunity test (Burst)* | | |
| DIN IEC 60255-22-4 [10.93]<br>DIN EN 61000-4-4 [07.02] | Current supply, mains inputs | ±4 kV, 2,5 kHz |
| Class 4 | Other inputs and outputs | ±2 kV, 5 kHz |
| *Electrical discharge immunity test* | | |
| DIN EN 60255-22-2 [05.97]<br>DIN EN 61000-4-2 [12/01] | Air discharge | 8 kV |
| Class 3 | Contact discharge | 6 kV |
| *Surge immunity test* | | |
| DIN EN 61000-4-5 [12/01]<br>Class 4 | Within an electric circuit | 2 kV |
| | Electric circuit against earth | 4 kV |
| (only valid for cable lenght < 30 m) | | |
| *Radiated radio-frequency electromagnetic field immunity test* | | |
| DIN EN 61000-4-3 [12/01]<br>Class 3 | | 10 V/m |
| *Immunity to conducted disturbances induced by radio frequency fields* | | |
| DIN EN 61000-4-6 [12/01]<br>Class 3 | | 10 V/m |
| *Power frequency magnetic field immunity test* | | |
| DIN EN 61000-4-8 [12/01] | continious | 100 A/m |
| Class 5 | 3 sec. | 1000 A/m |

### 6.6.4 EMC Emission tests

| | |
|---|---|
| *Radio interference suppressio voltage* | |
| DIN EN 55011 [10.97] | Limit value Class B |
| *Radio interference radiation test* | |
| DIN EN 55011 [10.97] | Limit value Class B |

### 6.6.5 Mechanical tests

| | | |
|---|---|---|
| *Vibration tests* | | |
| DIN EN 60255-21-1[05.96] Class 2 | Vibration response test | 0,075 mm, 1,0 gn, 1 sweep cycle in each axis |
| | Vibration endurance test | 2,0 gn, 20 sweep cycle in each axis |
| *Shock and bumb tests* | | |
| DIN EN 60255-21-2 [05.96] Class 1 | Shock test for proper functioning | 5 gn, 11 ms, 3 impulses in each direction |
| | Shock resistance test | 15 gn, 11 ms, 3 impulses in each direction |
| | Shock endurance test | 10 gn, 16 ms, 1000 impulses in each direction and axle |
| *Earthquake test* | | |
| DIN EN 60255-21-3 [11.95] Class 2 | Single axis earthquake vibration test | 7,5/3,5 mm 2,0/1,0 gn, 1 sweep cycle in each direction |

### 6.6.6 Protection level

| | | |
|---|---|---|
| | Front area | IP54 |
| | Terminals of protection and controls | IP20 |

### 6.6.7 Climatic conditions

| | | |
|---|---|---|
| *Temperature range* | | |
| | For storage / in case of emergency (max. 2 h, device must be in operation) | -25°C - +70°C |
| | Temperature range during operation | -10°C - +55°C |

### 6.6.8 Environmental tests

| | | |
|---|---|---|
| *Classification* | | |
| DIN EN 60068-1[03/95] | Climatic classification | 10/055/56 |
| DIN EN 60721-3-3[09/95] | Classification of ambient conditions | 3K6/3B1/3C3/3S2/3M4 |
| *Test Ad: Cold* | | |
| DIN EN 60068-2-1[03/95] | Temperature | -10°C/-25°C |
| | Duration of stress | 16h |
| *Test Bd: Dry heat* | | |
| DIN EN 60068-2-2[08/94] | Temperature | 55°C/70°C |
| | Relative humidity | <50% |
| | Duration of stress | 72 h |
| *Test Cab: Damp heat (steady state)* | | |
| IEC 60068-2-78[08/01] | Temperature | 40°C |
| | Relative humidity | 93% |
| | Duration of stress | 56 |
| *Test Dd: Damp heat (cyclic)* | | |
| DIN IEC 60068-2-30 [09/86] | Temperature | 55°C |
| | Relative humidity | 95% |
| | Cycles (12 + 12 hours) | 2 |

## 6.7 Dimensions and weights

*Dimensions*

| | |
|---|---|
| Base unit *CSP2-F/-L/-T25*: | W 367,8 mm x H 263,9 mm x D 138,4 mm |
| Base unit *CSP1-B*: | W 368,0 mm x H 447,0 mm x D 155,0 mm |
| Operating panel *CMP1*: | W 307,0 mm x H 246,0 mm x D 55,0 mm |

*Weights (Net)*

| | |
|---|---|
| Base unit *CSP2-F/-L*: | 6,5 kg |
| Base unit *CSP2-T*: | 6,9 kg |
| Base unit *CSP1-B*: | 13,0 kg |
| Operating panel *CMP1*: | 2,8 kg |

*CAN communication cable*

Length: 4 m

# 7 Order form

| Base unit (single device) of Feeder protection and control system [1] | ***CSP2-*** | | **CC** | | | |
|---|---|---|---|---|---|---|
| Current and voltage protection functions, measuring functions, monitoring functions, automatic reclosing, disturbance recording, programmable logic functions, control functions, up to 5 recognizable devices (display, wide range power supply: AC and DC | | | | | | |
| Control (direct/indirect) | | | | | | |
| of max. **3 switching elements** – DC driven (1 CB/isolator/ earthing switch) | | **F3** | | | | |
| of max. **5 switching elements** – DC driven (2 CBs/isolator/ earthing switch) | | **F5** | | | | |
| Measuring | | | | | | |
| Conventional transformer technology: Phase currents and earth current 1 A/5 A, voltage 100 V/110 V | | | | | | |
| Communication | | | | | | |
| without | | | | **00** | | |
| Type of protocol: | SCADA interface: | | | | | |
| IEC 60870-5-103 | fibre optic (FO) [2] | | | **3F** | | |
| | electrical: RS485 | | | **3W** | | |
| PROFIBUS DP | fibre optic (FO) [2] | | | **PF** | | |
| | electrical: RS485 | | | **PW** | | |
| MODBUS RTU [3] | fibre optic (FO) [2] | | | **MF** | | |
| | electrical: RS485 | | | **MW** | | |
| DNP 3.0 [3] | fibre optic (FO) [2] | | | **DF** | | |
| | electrical: RS485 | | | **DW** | | |
| Menu | | | | | | |
| German | | | | | **G** | |
| English | | | | | **E** | |
| Disturbance recording | | | | | | |
| Standard | | | | | | * |
| extended non-volatile memory | | | | | | **K** |

* Please leave box empty if option is not required (no extra charge).

[1] the complete feeder protection and control system consists of **one** base unit (CSP) and **one** indication and operating unit (CMP).

[2] Wave length: 850 nm; phase diameter (core/sleeve): 62,5/125 µm multimode; plug type: type FH-ST, range: up to 2 km.

[3] **in preparation!**

| Indication and operating unit for protection and control systems | ***CMP1-*** | **1** | **2** | |
|---|---|---|---|---|
| Front plate IP 54; key switches, LC- Display, control buttons, wide range power supply: AC and DC | | | | |
| Interfaces | | | | |
| 2 x RS232 (front plate and rear) CAN-Bus (rear) | | | | |
| Front plate design (Logo) | | | | |
| Standard (SEG) | | | | **0** |
| OEM | | | | **1** |

| Base unit (single device) of cable- and line differential protection and control system [1] | ***CSP2-*** | | **CC** | | | |
|---|---|---|---|---|---|---|
| Differential protection including extended protection and control functions, 1 base unit to each end of line,<br>phase selective current and voltage protection functions, measuring functions, monitoring functions, automatic reclosing, disturbance recording, programmable logic functions, control functions<br>Control (direct/indirect)<br>of max. **3 switching elements** – DC driven (1 CB/isolator/earthing switch), up to 5 recognizable switching elements (display),<br>wide range power supply: AC and DC | | | | | | |
| Communication interface (FO) to contrary protection device (CSP)<br>length of line: up to **2 km**<br>Type: 850 nm; 62.5/125 µm multimode / plug type: FH-ST | | **L1** | | | | |
| length of line: up to **20 km**<br>Type: 1300 nm; 9/125 µm singlemode / plug type: FH-ST<br>(fibre optic (FO) communication cables are not included in the scope of delivery) | | **L2** | | | | |
| Measuring<br>Conventional transformer technology:<br>Phase currents and earth current 1 A/5 A, voltage 100 V/110 V | | | | | | |
| Communication<br>without | | | | **00** | | |
| Type of protocol:<br>IEC 60870-5-103 | SCADA interface:<br>fibre optic (FO) [2] | | | **3F** | | |
| | electrical: RS485 | | | **3W** | | |
| PROFIBUS DP | fibre optic (FO) [2] | | | **PF** | | |
| | electrical: RS485 | | | **PW** | | |
| MODBUS RTU [3] | fibre optic (FO) [2] | | | **MF** | | |
| | electrical: RS485 | | | **MW** | | |
| DNP 3.0 [3] | fibre optic (FO) [2] | | | **DF** | | |
| | electrical: RS485 | | | **DW** | | |
| Menu<br>German | | | | | **G** | |
| English | | | | | **E** | |
| Disturbance recording<br>Standard | | | | | | * |
| extended non-volatile memory | | | | | | **K** |

* Please leave box empty if option is not required (no extra charge).

[1] the complete cable/line differential protection system consists of **two** base units (CSP) and **two** indication and operating units (CMP), (each end of line: one **CSP** and one **CMP**).

[2] Wave length: 850 nm; phase diameter (core/sleeve): 62,5/125 µm multimode; plug type: type FH-ST, range: up to 2 km.

[3] **in preparation**

| Base unit (single device) of transformer differential protection and control system [1] | | ***CSP2-*** | **CC** | | | |
|---|---|---|---|---|---|---|
| Application: 2-winding transformers;<br>Current and voltage protection functions, measuring functions, monitoring functions, automatic reclosing, disturbance recording, programmable logic functions, control functions, up to 5 recognizable devices (display), wide range power supply: AC and DC | | | | | | |
| Control (direct/indirect)<br>of max. **5 switching elements** – DC driven (2 CB/isolator/earthing switch) | | | **T25** | | | |
| Measuring<br>Conventional transformer technology:<br>Phase currents and earth current 1 A/5 A, voltage 100 V/110 V | | | | | | |
| Communication<br>without | | | | **00** | | |
| Type of protocol: | SCADA interface: | | | | | |
| IEC 60870-5-103 | fibre optic (FO) [2] | | | **3F** | | |
| | electrical: RS485 | | | **3W** | | |
| Profibus DP | fibre optic (FO) [2] | | | **PF** | | |
| | electrical: RS485 | | | **PW** | | |
| Modbus RTU | fibre optic (FO) [2] | | | **MF** | | |
| | electrical: RS485 | | | **MW** | | |
| DNP 3.0 | fibre optic (FO) [2,3] | | | **DF** | | |
| | electrical: RS485 [3] | | | **DW** | | |
| Menu<br>German | | | | | **G** | |
| English | | | | | **E** | |
| Disturbance recording<br>Standard | | | | | | * |
| extended non-volatile memory | | | | | | **K** |

* Please leave box empty if option is not desired (no extra charge)

[1] the complete feeder protection and control system consists of **one** base unit (CSP) and **one** indication and operation unit (CMP)

[2] Wave length: 850 nm; phase diameter (core/sleeve): 62.5/125 µm multimode; plug type: type FH-ST, range: up to 2 km

[3] availability: on request

**This Manual undergoes continuous further development and is subject to changes.**

**We reserve the right to include such changes in future editions of the manual, without prior notice.**

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