

Excitation System

UNITROL[®] F Series

Overview

| | | | | | | | | | | |
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1 Overview

An excitation system regulates the terminal voltage and the reactive power flow of a synchronous machine by altering the field current with the aid of thyristor converters in two ways:

- Field voltage of an excitation machine with indirect excitation
- Field voltage of a synchronous machine with direct excitation (static excitation)

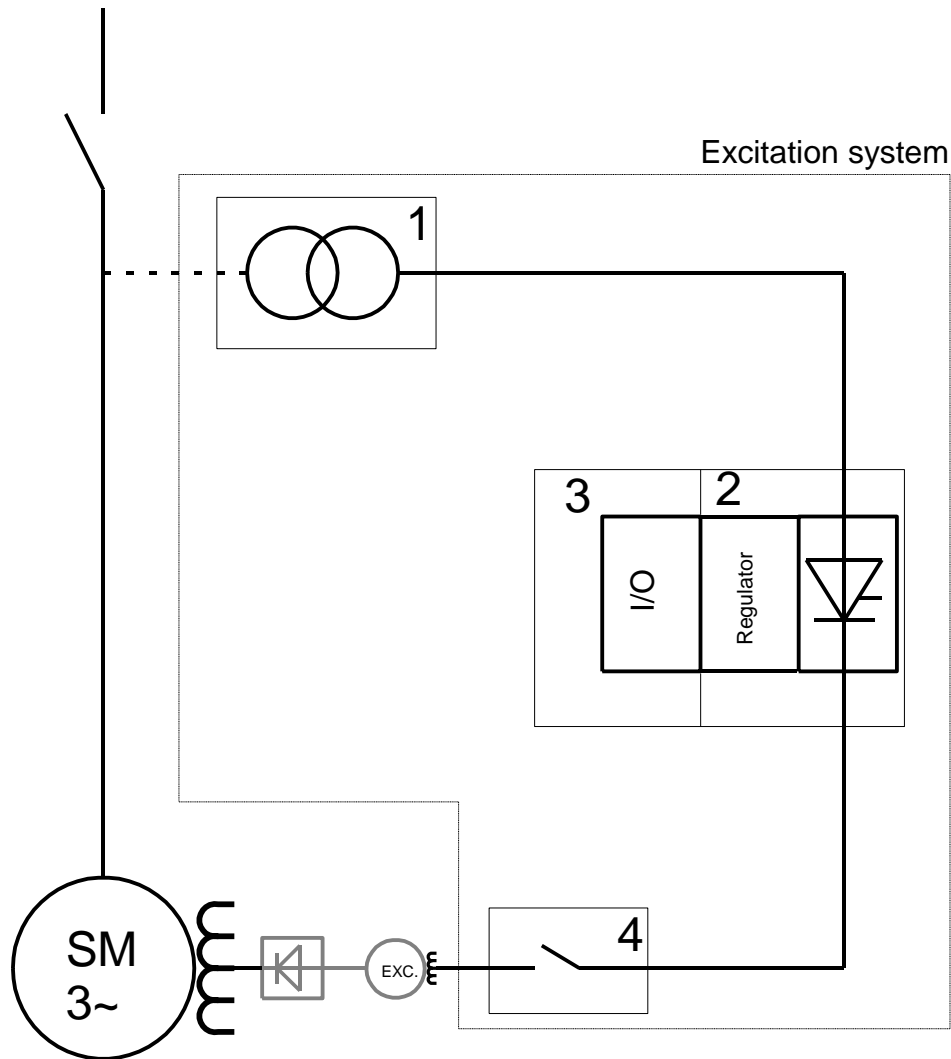


Fig. 1 Overview of excitation system

1 Supply system incl. excitation transformer (see Supply system p. 7)

2 Excitation module (see Excitation module p. 13)

3 Signal interface (see Signal interface p. 16)

4 Field de-excitation (see Field de-excitation p.19)

2 System configurations (single / dual auto. channel)

The two basic configurations are as follows:

- SINGLE CHANNEL **SFE**-...
- DUAL AUTOMATIC CHANNEL **AFT**-...

In contrast to the single channel version SFE (see Fig. 2), the dual automatic channel system AFT (see Fig. 3) contains two identical UNITROL® F excitation modules (2 AVR channels) and a common I/O system with carrier UNC 4868 and the assemblies AC-Actual Value Measurement UNS 0862 and I/O Interface UNS 0863. In operation, one of the two AVR channels is in standby, which means the converter and electronics are redundant.

The excitation configuration system is designed as follows:

SFE - O/C1N3 - F45

S/A: Single channel automatic voltage regulator with additional Manual Mode / Dual Automatic Channel) (AUTOMATIC / AUTOMATIC)

F: ConFigurable control functions

E/T: Economy, single converter configuration
Twin converter configuration

O: WithOut additional functions

| | | | |
|--------------------|-------------------|----------------------------|--|
| C1: | Type of converter | ≤ 140 A | 50/60 Hz |
| C2, C2b | | ≤ 1000 A | 50/60 Hz |
| A5 | | ≤ 2000 A | 50/60 Hz |
| C4 | | ≤ 4000 A | 50/60 Hz |
| C5 & C6 | | see separate documentation | |
| C7 | | ≤ 350 A | 16 ² / ₃ to 400 Hz |

N: for shunt supply

P: for PMG supply

F: for auxiliary supply

1 or 3: for 1-phase or 3-phase converter supply

F: Field breaker with de-excitation contact

45: Rated breaker current in Amps

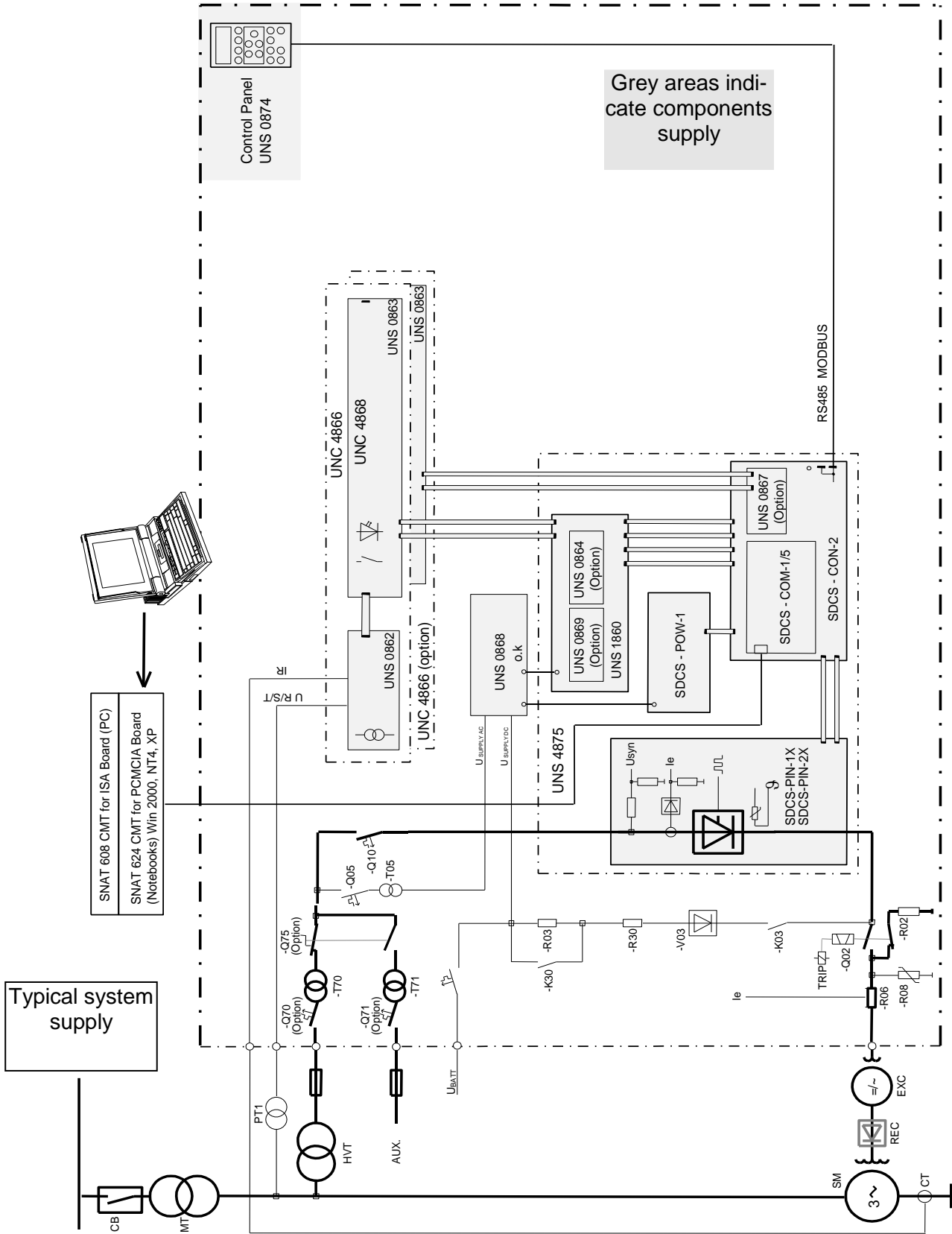


Fig. 2 SFE Excitation Module
Example of indirect excitation from machine terminals (shunt)

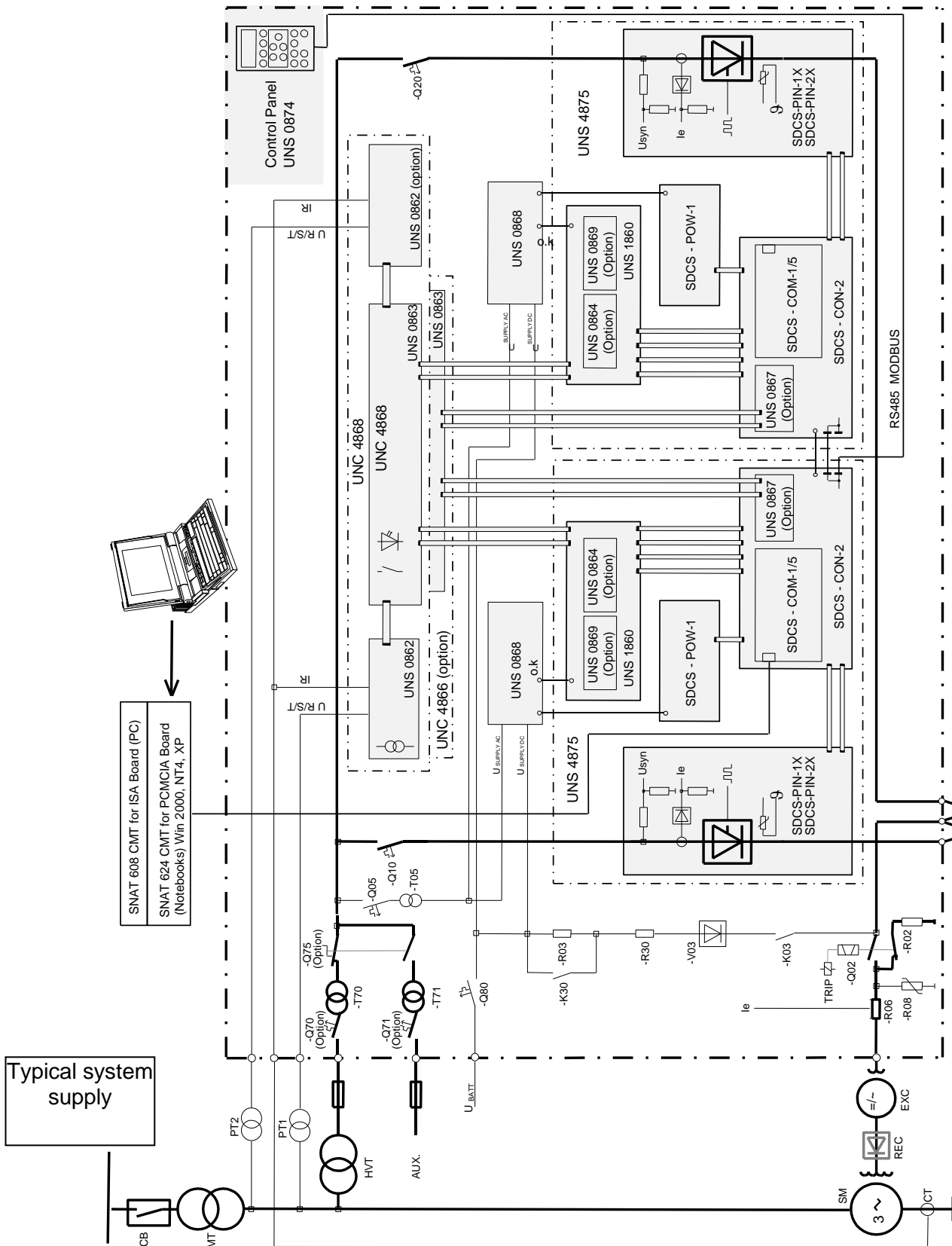


Fig. 3 AFT Excitation Module
Example of indirect excitation from machine terminals (shunt)

3 Supply system

There are three different modes of supply:

- Shunt supply
- P.E. / PMG supply
- Auxiliary supply

3.1 Shunt supply

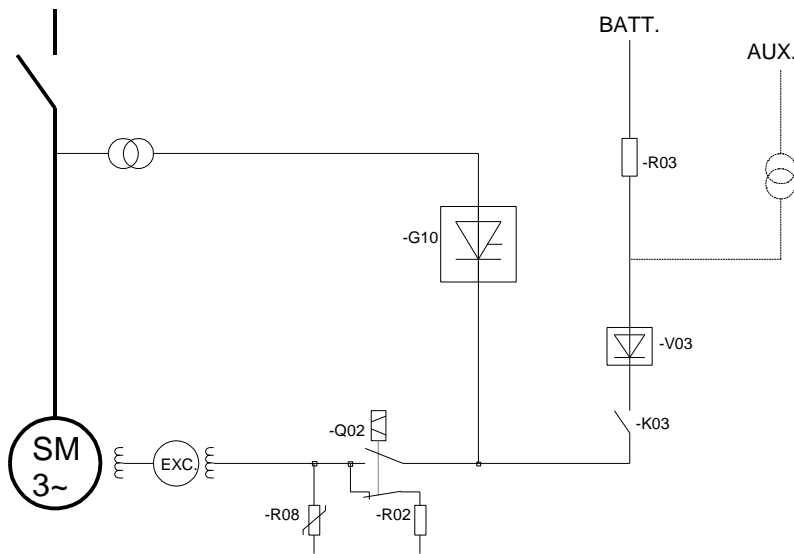


Fig. 4 Shunt supply

During normal operation, the supply of the entire system is taken from the machine terminals through a step down transformer, the so-called excitation transformer. The secondary voltage of the excitation transformer is determined in such a way that the AC supply for the thyristor converter will enable the DC output voltage to reach the required system ceiling voltage when the thyristors are in maximum conducting condition.

The excitation transformer is sized with a short circuit reactance in the range of 4 to 6% (typically 5%). This reactance value ensures sufficient limitation of the short circuit current and/or the current increase di/dt during the commutation period of the thyristors.

3.1.1 Field flashing

In shunt-supplied excitation circuits (excitation transformer connected to the machine terminals), the machine does not usually have enough residual voltage for a machine voltage build-up via the converter. For this purpose, a field flashing circuit is provided.

The field flashing circuit is activated as soon as the field breaker is closed and excitation switched on. If all conditions are fulfilled, the field flashing contactor (-K03) closes and the required initial field current starts flowing. If field flashing is not successful within a set time (10 s), the excitation will be tripped. The converter thyristors are fired at an input voltage of $U_{ac} = 10$ V. The converter takes over the excitation control as soon as it conducts. The field flashing breaker opens as soon as the machine voltage reaches the set threshold value of 30 to 40% of rated voltage. The diode bridge (-V03) prevents current from flowing back from the thyristor converter to the battery when the thyristor converter's output voltage exceeds the field flashing voltage.

The field flashing current (approx. 10 to 20% of no-load excitation current) is set by means of the resistor (-R03).

In larger systems, the field flashing power is taken from AC aux. line and stepped down to the required voltage by a transformer and rectified by the diode bridge (-V03).

3.1.2 Compounding option for indirect excitation

A compounding circuit is provided if the excitation transformer is fed from the machine terminals and the excitation has to be maintained for a certain time in the event of transient events (e.g. short circuits or major load surges in the network) in order to allow selectivity of protection.

- There are two modes of compounding:
- Shunt supply with battery compounding
 - Shunt supply with series compounding

3.1.2.1 Shunt supply with battery compounding (standard option)

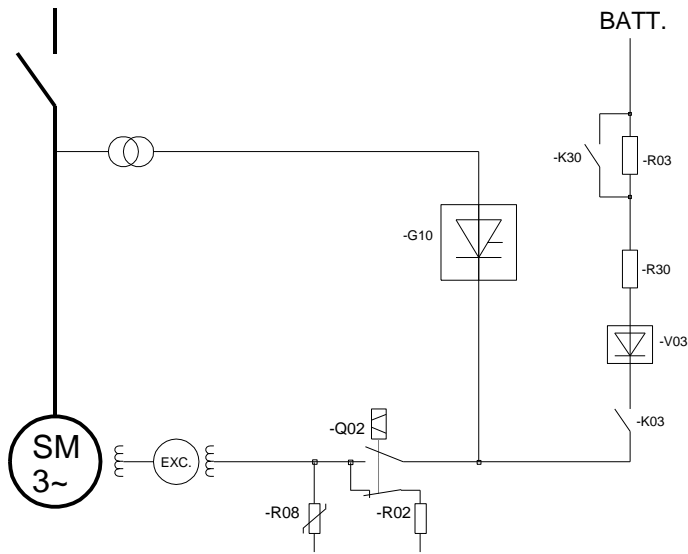


Fig. 5 Shunt supply with battery compounding

Normally, station batteries are required, and provided, for the operation of the system. This option is preferred for this reason.

The compounding circuit is supplied by the station batteries. At low machine voltage, the compounding contactor (-K30) and the field flashing contactor (-K03) close simultaneously, feeding the required compounding current through the diode bridge (-V03). The compounding current is determined by the resistor (-R30).

3.1.2.2 Shunt supply with series compounding (option)

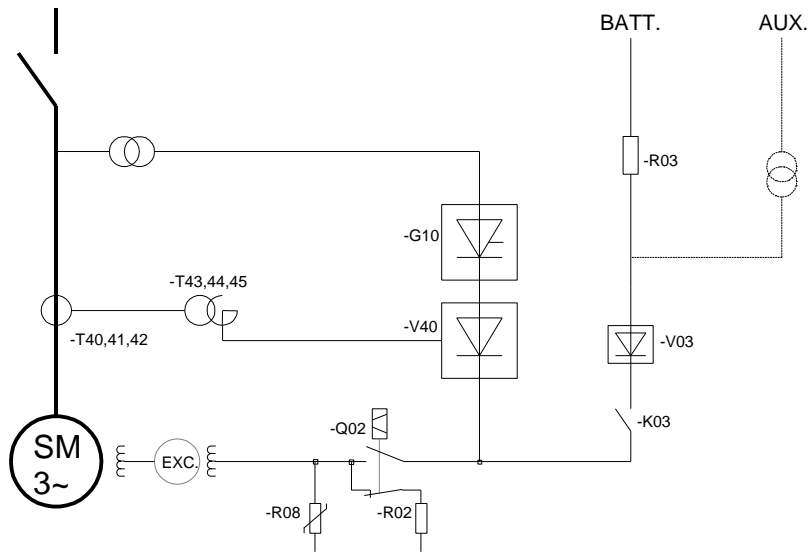


Fig. 6 Shunt supply with series compounding

Series compounding is used in case the battery voltage is not sufficient to supply the compounding current.

The series compounding circuit has three power CT's at machine terminal (-T40,-T41,-T42) which have the secondary fed to three single phase air gap transformers (current/voltage transformers -T43,-T44,-T45). The air gap transformers (compounding transformers) are in three phase connection. They transform the machine current into a voltage. The secondaries of the air gap transformers are connected in series with the thyristor converter via the diode bridge (-V40). The excitation voltage is derived from the sum of the voltages of the thyristor converter (-G10) and the diode bridge (-V40).

The special compounding transformers (-T43,-T44,-T45) have a low main reactance and a saturation characteristic calculated in such a way that the necessary excitation voltage required to sustain a certain machine current will be generated at the output of the diode bridge. The transformers are short-circuit-proof, so that no transformer fuses are required on the primary side. The maximum possible secondary voltage is limited by the saturation characteristic. No overvoltage protection is therefore required.

3.2 P.E. / PMG supply

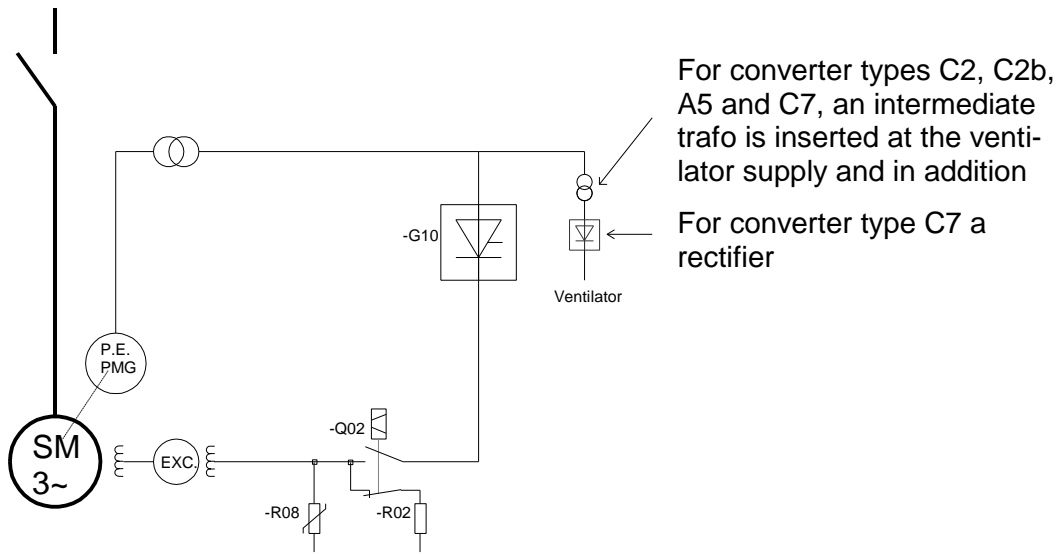


Fig. 7 P.E. / PMG supply

The power supply is taken from a permanent exciter (P.E. / PMG).

The following types of thyristor converters are used for different frequencies of the P.E./PMG machine:

| | | |
|------------|-----------------------------|-----------------------|
| P.E. / PMG | $f = 50 / 60 \text{ Hz}$ | Types C1, C2, C2b, A5 |
| P.E. / PMG | $f \neq 50 / 60 \text{ Hz}$ | Types C7 |

3.3 Auxiliary supply

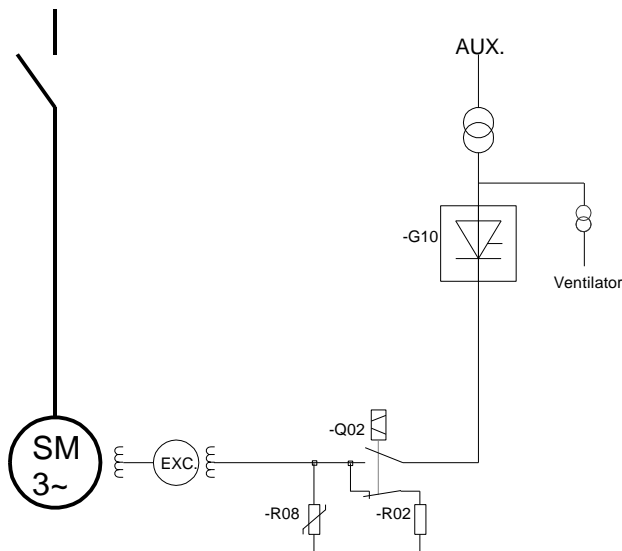


Fig. 8 Auxiliary supply

The power supply is taken from an auxiliary line.

4 Supply of control electronics

Two sources are provided for redundant supply:

- AC input of power converter
- Station battery.

This supply philosophy ensures the availability of all control, protection and recording functions when the machine is at a standstill, during start-up or even in the case of transient events (e.g. short circuits).

The AC input of the power converter is, in addition, connected to the Power Supply Unit UNS 0868 via a matching transformer (-T05) and is thus paralleled to the station battery as a back-up supply. -T05 also performs the function of galvanic isolation between the AC supply and station battery.

The Power Supply Unit UNS 0868 has two voltage outputs

1. Voltage supply $U_{dc} = 24\text{ V}$ for control contact interrogation and 24 V consumers (e.g. transducers, bus coupler, etc.). It is used for the galvanic isolation and decoupling of the two voltage sources. This output is short-circuit-proof and, in dual channel versions, guarantees the redundancy of the two $U_{dc} = 24\text{ V}$ sources.
2. Voltage supply $U_{dc} = 240\text{ V}$ for the internal power supply unit (POW-1).

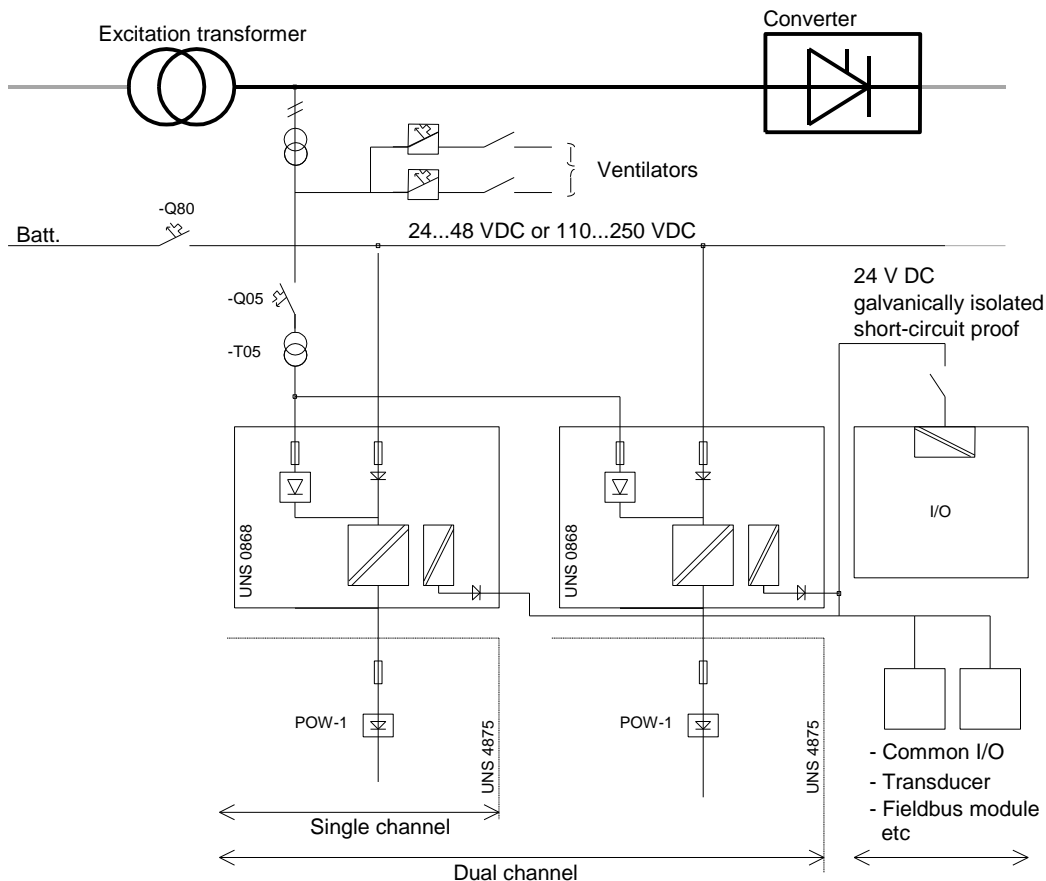


Fig. 9 Supply of the control electronics

5 Excitation module

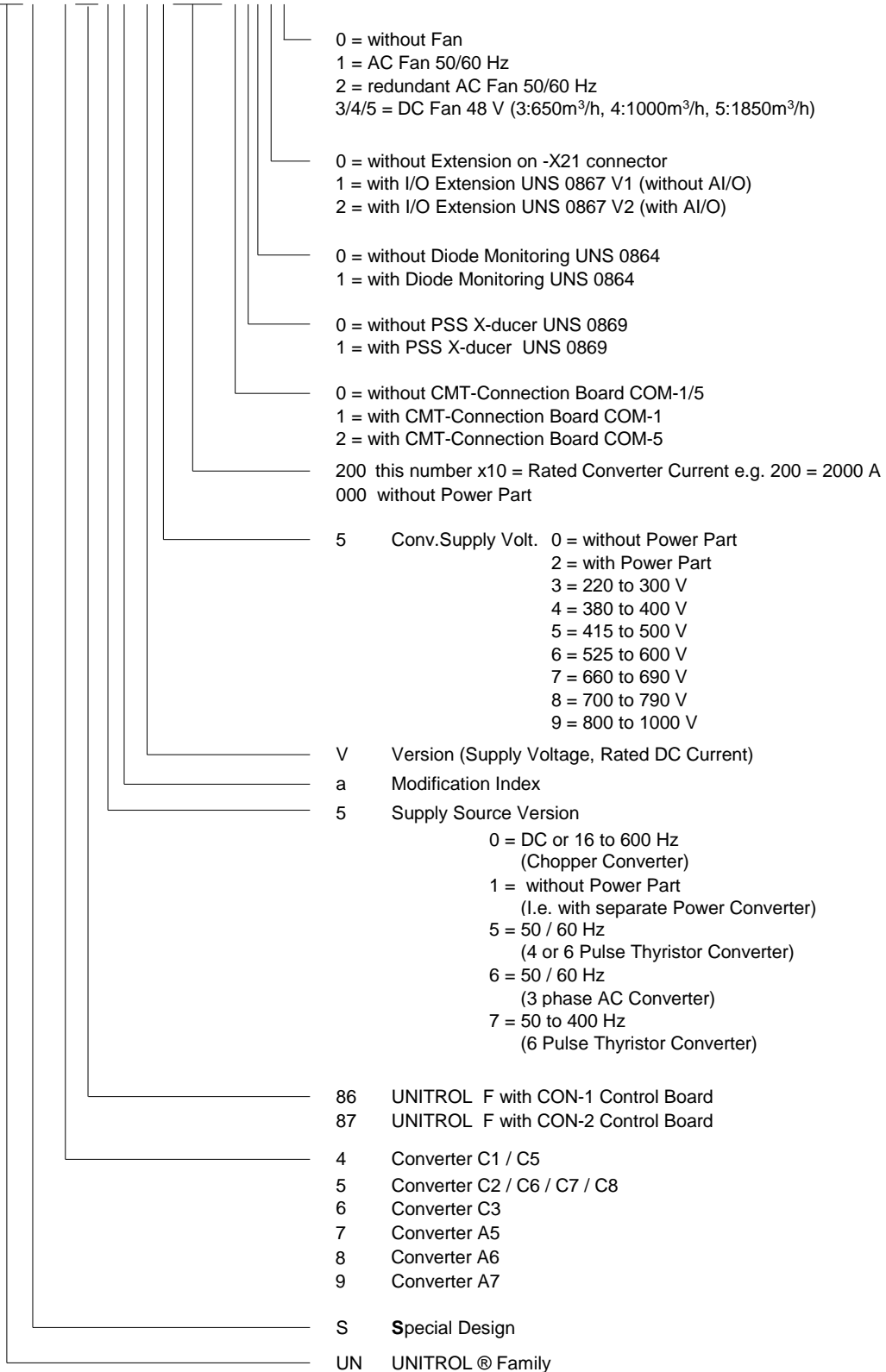
Each configuration consists of a common but flexible I/O System UNC 4866/8 with AC-Actual Value Measurement UNS 0862 (in AFT configuration, the second AC-Actual Value Measurement UNS 0862 can be provided as an option) and an I/O Interface UNS 0863, the UNITROL® F converter module, Power Supply Unit UNS 0868 and the common Control Panel UNS 0874 for local operation, commissioning and maintenance. A PC can be temporarily connected for the use of CMT (Commissioning and Maintenance Tool).

The UNITROL® F converter module UNS 487x consists of:

- Power interface board SDCS-PIN 1x / 20xB / 4x / 5x
- Converter 2 or 6 pulse thyristor bridge
- Control board SDCS-CON-2
- Communication interface board SDCS-COM-1/5 (optional for CMT)
- Power supply unit SDCS-POW-1
- Signal Processing Device UNS 1860
- Diode Failure Monitoring UNS 0864 (optional)
- PSS Signal Transformer (slip stabiliser) UNS 0869 (optional)
- Control Panel UNS 0874

5.1 Type designation of converter modules

UNS 4875 a V5200-10001



5.2 Power ranges and dimensions of excitation modules

| Typ | Typ UNITROL® F | Max. AC input Uac (≤60) Hz * | Rated DCI output system IP21 (Id) | Dimensions H / W / D | Weight | Amb. temp. | IP | Construction type |
|--------------------------|-------------------|--|---|-------------------------|--------|---------------|----|----------------------|
| | | [V] | [A] | [mm] | [kg] | [°C] | | |
| DCS 501B-0050-51-2100000 | UNS 4875V5005 | 400 to 500 | 50 | 420/273/195 | 8 | 45 | 54 | C1 |
| DCS 501B-0075-51-2100000 | UNS 4875V5007 | 400 to 500 | 75 | 420/273/195 | 8 | 35 | 21 | C1 |
| DCS 501B-0100-51-2100000 | UNS 4875V5010 | 400 to 500 | 100 | 469/273/228 | 12 | 35 | 21 | C1 |
| DCS 501B-0110-61-2100000 | UNS 4875V6010 | 600 | 100 | 469/273/228 | 12 | 35 | 21 | C1 |
| DCS 501B-0140-51-2100000 | UNS 4875V5014 | 400 to 500 | 125 | 469/273/228 | 12 | 35 | 21 | C1 |
| DCS 501B-0200-51-2100000 | UNS 5875V5018 | 400 to 500 | 180 | 505/273/361 | 23 | 35 | 21 | C2 |
| DCS 501B-0250-51-2100000 | UNS 5875V5022 | 400 to 500 | 225 | 505/273/361 | 23 | 35 | 21 | C2 |
| DCS 501B-0270-61-2100000 | UNS 5875V6025 | 600 | 245 | 505/273/361 | 23 | 35 | 21 | C2 |
| DCS 501B-0350-51-2100000 | UNS 5875V5032 | 400 to 500 | 315 | 505/273/361 | 23 | 35 | 21 | C2 |
| DCS 501B-0450-51-2100000 | UNS 5875V5041 | 400 to 500 | 405 | 505/273/361 | 29 | 35 | 21 | C2 |
| DCS 501B-0520-51-2100000 | UNS 5875V4047 | 400 to 500 | 470 | 505/273/361 | 29 | 35 | 21 | C2 |
| DCS 501B-0450-61-2100000 | UNS 5875V6041 | 600 | 405 | 505/273/361 | 29 | 35 | 21 | C2 |
| DCS 501B-0680-51-2100000 | UNS 5875V5061 | 400 to 500 | 610 | 652/273/384 | 60 | 35 | 21 | C2b |
| DCS 501B-0820-51-2100000 | UNS 5875V6074 | 400 to 500 | 740 | 652/273/384 | 60 | 35 | 21 | C2b |
| DCS 501B-1000-51-2100000 | UNS 5875V5090 | 400 to 500 | 900 | 652/273/384 | 60 | 35 | 21 | C2b |
| DCB 505-1203-51-0000000 | UNS 7875V5120 | 400 to 500 | 1200 | 1005/510/400 | 110 | 35 | 21 | A5 |
| DCB 505-1503-51-0000000 | UNS 7875V5150 | 400 to 500 | 1500 | 1005/510/400 | 110 | 35 | 21 | A5 |
| DCB 505-2003-51-0000000 | UNS 7875V5200 | 400 to 500 | 2000 | 1005/510/400 | 110 | 35 | 21 | A5 |
| DCB 505-0903-61-0000000 | UNS 7875V7090 | 600 to 690 | 900 | 1005/510/400 | 110 | 35 | 21 | A5 |
| DCB 505-1503-61-0000000 | UNS 7875V7150 | 600 to 690 | 1500 | 1005/510/400 | 110 | 35 | 21 | A5 |
| DCB 505-2003-61-0000000 | UNS 7875V7200 | 600 to 690 | 2000 | 1005/510/400 | 110 | 35 | 21 | A5 |

* With voltage safety factor of 2.5

6 Signal interface

Depending on the customer's requirements, the basic interface consists of the AC-Actual Value Measurement UNS 0862, and I/O Interface UNS 0863, which are mounted on the common aluminium carrier UNC 4866 (600 mm systems) or UNC 4868 (800 mm systems). The whole unit is normally placed on the customer's interface and can be connected directly to the control room.

6.1 Input/output expansion

The number of inputs and outputs (both analogue and digital) can be doubled through the additional installation of the Extended I/O Card UNS 0867 on the basic board CON-2 and an additional I/O Interface UNS 0863 (on the module carrier UNC 4866).

6.1.1 Basic interface - single channel SFE

The basic interface for the single channel system SFE contains the following modules with the corresponding signals (see also Overview Fig. 2):

- 1 AC-Actual Value Measurement UNS 0862 for machine current and voltage transformer signals.
- 1 I/O Interface UNS 0863 as interface with the following analogue and control signals:
 - 16 potential-isolated digital inputs for rated voltage $U_{dc} = 24 \text{ V}$. The interrogation voltage $U_{dc} = 24 \text{ V}$ can be supplied locally from the Power Supply Unit UNS 0868 or externally.
 - 18 potential-free outputs for control, status indication and alarm signalling.
 - 2 analogue inputs for $\pm 10 \text{ V}$ or $\pm 20 \text{ mA}$ (e.g. for remote power factor set point $\cos \phi$, temperature signal)
 - 1 analogue input for external slip-stabilisation signal for the option PSS Signal Transformer UNS 0869
 - 4 analogue outputs, one of which is for the indication of excitation current and, where the option PSS Signal Transformer UNS 0869 is installed, one for the indication of active power.

6.1.2 Basic interface - dual channel AFT

The basic interface for the dual channel system AFT contains the following modules with the corresponding signals (see also Overview

Fig. 3):

- 1 AC-Actual Value Measurement UNS 0862 for machine current and voltage transformer signals.
- 1 additional AC-Actual Value Measurement UNS 0862 is used if two sets of machine current and voltage transformers are available.
- 1 common I/O Interface UNS 0863 is provided for the interfacing of analogue and control signals (see 6.1.1).

This dual channel system has the following redundancy or double security:

- The analogue and digital outputs are processed by both channels (I and II). The values from the currently-active channel are output.
- Certain protection functions are triggered by both channels, both the active channel and the standby channel.

7 Control panel

The local control panel, with 16 keys and a four-line LCD display, can perform the following functions:

- Local operation of the excitation system (e.g. ON / OFF, operating mode selection, reference setting etc.)
- Setting of parameters (e.g. set point values, gains, time constants etc.)
- Visualisation of values (e.g. actual values, parameter values etc.)

| | |
|--------------|--|
| Line 1 | Status (local, ON / OFF, set point, ...) |
| Lines 2 to 4 | Freely-selectable signals (normally actual values, e.g. U MACH, I MACH, etc.) |

- Alarm- / fault indication

7.1 Panel link

The Control Panel UNS 0874 is connected to the main control board of the excitation module via the panel bus. The panel bus, which is based on the standard RS 485, uses the Modbus protocol, with a baudrate of 9600 bit/s. Each device must have a unique ID number:

| | |
|-------|---------------|
| ID=0, | control panel |
| ID=1, | channel 1 |
| ID=2, | channel 2 |

The control panel acts as the bus master and must always be present.

7.2 Display

The control panel has an LCD readout with four lines of 20 characters for displaying excitation functions, parameter selections and other excitation information.

The default dialogue language on the display is English. German, French, Italian etc. can be selected.

For further information, please refer to the documentation „Functional Description Control Panel UNS 0874“.

8 Field de-excitation

If a malfunction occurs in the machine which is detected by a protective relay, in order to protect the machine the stored field energy must be dissipated quickly and safely. This is done by the converter, the field circuit-breaker and the field suppression resistor.

8.1.1 Field de-excitation variants

Four different means of field suppression are used. These are selected with the parameter CB-CONFIG.

- 0 The field circuit-breaker is installed between the excitation transformer and the AC side of the converter. Field suppression takes place by means of the "CROWBAR".
- 1 The field circuit-breaker is installed between the DC side of the converter and the field. The field circuit-breaker does not feature a field discharge contact. Field suppression takes place by means of the "CROWBAR".
- 2 The field circuit-breaker is installed between the DC side of the converter and the field. The field circuit-breaker features one field discharge contact. Field suppression takes place via the field discharge contact. The "CROWBAR" is used as overvoltage protection.
- 3 The field circuit-breaker is installed between the DC side of the converter and the field. The field circuit-breaker features one field discharge contact. Field suppression takes place via the field discharge contact. A "MOX" (overvoltage limiter) is used as overvoltage protection.

| CB-config parameter | Normal STOP RELEASE FCB OFF=NO | Protective trip TRIP or normal STOP RELEASE FCB OFF=YES | Behaviour after 60 sec. |
|---|---|--|-------------------------------|
| 0 AC side | INV-mode | - Pulse blocking - Firing of the Crowbar (field suppression thyristor) - TRIP switch - Crowbar monitoring active | — |
| 1 DC side without field discharge contact | INV-mode | - INV-mode - Firing of the Crowbar (field suppression thyristor) - TRIP switch - Crowbar monitoring active | Pulse blocking |
| 2 DC side with field discharge contact | INV -mode | - INV-mode - TRIP switch - no Crowbar monitoring | Pulse blocking |
| 3 without Crowbar | INV -mode | - INV-mode - TRIP switch | Pulse blocking |

8.2 ON (START), OFF (STOP) and protection logic

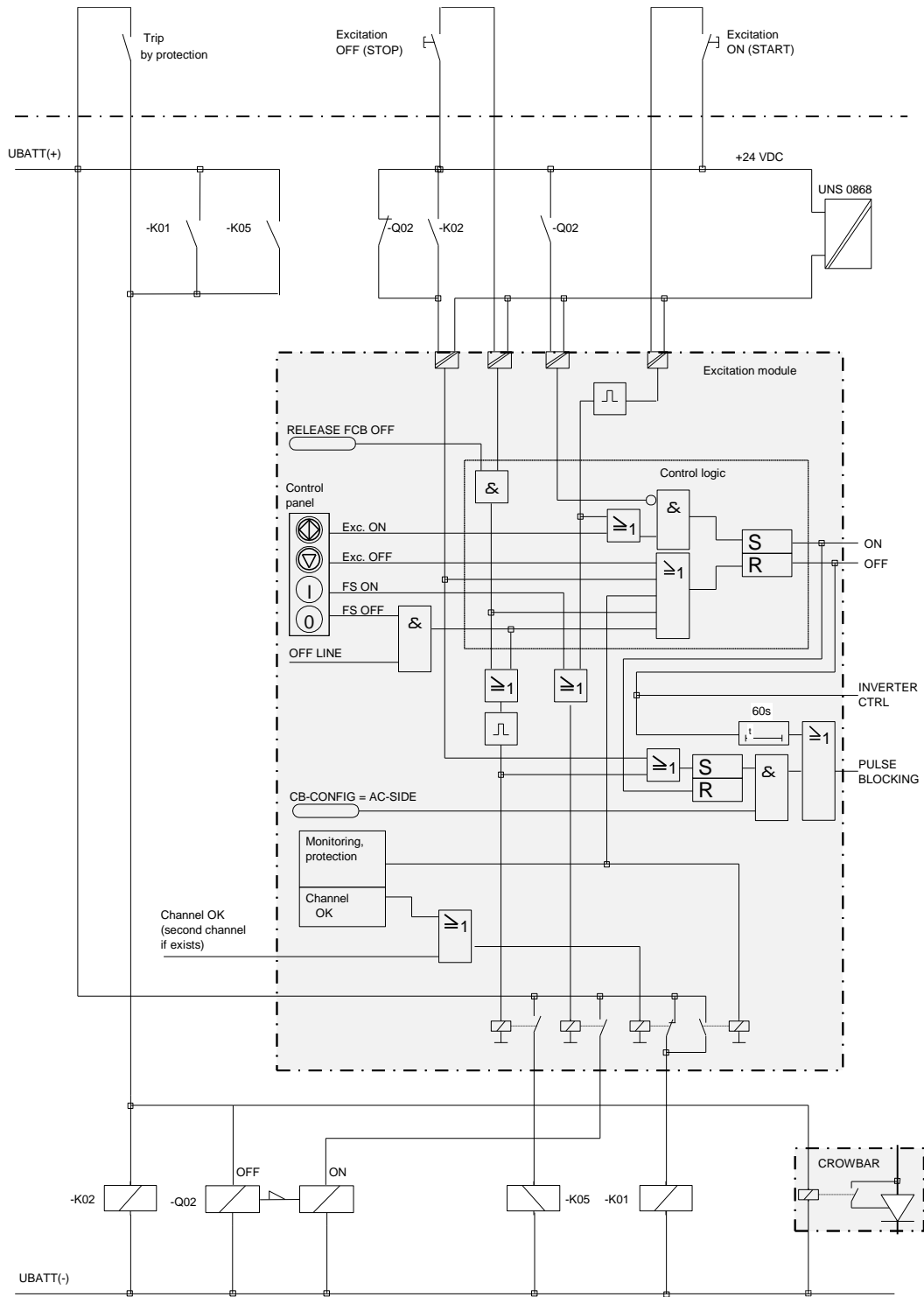


Fig. 10 ON (START), OFF (STOP), protection logic



Excitation System

UNITROL[®] Series

Functional Description Control Panel UNS 0874

| | | | | | | | | | | |
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1 Safety regulations

1.1 Use of the control panel

The control panel is a very versatile device which, in addition to featuring simple functions for local operation, also provides all the means of intervening the excitation system which are required in order to carry out complete commissioning. **Serious intervening of the operating behaviour of voltage regulators, limits, protection and control is possible.**

All modifications to the system are carried out by means of so-called parameter settings and are described in section 3.3.1 (p. 18). **This work may only be carried out by trained commissioning and service personnel.** This does not apply to the alteration of reference values in local operation (see section 3.2.3, p. 17). If the operating mode "Parameter-setting" is unintentionally activated through operating error, the following instructions are to be followed:

[. . .] **As soon as a value in square brackets appears, the "Parameter" mode is activated and the parameter value will be changed each time the arrow keys are pressed.**

 **Do not press the ENTER key after an operating error. This saves any changes.**

 **In order to cancel a change and quit the "Parameter" mode, press the ACT key.**

1.2 Personnel categories

This document explains the use of the control panel in connection with local control of the excitation system, as well as servicing and commissioning. It is not an operating manual for the excitation system, nor is it an instruction manual for servicing and commissioning. Before carrying out any work on the excitation system, the corresponding manuals are to be consulted; in particular, it is essential that the safety regulations in the operating manual (for the excitation system) and in the instructions on servicing and fault-location are complied with.

Operating personnel

The operating manual (section 3) is divided into two parts, a general section for the operating personnel and a special section for the service and commissioning personnel. The first section contains all the functions required for local control of the excitation system such as display of actual values, display of faults and fault resetting. It is essential that the operating personnel familiarise themselves with the contents of this section.

Commissioning and service personnel

The second part of the operating manual is intended as a reference work for this group of persons. Individual settings can be carried out with reference to this manual. For more complex work, including the commissioning of a system, we urgently recommend participation in a training course at our company or an intensive introduction by our commissioning personnel when the system is commissioned for the first time.

2 Device description

2.1 Introduction

This document describes the handling of the Control Panel UNS 0874 and its use in connection with UNITROL[®] devices for the local control of the excitation system and for setting parameter values.

The panel has 16 membrane keys and an LCD display with 4 lines of 20 characters and is approximately the size of a pocket calculator.

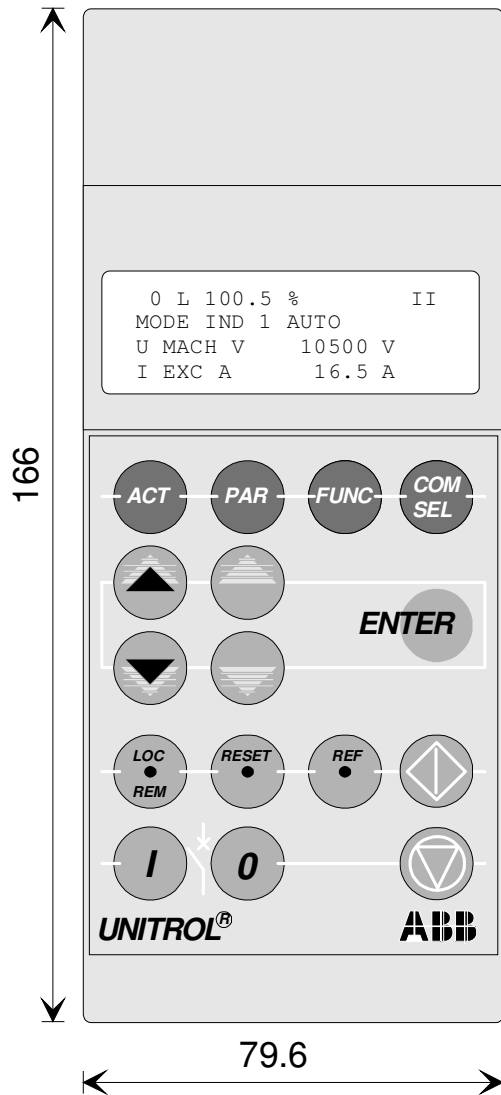
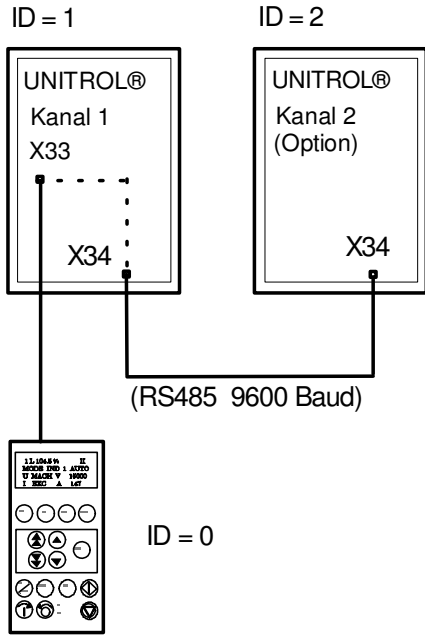


Fig. 1 Control Panel UNS 0874

The control panel is linked with the UNITROL[®] devices via a serial interface (RS 485). The communication speed is 9600 bits/s. The power supply to the panel is also provided via the serial connection cable, the device itself does not contain any batteries.

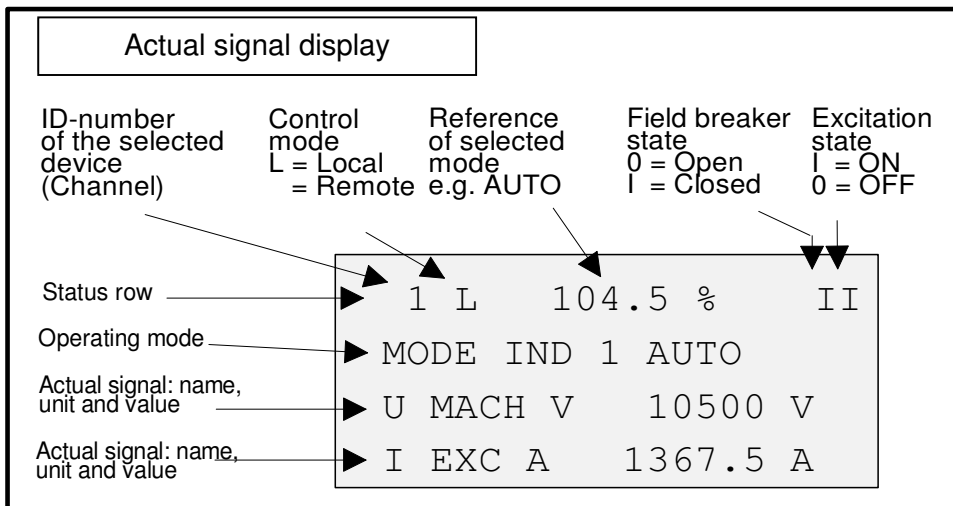


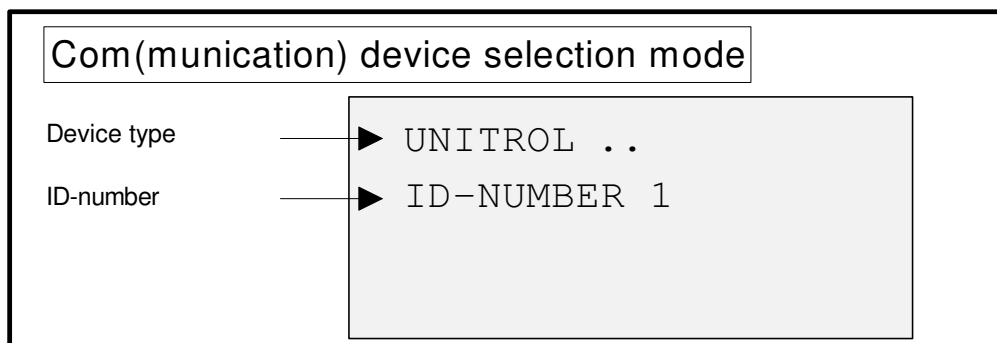
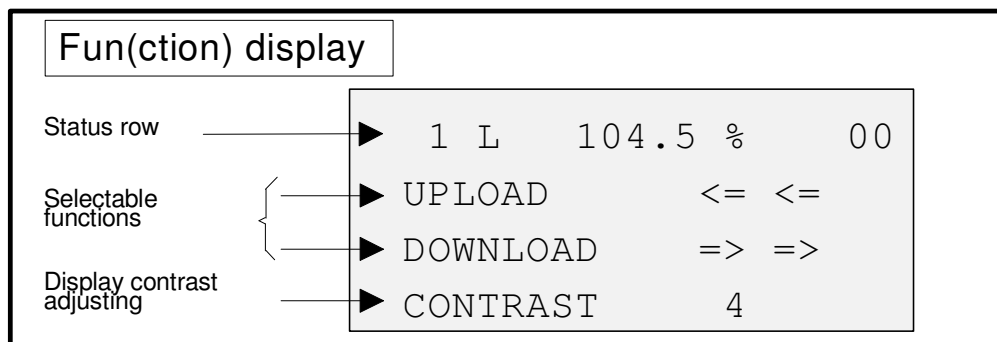
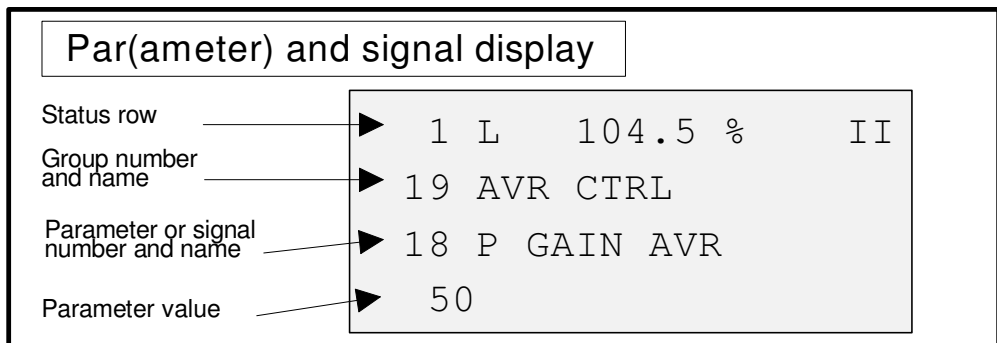
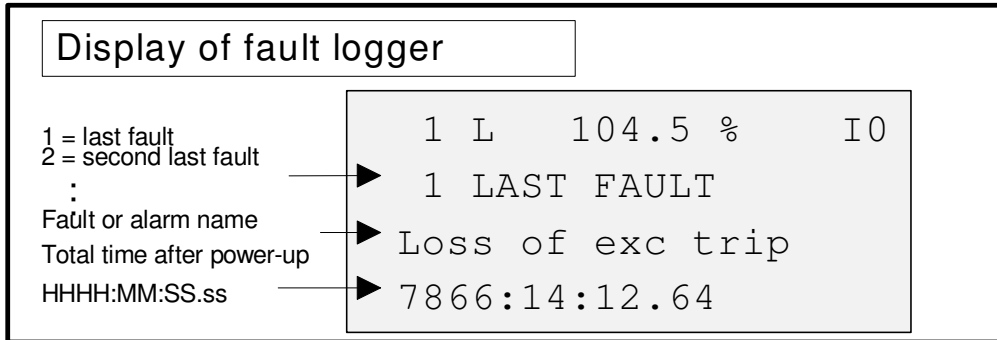
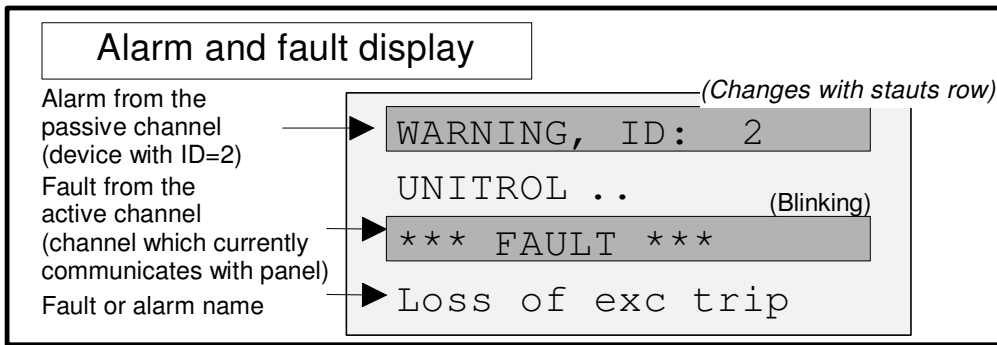
In the case of double channel systems (designation AFT), the device communicates with both channels via a common interface. The channels are distinguished by means of an ID number and the panel can communicate selectively with both devices without unplugging the cable.

Fig. 2 Panel connection

2.2 Display formats

















Depending on the operating mode in which it is being used, the LCD display of the control panel shows the operating status of the excitation, fault messages, parameter values and other information on the excitation system. All information, parameters and fault messages are displayed in English. The meaning of the individual fields can be seen from the following examples:





2.3 Function keys

The membrane keypad is used to switch between the different display modes and to operate the panel functions. The key functions are as follows:

| Key | Text reference | Function |
|--|--|--|
|  | ACT | Selects "Actual Signal Display" mode. This also includes the alarm and fault display and the display of the fault logger |
|  | PAR | Selects "Parameter" mode |
|  | FUNC | Selects "Function" mode |
|  | COM/SEL | Selects "Device Selection" mode |
|   | [Double Up Arrow] [Double Down Arrow] | Different key functions depending on the display mode: - selects a parameter- or signal group - changes a parameter value quickly - changes between actual signal display and display of the fault logger |
|   | [Up Arrow] [Down Arrow] | Different key functions depending on the display mode: - selects a parameter or signal - changes a parameter value slowly - shifts cursor by one line |
|  | ENTER | Confirms a selection or input |
|  | LOC/REM | Used to select local or remote operation LOC: local operation using the control panel REM: any other operation mode |
|  | RESET | Alarm- & fault reset |
|  | REF | Local control of the excitation: reference setting |
|  | [START] | Excitation ON |
|  | [STOP] | Excitation OFF |
|  | [ON] | Field breaker ON |
|  | [OFF] | Field breaker OFF |

2.4 Operating modes

The Control Panel UNS 0874 has five different operating modes: Actual Signal Display Mode, Parameter Mode, Function Mode, Device Selection Mode and Start Mode. In most modes, local control of the excitation is also possible at the same time. Each mode is described briefly in the following.

2.4.1 Actual Signal Display Mode



In Actual Signal Display Mode, three actual values can be shown on the display simultaneously, e.g. machine voltage, reactive power and excitation current.

Each signal is identified by a signal group and signal number, e.g. "10101 U MACH RELATIVE" (machine voltage in %), with the signal group 101 and signal number 01. The operating mode, which normally appears in the second line, is also a signal ("10301 MODE INDICATION").

This mode also includes the fault display and display of the fault logger. The double arrow keys are used to switch between actual signal display and display of the fault logger.

The actual signal display is the normal operating mode of the control panel. As long as no faults are effective, the display switches back to the actual signal display from any other mode after 1 minute.

The operation of the actual signal display is described in section 3.1.1 (p. 11). The signal- and signal group numbers can be found in the "Parameter and Signal List Version" for the current software version

2.4.2 Parameter Mode



In Parameter Mode, most of the setting values of the excitation system can be changed, e.g. reference value limits of the voltage regulator, limiter settings etc.

These settings may only be carried out by the commissioning and service personnel. Parameter setting is described in section 3.3.1 (p. 18), the parameter numbers can also be found in the "Parameter and Signal List Version".

2.4.3 Function Mode



In this mode, complete parameter sets can be exchanged between the control panel and the selected UNITROL® F device. These functions are called "upload" and "download".

Upload and download are used to copy a complete parameter set from one channel into the second channel or into the UNITROL® device of another machine (with the same settings). In addition, the contrast of the LCD display can be adjusted in Function mode. The control of these functions is described in 3.1.5 Adjusting the display contrast.

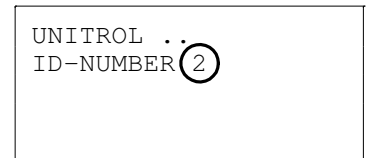
In addition: Function mode offers the system engineer the possibility of intervening the plant control system and introducing new function blocks. The description of these functions goes beyond the scope of this manual and is described in the document "Programming Manual", which we can supply on request.

2.4.4 Device Selection Mode



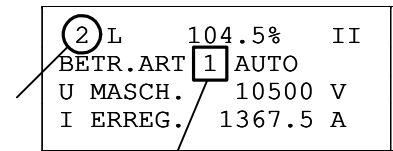
The Device Selection mode is used to select the device with which the control panel is to communicate. This function is only relevant in double channel systems.

After the COM SEL key is pressed, the ID number of the channel with which the panel link is currently established appears on the display. The ID number can be changed and communication established with the other channel using the arrow keys.



In other display modes, this information is repeated in the first line (status line), e.g. in ACT mode:

channel communicating with the control panel



active regulator channel

After the COM SEL key is pressed, the ID number of the channel with which the panel link is currently established appears on the display. The ID number can be changed and communication established with the other channel using the arrow keys.

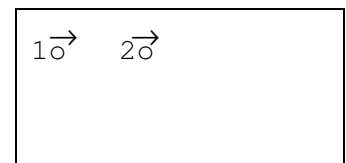
In other display modes, this information is repeated in the first line (status line), e.g. in ACT mode:

This setting should not be confused with the selection of the regulator channel. The number of the active regulator channel, i.e. the channel on which the firing pulses are released and which supplies the field current, is shown on the second line in the actual signals display.

The ID numbers are defined as follows:

- 0 control panel
- 1 channel 1
- 2 channel 2 (if present)

A special status display appears after the last UNITROL® device on the serial communication has been displayed. The status display shows the operating status of all connected devices in abbreviated form:

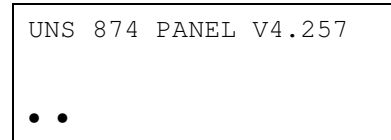


Explanation of symbols:

| Symbol | Status |
|----------------------|----------------------------------|
| $\overleftarrow{0}$ | Field breaker and excitation OFF |
| $\overrightarrow{0}$ | Field breaker ON, excitation OFF |
| $\overrightarrow{1}$ | Excitation and field breaker ON |
| F | Alarm or fault in device |

2.4.5 Start Mode

When the panel is first connected or power is applied to the system, an identification screen appears showing the software version. At the same time, the parameters are downloaded from the excitation system into the control panel. When the panel is first connected, this operation can take up to one minute. The panel then switches to Actual Signal Display mode.



The serial connection cable to the control panel can be plugged in or unplugged at any time without the supply voltage of the UNITROL[®] device needing to be interrupted. Following an interruption in communication, the panel re-establishes communication with the same channel which was selected before the interruption.

If the channel with which the panel is currently communicating fails, a connection with the other channel is automatically established. A display similar to the special status display described above appears, which it is possible to quit by pressing the ACT key.

3 Operating Manual










In the following, the handling of the control panel is explained step by step, showing the necessary key commands and the resulting displays which appear.

In the examples, the selected line (cursor position) is marked with a grey rectangle:




| | | |
|----------|---------|------|
| 1 L | 104.5 % | II |
| MODE IND | 1 | AUTO |
| U MACH | 102.4 % | |
| I EXC | 100.5 % | |

3.1 Normal operation

3.1.1 To display signals

| | Function | Key | Display which appears after key is pressed | | | | | | | | | | | | |
|----------|---|---|--|-----|---------|----|----------|---------------|------|--------|---------|----------|-------|---------|---------|
| 1. | To activate actual value display mode |  | <table border="1"> <tr> <td>1 L</td> <td>104.5 %</td> <td>II</td> </tr> <tr> <td>MODE IND</td> <td>1</td> <td>AUTO</td> </tr> <tr> <td>U MACH</td> <td>102.4 %</td> <td></td> </tr> <tr> <td>I EXC</td> <td>100.5 %</td> <td></td> </tr> </table> | 1 L | 104.5 % | II | MODE IND | 1 | AUTO | U MACH | 102.4 % | | I EXC | 100.5 % | |
| 1 L | 104.5 % | II | | | | | | | | | | | | | |
| MODE IND | 1 | AUTO | | | | | | | | | | | | | |
| U MACH | 102.4 % | | | | | | | | | | | | | | |
| I EXC | 100.5 % | | | | | | | | | | | | | | |
| 2. | To select line |   or | <table border="1"> <tr> <td>1 L</td> <td>104.5 %</td> <td>II</td> </tr> <tr> <td>MODE IND</td> <td>1</td> <td>AUTO</td> </tr> <tr> <td>U MACH</td> <td>102.4 %</td> <td></td> </tr> <tr> <td>I EXC</td> <td>100.5 %</td> <td></td> </tr> </table> | 1 L | 104.5 % | II | MODE IND | 1 | AUTO | U MACH | 102.4 % | | I EXC | 100.5 % | |
| 1 L | 104.5 % | II | | | | | | | | | | | | | |
| MODE IND | 1 | AUTO | | | | | | | | | | | | | |
| U MACH | 102.4 % | | | | | | | | | | | | | | |
| I EXC | 100.5 % | | | | | | | | | | | | | | |
| 3. | To confirm line selection The signal group, signal name and signal value are displayed |  | <table border="1"> <tr> <td>1 L</td> <td>104.5 %</td> <td>II</td> </tr> <tr> <td>101</td> <td>ANALOG INPUTS</td> <td></td> </tr> <tr> <td>01</td> <td>U MACH</td> <td>RELATIVE</td> </tr> <tr> <td></td> <td>102.4 %</td> <td></td> </tr> </table> | 1 L | 104.5 % | II | 101 | ANALOG INPUTS | | 01 | U MACH | RELATIVE | | 102.4 % | |
| 1 L | 104.5 % | II | | | | | | | | | | | | | |
| 101 | ANALOG INPUTS | | | | | | | | | | | | | | |
| 01 | U MACH | RELATIVE | | | | | | | | | | | | | |
| | 102.4 % | | | | | | | | | | | | | | |
| 4. | To select different signal group |   or | <table border="1"> <tr> <td>1 L</td> <td>104.5 %</td> <td>II</td> </tr> <tr> <td>105</td> <td>CONVERTER</td> <td></td> </tr> <tr> <td>02</td> <td>I EXC</td> <td>A</td> </tr> <tr> <td></td> <td>1350</td> <td>A</td> </tr> </table> | 1 L | 104.5 % | II | 105 | CONVERTER | | 02 | I EXC | A | | 1350 | A |
| 1 L | 104.5 % | II | | | | | | | | | | | | | |
| 105 | CONVERTER | | | | | | | | | | | | | | |
| 02 | I EXC | A | | | | | | | | | | | | | |
| | 1350 | A | | | | | | | | | | | | | |
| 5. | To select another signal within the group |   or | <table border="1"> <tr> <td>1 L</td> <td>104.5 %</td> <td>II</td> </tr> <tr> <td>105</td> <td>CONVERTER</td> <td></td> </tr> <tr> <td>06</td> <td>U EXC</td> <td>V</td> </tr> <tr> <td></td> <td>453</td> <td>V</td> </tr> </table> | 1 L | 104.5 % | II | 105 | CONVERTER | | 06 | U EXC | V | | 453 | V |
| 1 L | 104.5 % | II | | | | | | | | | | | | | |
| 105 | CONVERTER | | | | | | | | | | | | | | |
| 06 | U EXC | V | | | | | | | | | | | | | |
| | 453 | V | | | | | | | | | | | | | |
| 6. | To confirm selection and return to the actual value display |  | <table border="1"> <tr> <td>1 L</td> <td>104.5 %</td> <td>II</td> </tr> <tr> <td>MODE IND</td> <td>1</td> <td>AUTO</td> </tr> <tr> <td>U EXC</td> <td>V</td> <td>453 V</td> </tr> <tr> <td>I EXC</td> <td></td> <td>100.5 %</td> </tr> </table> | 1 L | 104.5 % | II | MODE IND | 1 | AUTO | U EXC | V | 453 V | I EXC | | 100.5 % |
| 1 L | 104.5 % | II | | | | | | | | | | | | | |
| MODE IND | 1 | AUTO | | | | | | | | | | | | | |
| U EXC | V | 453 V | | | | | | | | | | | | | |
| I EXC | | 100.5 % | | | | | | | | | | | | | |










To display full signal names:

| | Function | Key | Display which appears after key is pressed |
|----|----------------------------------|---|--|
| 1. | To display full signal names | hold  | 1 L 104.5 % II MODE INDICATION U MACH RELATIVE I EXC RELATIVE |
| 2. | To display signal name and value | release  | 1 L 104.5 % II MODE IND 1 AUTO U MACH 102.4 %  EXC 100.5 % |

3.1.2 To display the fault logger




In the fault logger, the UNITROL® devices possess a very convenient aid to fault location. However, this requires that the operating personnel check the fault logger each time before a fault is acknowledged and pass on the information to the service personnel.

In double channel systems, the fault message can also originate from the channel with which the panel is not currently communicating. In this case, the connection with the other channel must first be established using the function "Device Selection " (see section 3.1.4 p.14) before the fault logger is read.

| | Function | Key | Display which appears when key is pressed |
|----|---|---|---|
| 1. | To activate actual value display |  | 1 L 0.0 % 00 MODE IND 1 AUTO  EXC V 0 V I EXC 0.0 % |
| 2. | To display fault logger |   or | 1 L 0.0 % 00 1 LAST FAULT Loss of exc trip xxxx:xx:xx.xx |
| 3. | To scroll through fault list: up arrow: view older fault message down arrow: view more recent fault message |   or | 1 L 0.0 % 00 2 LAST FAULT Loss conv. supply xxxx:xx:xx.xx |
| 4. | To return to actual value display |   or | 1 L 0.0 % 00 MODE IND 1 AUTO  EXC V 0 V I EXC 0.0 % |

3.1.3 Fault resetting

Procedure for single channel systems (SFE) and for dual channel systems (AFT) in case the fault has occurred in the channel, which the operating panel is actually communicating with.







| | Function | Key | Display which appears when key is pressed |
|----|-------------------------------------|---|--|
| | Display after a fault has occurred: | | <pre> 1 0.0 % 00 UNITROL .. *** FAULT *** Loss of exc trip </pre> |
| 1. | To switch to LOCAL mode |  | <pre> 1 L 0.0 % 00 UNITROL .. *** FAULT *** Loss of exc trip </pre> |
| 2. | To reset fault |  | <pre> 1 L 0.0 % 00 MODE IND 1 AUTO U EXC V 0 V I EXC 0.0 % </pre> |
| 3. | To switch back to remote operation |  | <pre> 1 0.0 % 00 MODE IND 1 AUTO U EXC V 0 V I EXC 0.0 % </pre> |

Procedure for dual channel systems in case the fault has occurred in the channel, which the operating panel is not currently communicating with.









| | Function | Key | Display which appears when key is pressed |
|--|--|-----|--|
| | Display after a fault has occurred: (first line is alternating with the status line at an interval of 1 second) | | <pre> FAULT, ID: 2 MODE IND 1 AUTO U EXC V 0 V I EXC 0.0 % </pre> |
| | Set up communication with the other channel (see chapter 3.1.4) | | <pre> 2 0.0 % 00 UNITROL .. *** FAULT *** Loss of exc trip </pre> |
| | Reset fault as described above. | | <pre> 2 0.0 % 00 MODE IND 1 AUTO U EXC V 0 V I EXC 0.0 % </pre> |
| | If necessary set up communication with the original channel. | | <pre> 1 0.0 % 00 MODE IND 1 AUTO U EXC V 0 V I EXC 0.0 % </pre> |

3.1.4 Device Selection

This function is only relevant in double channel systems.

| | Function | Key | Display which appears when key is pressed |
|----|---|--|---|
| 1. | To activate device selection mode |  | UNITROL .. ID-NUMBER 1 |
| 2. | To select preceding or following station on the serial link |   | UNITROL - .. ID-NUMBER 2 |
| 3. | To establish connection with the selected device and at the same time select one of the three display modes (press one of the three keys) |    | 2 L 0.0 % 00 MODE IND 1 AUTO U EXC V 0 V I EXC A 0.0 A |

3.1.5 Adjusting the display contrast

| | Function | Key | Display which appears after key is pressed |
|----|---|---|---|
| 1. | To enter Function mode |  | 1 L 0.0 % 00 U PLOAD <= <= D OWNLOAD => => C ONTRAST 7 |
| 2. | To select contrast setting (4th line) |   | 1 L 0.0 % 00 U PLOAD <= <= D OWNLOAD => => C ONTRAST 7 |
| 3. | Confirm line selection |  | 1 L 0.0 % 00 C ONTRAST 7 |
| 4. | To enter contrast setting function (the set value appears in square brackets) |  | 1 L 0.0 % 00 C ONTRAST [7] |
| 5. | Adjust contrast (adjustment range 1...7) |   | 1 L 0.0 % 00 C ONTRAST [4] |
| 6. | Confirm new setting |  | 1 L 0.0 % 00 C ONTRAST 4 |





3.2 Local control of the excitation system

In local operation, the excitation can be controlled locally, i.e. at the excitation cabinet, with the aid of the control panel. As a rule, the same functions are available as in the control room.

In the following, only the control procedures using the control panel are described. The necessary safety precautions which are to be taken with local operation are described in the operating manual for the excitation system.














3.2.1 Field breaker- and excitation control

The four commands EXCITATION ON / OFF and FIELD BREAKER ON / OFF are directly assigned to four keys. After switching over to local operation, these commands are enabled in all operating modes of the control panel and are executed immediately when the key is pressed. Exceptions are locking functions in the control system which, for example, prevent excitation being switched off when the machine is connected to the network.

| Control panel Key | Name of the key | Function |
|---|-----------------|---|
|  | [START] | EXCITATION ON (only effective with closed field breaker) |
|  | [STOP] | EXCITATION OFF ¹⁾ |
|  | [ON] | FIELD BREAKER ON |
|  | [OFF] | FIELD BREAKER OFF ¹⁾ (switches the excitation off at the same time) |













¹⁾ only possible if the machine is isolated from the network

3.2.2 Selecting the operating mode (AUTO-MANUAL etc.)

| | Function | Key | Display which appears when key is pressed |
|-----|---|--|--|
| 1. | To activate parameter mode |  | <div style="border: 1px solid black; padding: 5px;"> 1 L 0.0 % 00 3 CONTROL LOGIC 01 RELEASE FCB OFF NO </div> |
| 2. | To select signal group 103 "CONTROL LOGIC" |   or | <div style="border: 1px solid black; padding: 5px;"> 1 L 0.0 % 00 103 CONTROL LOGIC 01 MODE INDICATION 1 REF MIN </div> |
| 3. | To select signal 02 "MODE SELECTION" |   or | <div style="border: 1px solid black; padding: 5px;"> 1 L 0.0 % 00 103 CONTROL LOGIC 02 MODE SELECTION AUTO ON </div> |
| 4. | To confirm selection (the parameter value appears in square brackets) |  | <div style="border: 1px solid black; padding: 5px;"> 1 L 0.0 % 00 103 CONTROL LOGIC 02 MODE SELECTION [AUTO ON] </div> |
| 5. | To change operating mode, e.g. select power factor regulator |   or | <div style="border: 1px solid black; padding: 5px;"> 1 L 0.0 % 00 103 CONTROL LOGIC 02 MODE SELECTION [COSPHI SEL] </div> |
| 6a. | Confirm new setting |  | <div style="border: 1px solid black; padding: 5px;"> 1 L 0.0 % 00 103 CONTROL LOGIC 02 MODE SELECTION COSPHI SEL </div> |
| 6b. | cancel the new setting by switching to another display mode |     | <div style="border: 1px solid black; padding: 5px;"> 1 L 0.0 % 00 103 CONTROL LOGIC 02 MODE SELECTION AUTO ON </div> |

3.2.3 Setting reference values





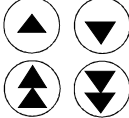

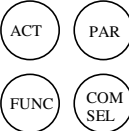
The setting always acts on the currently selected regulator (AUTO, MANUAL, COSPHI, Q-CTRL).

| | Function | Key | Display which appears when key is pressed |
|----|--|--|---|
| 1. | Select actual value display The signal 10301 MODE INDICATION (operating mode) normally appears in the second line |  | <pre> 1 104.5 % II MODE IND 1 AUTO U MACH V 13500 V I EXC A 1350.5 A </pre> |
| 2. | Select LOCAL mode |  | <pre> 1 L 104.5 % II MODE IND 1 AUTO U MACH V 13500 V I EXC A 1350.5 A </pre> |
| 3. | Activate reference value setting The reference value in the status line appears in square brackets |  | <pre> 1 L [104.5 %] II MODE IND 1 AUTO U MACH V 13500 V I EXC A 1350.5 A </pre> |
| 4. | Change reference value Use arrow keys for small steps, double arrow keys for large steps Caution: the alteration of the reference value becomes effective immediately! |     | <pre> 1 L [105.7 %] II MODE IND 1 AUTO U MACH V 13635 V I EXC A 1375.9 A </pre> |
| 5. | Exit from reference setting mode by switching to another display mode |     | <pre> 1 L 105.7 % II MODE IND 1 AUTO MACH V 13635 V I EXC A 1375.9 A </pre> |
| 6. | To switch to remote operation |  | <pre> 1 105.7 % II MODE IND 1 AUTO U MACH V 13635 V I EXC A 1375.9 A </pre> |

The adjustment range of the panel reference value is always -100% to +150%. However, in the UNITROL® device, this value is limited to the set reference value range, e.g. 90 % to 110 % for the voltage regulator (AUTO).

3.3 Commissioning and servicing

3.3.1 Altering parameters

| | Function | Key | Display which appears after key is pressed |
|-----|--|---|---|
| 1. | To select parameter setting mode |  | 1 L 0.0 % 00 3 CONTROL LOGIC 01 RELEASE FCB OFF NO |
| 2. | To select the parameter group |  oder | 1 L 0.0 % 00 5 CONVERTER 01 U EXC V NOMINAL 350 V |
| 3. | To select the parameter |  oder | 1 L 0.0 % 00 5 CONVERTER 02 I EXC A NOMINAL 1000.0 A |
| 4. | To confirm the selection The parameter value now appears in square brackets |  | 1 L 0.0 % 00 5 CONVERTER 02 I EXC A NOMINAL [1000.0 A] |
| 5. | To change the parameter value. Use arrow keys for small changes. Use double arrow keys for large changes |  | 1 L 0.0 % 00 5 CONVERTER 02 I EXC A NOMINAL [1350.0 A] |
| 6a. | Confirm new value |  | 1 L 0.0 % 00 5 CONVERTER 02 I EXC A NOMINAL 1350.0 A |
| 6b. | cancel the new setting by switching to a different display mode |  | 1 L 0.0 % 00 5 CONVERTER 02 I EXC A NOMINAL 1000.0 A |

It is essential to consult the Parameter and Signal List for the relevant software version in order to determine the significance and consequences of parameter modifications. Permanent modifications are to be stored using the "Backstore mode" (see section 3.3.2, p. 21).

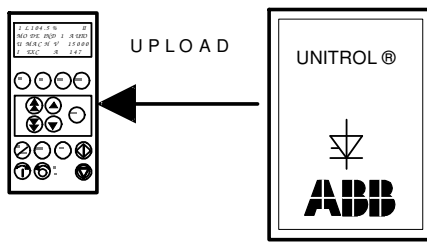
Some parameters are write-protected. If one attempts to alter one of these values, this message appears on the display:

WARNING
WRITE ACCESS DENIED
PARAMETER SETTING
NOT POSSIBLE

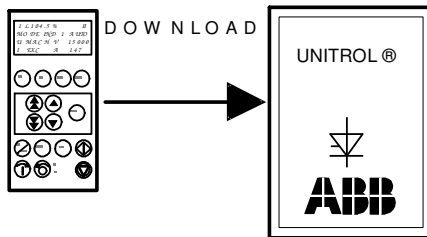
3.3.1.1 Altering language of the control panel

The language of the control panel can be alter with the parameter LANGUAGE (1215) in the group MAINTENANCE. To alter parameter see the instruction before.

3.3.2 Uploading and downloading of parameters



Upload: All the parameters of the currently selected device are copied into the control panel. Uploading can be carried out while the machine is running.



Download: Copies a complete parameter set from the control panel into the currently selected UNITROL® device. **Downloading is only possible when the excitation and field breaker in the destination system are switched off.**

Between uploading and downloading, the control panel can be unplugged from the serial cable and carried to another system. The parameter set remains safely stored even when the supply voltage is interrupted.

Following a download, the parameters are stored in the volatile memory (RAM) of the destination system, i.e. the connected UNITROL® device, and are effective until the next time the supply voltage is switched off. In order to store the values permanently, they must be copied into the non-volatile memory (FPROM). The so-called Backstore mode is used for this purpose.

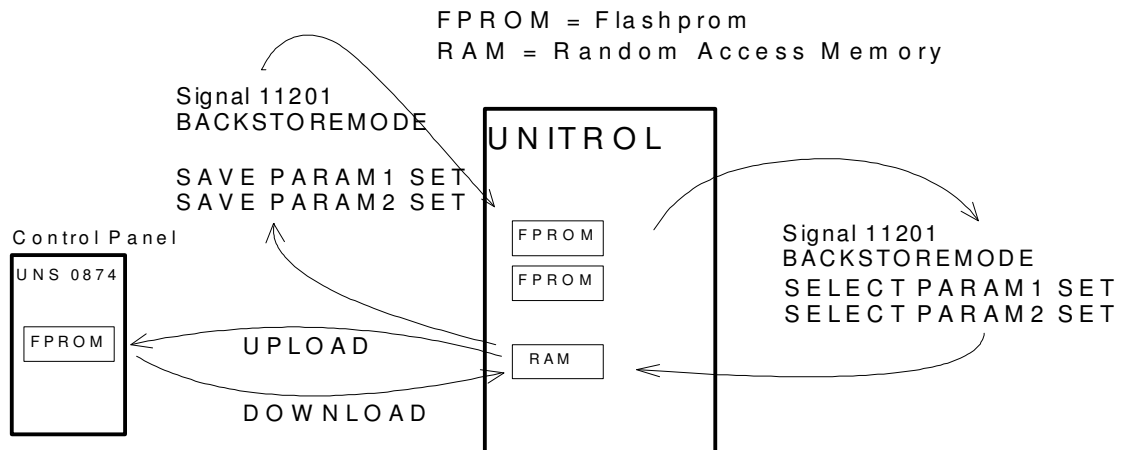

















Fig. 3 Handling of parameter sets

To carry out upload and download functions:
















| | Function | Press key | Display after key is pressed |
|----|--------------------------------------|---|--|
| 1. | To enter Function mode |  | <pre> 1 L 0.0 % 00 U PLOAD <= <= D OWNLOAD => => C ONTRAST 7 </pre> |
| 2. | To select function e.g. Down-load |   | <pre> 1 L 0.0 % 00 U PLOAD <= <= D OWNLOAD => => C ONTRAST 7 </pre> |
| 3. | To execute selected function |  | <pre> 1 L 0.0 % 00 => => => => => => => D OWNLOAD </pre> |
| 4. | Parameter storage completed | | <pre> 1 L 0.0 % 00 M ODE IND 1 AUTO U EXC V 0 V I EXC A 0.0 A </pre> |

To activate Backstore mode

| | Function | Press key | Display after key is pressed |
|-----|--|--|--|
| 1. | To enter parameter mode |  | <div style="border: 1px solid black; padding: 5px;"> 1 L 0.0 % 00 52 ANALOG OUTPUTS 05 A02.[IN] 101.01 </div> |
| 2. | Select parameter group 112 |   | <div style="border: 1px solid black; padding: 5px;"> 1 L 0.0 % 00 112 MAINTENANCE 01 BACKSTOREMODE NON </div> |
| 3. | Parameter 11201 BACKSTOREMODE has already been selected | | <div style="border: 1px solid black; padding: 5px;"> 1 L 0.0 % 00 112 MAINTENANCE 01 BACKSTOREMODE None </div> |
| 4. | Confirm parameter selection The parameter value (NONE) now appears in square brackets |  | <div style="border: 1px solid black; padding: 5px;"> 1 L 0.0 % 00 112 MAINTENANCE 01 BACKSTOREMODE [NONE] </div> |
| 5. | To select the parameter set SAVE PARAM1 SET |   | <div style="border: 1px solid black; padding: 5px;"> 1 L 0.0 % 00 112 MAINTENANCE 01 BACKSTOREMODE [SAVE PARAM1 SET] </div> |
| 6a. | Confirm save or |  | <div style="border: 1px solid black; padding: 5px;"> 1 L 0.0 % 00 112 MAINTENANCE 01BACKSTOREMODE ERASING... </div> |
| 6b. | abort save operation by switching to another display mode The operation has been completed when NONE is displayed as pa- rameter value |     | <div style="border: 1px solid black; padding: 5px;"> 1 L 0.0 % 00 112 MAINTENANCE 01 BACKSTOREMODE NONE </div> |

3.3.3 Connecting function block inputs

Function block inputs are special parameters and can also be connected using the control panel.

| | Function | Press key | Display after key is pressed |
|-----|--|--|--|
| 1. | To enter Parameter mode |  | 1 L 0.0 % 00 3 CONTROL LOGIC 01 RELEASE FCB OFF NO |
| 2. | To select signal- or parameter group |   | 1 L 0.0 % 00 52 ANALOG OUTPUTS 01 A01.[IN] 138.06 |
| 3. | To select function block input or signal number |   | 1 L 0.0 % 00 52 ANALOG OUTPUTS 05 A02.[IN] 101.01 |
| 4. | To confirm selection The number of the input signal now appears in square brackets |  | 1 L 0.0 % 00 52 ANALOG OUTPUTS 05 A02.[IN] [101.01] |
| 5. | To change the number of the input signal Use arrow keys for the signal number Use double arrow keys for the signal group |     | 1 L 0.0 % 00 52 ANALOG OUTPUTS 05 A02.[IN] [101.03] |
| 6a. | To confirm new signal number |  | 1 L 0.0 % 00 52 ANALOG OUTPUTS 05 A02.[IN] 101.03 |
| 6b. | cancel the new setting by switching to another display mode |     | 1 L 0.0 % 00 52 ANALOG OUTPUTS 05 A02.[IN] 101.01 |

Excitation System

UNITROL[®] F Series

Operating Instructions

| | | | | | | | | | |
|------------|--|------------|---------|--------------------------|-----------------------|-----------|----------|----------|--------------|
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1 Introduction

The Operating Instructions serves as a self-contained document explaining the operation and use of the excitation system. This document describes the safety precautions which need to be taken and also includes a complete description of automatic and manual operation.

1.1 Safety regulations

Warning signs are affixed to all cabinet doors in order to warn of the operating voltages present in the control cabinets (50 Volts), but in particular the voltages present in the power section (over 1000 Volts possible) and the enormously high short-circuit currents. These signs are intended to prevent the doors from being opened during operation.

| Signal | Definition |
|---|---|
|  | <p>General warning!</p> |
|  | <p>Caution - high voltage - danger of electrocution!</p> |

Counter procedures must be taken to prevent installations which have been switched off from being unintentionally switched on as a result of control errors or by third parties; (e.g. prevent switching-on through the use of key switches). In addition, before switching on, the operating personnel must make sure that the installation is ready for operation and that the cabinet doors are properly locked.

This manual covers normal operation, both in automatic mode and in manual mode. It is not possible to cover special operating modes such as short-circuit tests, auxiliary power supply inputs etc. These operating modes require a comprehensive knowledge of all installation components (excitation, generator, etc.). They can therefore only be carried out by a specialist.

- **The operating personnel are prohibited from carrying out any manipulations inside the control cabinets.**
- **Maintenance and repair work is not covered by this document.**

1.2 Requirements for operating personnel

- The operator must be familiar with this document.
- They must understand the influence of the excitation on the network variables (field current, generator voltage, reactive power)
- They must be familiar with the control elements, operating and alarm indicators for the excitation, both at their working place (control room, remote control etc.) and on the excitation system itself (local operation).
- They must understand the effect of the commands sent to the excitation system and must be able to interpret the alarms from the excitation system which are indicated in the control room.

2 Control and display elements

2.1 Remote control (control room)

A number of control commands with acknowledgement signals and a number of acknowledgement signals are available in the control room for the control of the excitation system. In addition, the most important status variables for the excitation are provided in the form of analogue signals.

The command keys, signal lamps and display instruments in the control room which are required for operation are not part of the normal scope of delivery.

REMOTE means all actions outside of the I/O Interface UNS 0863. If LOCAL operation is selected on the control panel, then all commands outside of the I/O Interface UNS 0863 become ineffective, with the exception of TRIP commands (emergency shutdowns). Fieldbus control via a serial communications medium, if installed, is dealt with in a separate manual.

The operating personnel must familiarise themselves with the layout of these elements and their effect on the control commands for the excitation (see system diagram, sheets 900 onwards for an overview of the control commands).

These control elements enable the operating personnel to operate the generator, on the excitation side, according to changing operating requirements, both in automatic mode (AUTO) and in MANUAL mode.

The commands from the control room are enabled if the command input on the control panel is switched to "REMOTE" (see 2.1.3.2 page 10).

Overview of the different control commands in LOCAL and REMOTE operation:

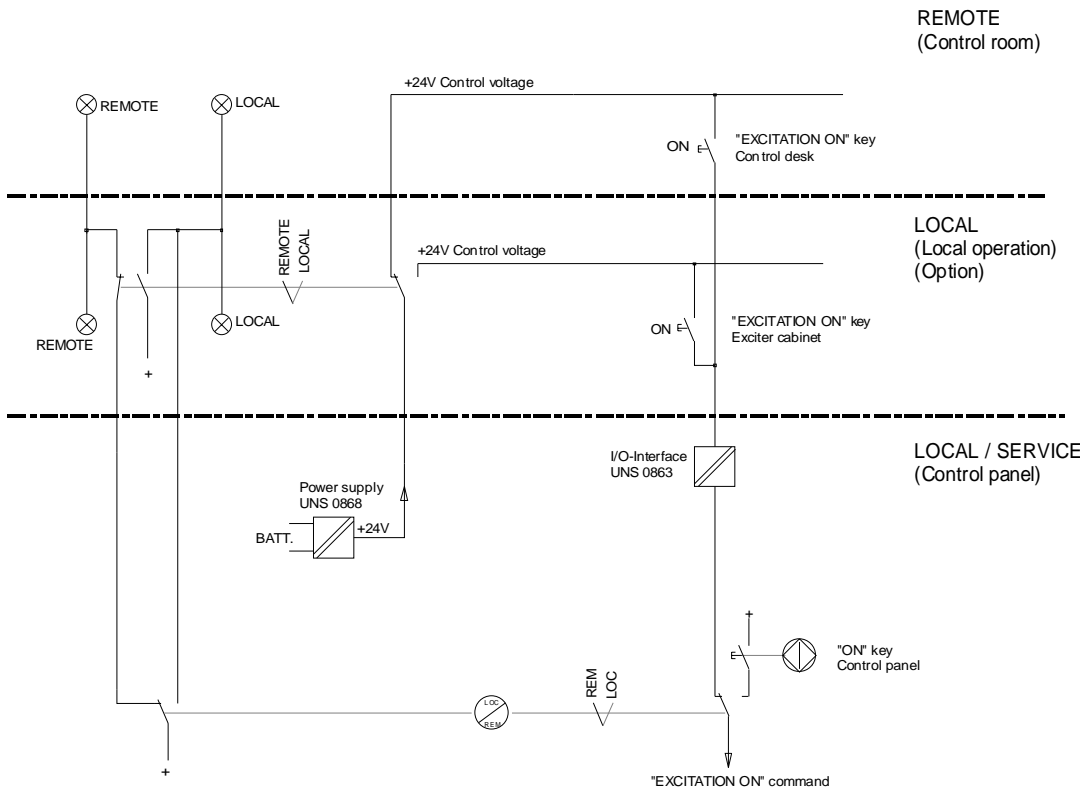


Fig. 1 Local / remote control

2.1.1 Commands and acknowledgement signals

The following commands are available for operation from the control room:

| Commands | | Acknowledgement signals | |
|--|---------|-------------------------|---|
| Excitation | ON | Excitation | ON |
| Excitation | OFF | Excitation | OFF |
| AUTO | ON | AUTO | ON |
| MANUAL | ON | MANUAL | ON |
| COSPHI / var control | ON | COSPHI / var control | ON |
| COSPHI / var control | OFF | COSPHI / var control | OFF |
| Reference value of the active controller (AUTO, MANUAL, COSPHI etc.) | HIGHER | Reference value | MAX |
| Reference value of the active controller (AUTO, MANUAL, COSPHI etc.) | LOWER | Reference value | MIN |
| TRIP Potential-free contact of protection system for emergency shutdown | COMMAND | TRIP | MESSAGE No message in the event of certain faults (e.g. failure of the battery power supply) |
| RESET (option) | | ALARM | MESSAGE |

2.1.1.1 Excitation ON / OFF

The excitation of the machine is switched on with the command EXCITATION ON. In the case of generators, this causes the generator voltage to build up, the motors commence synchronous operation. The switch-on command remains ineffective as long as a TRIP command or a fault message is active. If the excitation switch is still open when the EXCITATION ON command is given, then a closing command is automatically issued. Only after the switch has been closed is the excitation enabled, and the field current begins to flow. A normal start-up sequence for generators is shown in [Fig. 5](#) (p. 24).

The command EXCITATION OFF switches off the excitation, i.e. the converter is switched to inverter mode, so that the machine is de-excited. After 60 seconds, the firing pulses are blocked and the converter is shut down completely. If the parameter RELEASE FCB OFF is set to YES (1), the command EXCITATION OFF also opens the field breaker.

2.1.1.2 Switching between AUTO / MANUAL operation

AUTOMATIC operation means voltage regulation. The excitation is automatically regulated so that a constant voltage is achieved at the machine terminals. In MANUAL mode, on the other hand, the excitation is kept constant. In the event of a changing machine load, the excitation must be adjusted manually so that the voltage remains constant.

As a basic rule, it is possible to switch between operating modes at any time, since the inactive regulator is always automatically adjusted to the active regulator. Special attention should be paid to the following points:

- If a fault is detected in AUTO mode (→ emergency switchover to MANUAL mode), it is not possible to switch back to AUTO mode until the fault has been eliminated.
- Switching over from AUTO to MANUAL mode is prevented if there is a fault in the latter.
- In the event of automatic switchover due to a fault, the system switches over to the operating mode which was active before the fault occurred. For this purpose, the follow-up control only reacts slowly to changes in the machine values. This behaviour must be taken into account whenever switching over deliberately. It is necessary to wait for the signal READY FOR CHANNEL SELECTION in order for the switchover to take place smoothly.
- The generator can switch over to AUTO mode within extreme operating ranges, but also within permitted operating ranges which lie outside of the permitted (and set) operating range of the MANUAL modes. In these cases, the MANUAL regulator can no longer follow the AUTO regulator. The acknowledgement signal READY FOR CHANNEL SELECTION allows the deviation between the adjustment values of the two regulators to be observed. A smooth switchover is only guaranteed if this acknowledgement signal is present.

Note:

The MANUAL mode is designed as a special operation regulator (back-up regulator) and basically functions as a field current regulator. In manual operation, it is necessary for the excitation of the generator to be supervised by a trained operating personnel.

As long as the machine current and machine voltage converter signals are present, also in MANUAL mode, an underexcitation limiter prevents a dangerous underexcitation of the machine which could, in extreme cases, lead to slipping. In addition, in no-load operation, a V/Hz limiter reduces the excitation and thus prevents oversaturation of the machine. The other operating variables such as machine current and reactive power must be supervised by the operating personnel.

2.1.1.3 COSPHI / var control ON / OFF

The reactive load (Q) or power regulator (COSPHI) can be switched on if AUTO mode is selected and the excited machine is connected to the network. Both operating modes are superimposed on the voltage regulator and only react slowly to changes in the operating condition. Short-term network faults do not influence the superimposed regulation and are compensated by the voltage regulator. All limitations of the AUTO mode also apply as previously.

When the superimposed regulator is switched on, the reference value setting is determined by the parameters (COSPHI) RELEASE FOLLOW C (1701) and RELEASE FOLLOW Q (1801). If the parameters are set (1), then the reference value always follows the actual value if the regulator is switched off. The transition from voltage regulator to superimposed regulator thus has no direct effect on the operating point. Only if the reference value is adjusted using the HIGHER/LOWER commands, the reactive power changes. If the follow-up is switched off (parameter values 0), then the reference value remains at the last set value when the regulator is switched off. Only when the excitation is switched on the reference value is set once to the so-called preset value, which in turn can be selected via a parameter.

2.1.1.4 HIGHER/LOWER (↑/↓) commands with acknowledgement signals MIN / MAX

There are common HIGHER / LOWER inputs for all operating modes such as AUTO, MANUAL and, if available, COSPHI- or Q-regulation. Only the reference value of the selected operating mode is adjusted with these inputs.

a) In AUTO mode

In AUTO mode, the reference value for the generator voltage is adjusted using the ↑/↓ commands. In no-load operation, the adjustment alters the generator voltage, in load operation the reactive power. If the operating limits of the rotor and generator have been reached, corresponding limiting regulators act to prevent the effect of the ↑/↓ commands in the direction of limitation.

If the reference value for the generator voltage reaches its minimum or maximum adjustment value, the active regulator MIN or MAX signal lamp lights up. If the ↑- and ↓ commands are given together, no adjustment of the reference value takes place. When the excitation is switched on, the reference value for the generator voltage is automatically set to its nominal value.

b) In MANUAL mode

In MANUAL mode, the reference value for the field current is adjusted using the ↑/↓ commands. In no-load operation, the adjustment alters the generator voltage, in load operation the reactive power. Since the same limiters available in AUTO mode are not available in MANUAL mode, it must be ensured when entering ↑/↓-commands that the operating limits for the rotor and generator (according to the power diagram) are not exceeded.

If the field current reference value reaches its minimum or maximum adjustment value, the active regulator MIN or MAX signal lamp lights up. If the \uparrow - and \downarrow commands are given together, no adjustment of the reference value takes place. When the excitation is switched on, and when the generator switch opens, the reference value for the field current is automatically set to the no-load excitation current value (I_{f0}).

c) COSPHI regulation or Q-regulation, if available

One of these two modes is possible, depending on the pre-selected parameters, or one of the two modes can be selected via a remote signal.

The slow reaction of the superimposed regulator (see 2.1.1.3) must be taken into account during reference value adjustment, and the reference value setting is normally passed to the control console as an analogue signal for monitoring purposes.

The MIN / MAX display indicates that the set reference value limits have been reached.

An alternative is the use of an analogue input (e.g. 4...20 mA) instead of the internal reference value generator. In this case, the remote signal determines the desired reference value directly. Reference value MAX / MIN is displayed if the external reference value has reached the limit of the internal reference value. A remote reference value outside of the range of the internal generator will be limited.

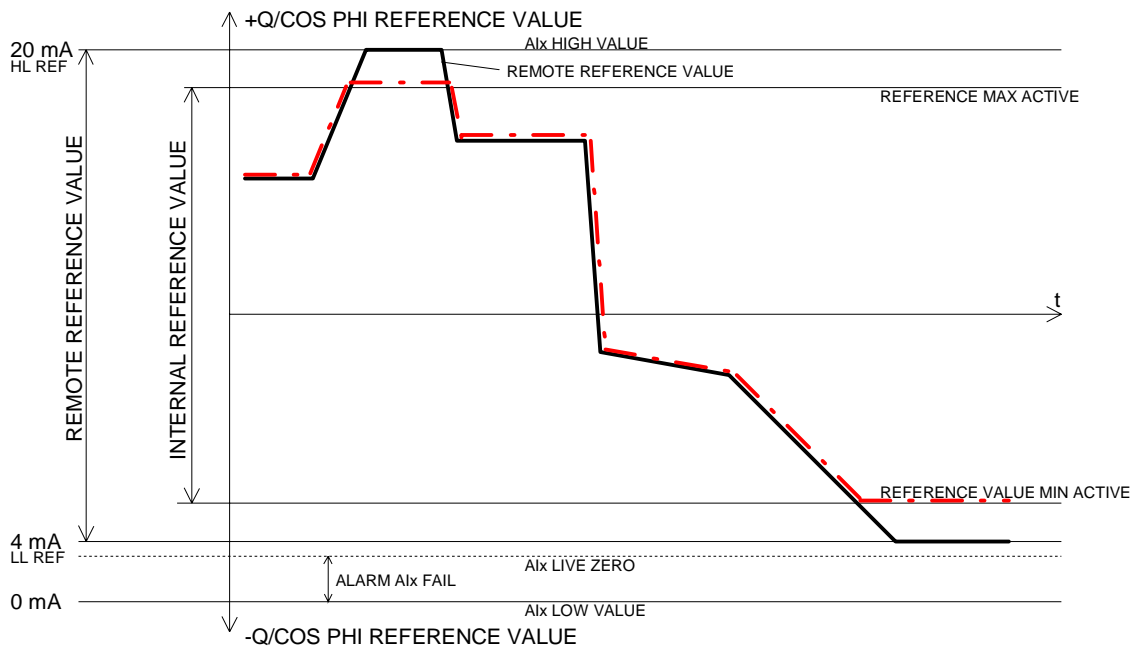


Fig. 2

2.1.1.5 TRIP command

In the event of a fault within the plant (e.g. machine protection), the excitation is automatically switched off and the field breaker opened.

2.1.1.6 RESET (option)

Normally, alarm messages should be acknowledged locally at the excitation cabinet, so that the operating personnel can also read the fault text on the control panel. However, a remote reset can also be installed in the control room if requested.

The remote reset acknowledges a fault which is present. If the alarm message fails to disappear after being acknowledged, it must be assumed that the cause of the fault has not been eliminated. The reset key should not be pressed several times in succession, because each time the key is pressed, this is entered in the fault logger of the UNITROL[®] F device. Pressing the key too often fills the error logger and deletes the actual fault entries.

2.1.2 Analogue displays

Normally, only the excitation current signal is passed from the excitation cabinet to the control room. The other displays necessary for the operation of the machine, such as machine voltage, machine current, active and reactive load, are to be provided by the operator.

2.1.3 Status and alarm messages

In addition to the acknowledgement signals described above, the following status and alarm messages are available:

| |
|------------------------------|
| FIELD BREAKER ON |
| FIELD BREAKER OFF |
| LOCAL |
| LIMITER ACTIVE, OVEREXCITED |
| LIMITER ACTIVE, UNDEREXCITED |
| ALARM MESSAGE |
| READY FOR CHANNEL SELECTION |

2.1.3.1 FIELD BREAKER ON / OFF

These messages indicate that the field breaker is switched ON or OFF.

2.1.3.2 LOCAL

This status message means: the system cannot be operated by REMOTE.

Remedy:

Switch over to REMOTE on the control panel of the excitation cabinet.

2.1.3.3 LIMITER ACTIVE - OVEREXCITED / UNDEREXCITED

Operation with the limiter continuously active is permissible, but generally impairs the dynamic behaviour of the excitation under changing loads.

Remedy:

If possible, deactivate limitation by adjusting the reference value.

2.1.3.4 ALARM MESSAGE

The alarm message is a collective message for all faults in the excitation system. Detailed fault displays are provided on the control panel of the cabinet itself. If a fault occurs during operation, these fault messages must be noted and the service personnel informed. Operation of the system can generally be continued while a fault is present, automatic shutdown takes place in the event of serious faults. However, after a shutdown has taken place, the system should not be started up again until the causes of all faults have been eliminated and the alarm message is cancelled.

2.1.3.5 READY FOR CHANNEL SELECTION

A smooth switchover between AUTO and MANUAL mode is only guaranteed if the message READY FOR CHANNEL SELECTION appears. See also 2.1.1.2

2.2 Local control

The Control Panel UNS 0874 is used for local control of the excitation. It has a membrane keypad with 16 keys and an LCD display with 4 lines of 20 characters and is fitted to one door of the excitation cabinet.

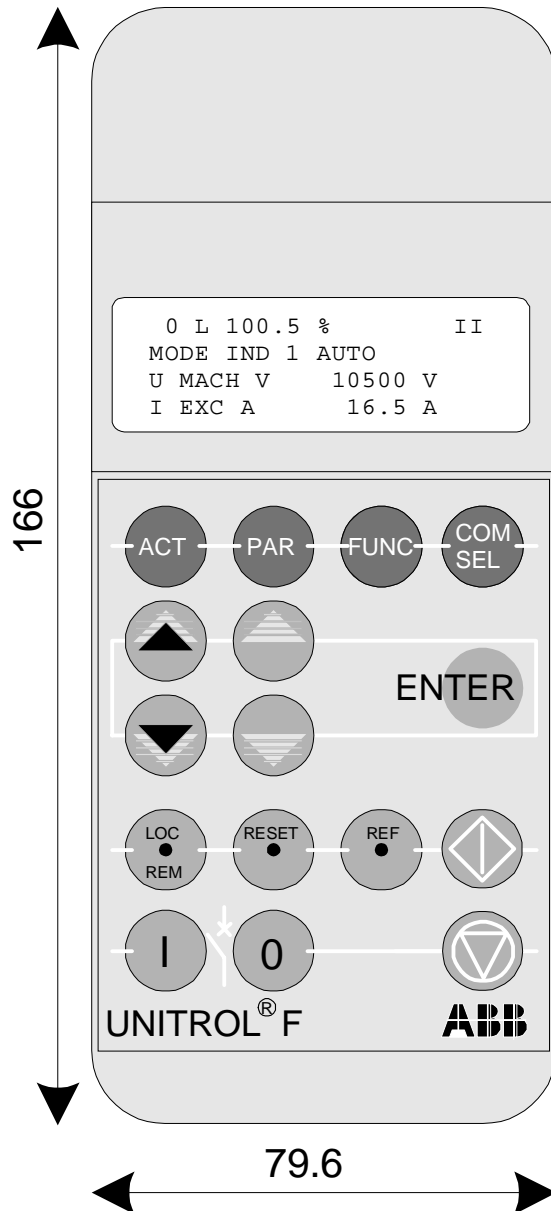


Fig. 3 Control Panel UNS 0874

The functions necessary for the local control of the excitation are described in this section. For a complete description of the panel, see also "Functional Description Control Panel UNS 0874", 3BHS102402 E82.

2.2.1 Display format

The LCD display shows the operating status of the excitation, fault messages and parameter values, depending on the operating mode it is used in. All information on the display is in English. To change the language see also "Functional Description Control Panel UNS 0874", 3BHS102402 E82. The meaning of the individual fields is shown in the following:

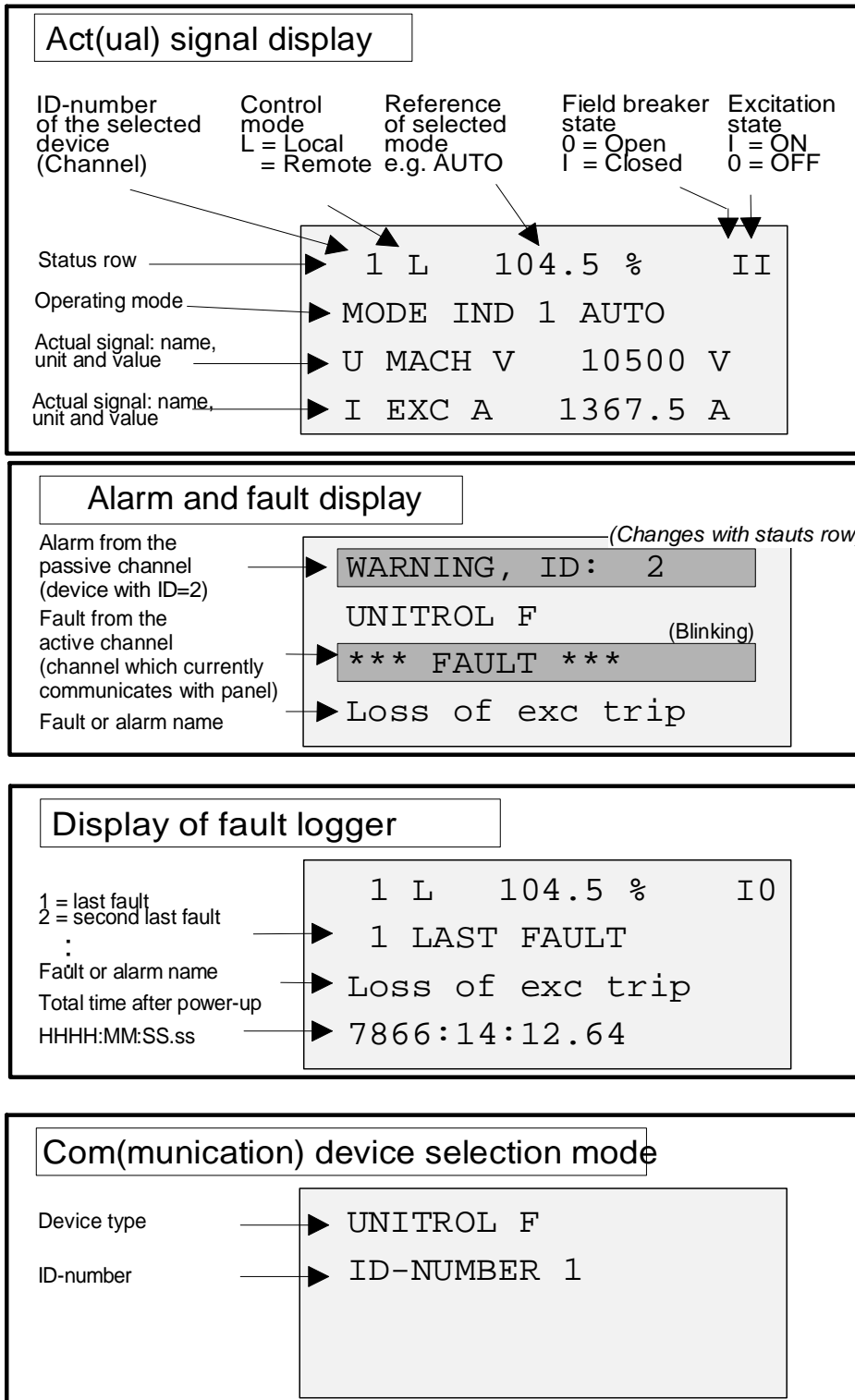
















Fig. 4 Display format

2.2.2 Function keys

The membrane keypad is used to switch between the different display modes and carry out the panel functions. The key functions are as follows:










| Key | Text reference | Function |
|---|--|--|
|  | ACT | Switches to "Actual Value Display" mode This also includes the alarm and fault display and the display of the fault logger |
|  | PAR | Switches to "Parameter" mode |
|  | FUNC | Switches to "Functions" mode |
|  | COM/SEL | Switches to "Device Selection" mode |
|  | [Double arrow up] [Double arrow down] | Different key function, depending on display mode: <ul style="list-style-type: none"> - Selection of a parameter- or signal group - Fast change of a parameter value - Changes between actual value display and display of the fault logger |
|  | [Arrow up] [Arrow down] | Different key function, depending on display mode: <ul style="list-style-type: none"> - Selection of a parameter or signal - Slow change of a parameter value - Shifts cursor by one line |
|  | ENTER | Confirms a selection or entry |
|  | LOC/REM | Switches from local operation to remote operation LOC: Local control using the control panel REM: Any other control mode |
|  | RESET | Alarm- & fault reset |
|  | REF | Local control of the excitation: Reference value adjustment |
|  | [START] | Excitation ON |
|  | [STOP] | Excitation OFF |
|  | [ON] | Field breaker ON |
|  | [OFF] | Field breaker OFF |

2.2.3 Description of the most important functions

The most important functions of the control panel are described step by step in the following. In the examples, the selected line (cursor position) is marked with a grey rectangle:

| | | |
|--------|---------|------|
| 1 L | 104.5 % | II |
| MODE | IND 1 | AUTO |
| U MACH | 102.4 % | |
| I EXC | 100.5 % | |

2.2.3.1 To display signals

| | Function | Key | Display which appears after key is pressed | | | | | | | | | | | | |
|--------|---|---|---|-----|---------|----|------|-----------|--------|--------|---------|----------|-------|---------|---|
| 1. | To activate actual value display mode |  | <table border="1"> <tr> <td>1 L</td> <td>104.5 %</td> <td>II</td> </tr> <tr> <td>MODE</td> <td>IND 1</td> <td>AUTO</td> </tr> <tr> <td>U MACH</td> <td>102.4 %</td> <td></td> </tr> <tr> <td>I EXC</td> <td>100.5 %</td> <td></td> </tr> </table> | 1 L | 104.5 % | II | MODE | IND 1 | AUTO | U MACH | 102.4 % | | I EXC | 100.5 % | |
| 1 L | 104.5 % | II | | | | | | | | | | | | | |
| MODE | IND 1 | AUTO | | | | | | | | | | | | | |
| U MACH | 102.4 % | | | | | | | | | | | | | | |
| I EXC | 100.5 % | | | | | | | | | | | | | | |
| 2. | To select line |   or | <table border="1"> <tr> <td>1 L</td> <td>104.5 %</td> <td>II</td> </tr> <tr> <td>MODE</td> <td>IND 1</td> <td>AUTO</td> </tr> <tr> <td>U MACH</td> <td>102.4 %</td> <td></td> </tr> <tr> <td>I EXC</td> <td>100.5 %</td> <td></td> </tr> </table> | 1 L | 104.5 % | II | MODE | IND 1 | AUTO | U MACH | 102.4 % | | I EXC | 100.5 % | |
| 1 L | 104.5 % | II | | | | | | | | | | | | | |
| MODE | IND 1 | AUTO | | | | | | | | | | | | | |
| U MACH | 102.4 % | | | | | | | | | | | | | | |
| I EXC | 100.5 % | | | | | | | | | | | | | | |
| 3. | To confirm line selection The signal group, signal name and signal value are displayed |  | <table border="1"> <tr> <td>1 L</td> <td>104.5 %</td> <td>II</td> </tr> <tr> <td>101</td> <td>ANALOG</td> <td>INPUTS</td> </tr> <tr> <td>01</td> <td>U MACH</td> <td>RELATIVE</td> </tr> <tr> <td></td> <td>102.4 %</td> <td></td> </tr> </table> | 1 L | 104.5 % | II | 101 | ANALOG | INPUTS | 01 | U MACH | RELATIVE | | 102.4 % | |
| 1 L | 104.5 % | II | | | | | | | | | | | | | |
| 101 | ANALOG | INPUTS | | | | | | | | | | | | | |
| 01 | U MACH | RELATIVE | | | | | | | | | | | | | |
| | 102.4 % | | | | | | | | | | | | | | |
| 4. | To select different signal group |   or | <table border="1"> <tr> <td>1 L</td> <td>104.5 %</td> <td>II</td> </tr> <tr> <td>105</td> <td>CONVERTER</td> <td></td> </tr> <tr> <td>02</td> <td>I EXC</td> <td>A</td> </tr> <tr> <td></td> <td>1350</td> <td>A</td> </tr> </table> | 1 L | 104.5 % | II | 105 | CONVERTER | | 02 | I EXC | A | | 1350 | A |
| 1 L | 104.5 % | II | | | | | | | | | | | | | |
| 105 | CONVERTER | | | | | | | | | | | | | | |
| 02 | I EXC | A | | | | | | | | | | | | | |
| | 1350 | A | | | | | | | | | | | | | |
| 5. | To select another signal within the group |   or | <table border="1"> <tr> <td>1 L</td> <td>104.5 %</td> <td>II</td> </tr> <tr> <td>105</td> <td>CONVERTER</td> <td></td> </tr> <tr> <td>06</td> <td>U EXC</td> <td>V</td> </tr> <tr> <td></td> <td>453</td> <td>V</td> </tr> </table> | 1 L | 104.5 % | II | 105 | CONVERTER | | 06 | U EXC | V | | 453 | V |
| 1 L | 104.5 % | II | | | | | | | | | | | | | |
| 105 | CONVERTER | | | | | | | | | | | | | | |
| 06 | U EXC | V | | | | | | | | | | | | | |
| | 453 | V | | | | | | | | | | | | | |
| 6. | To confirm selection and return to the actual value display |  | <table border="1"> <tr> <td>1 L</td> <td>104.5 %</td> <td>II</td> </tr> <tr> <td>MODE</td> <td>IND 1</td> <td>AUTO</td> </tr> <tr> <td>I EXC</td> <td>V</td> <td>453 V</td> </tr> <tr> <td>I EXC</td> <td>100.5 %</td> <td></td> </tr> </table> | 1 L | 104.5 % | II | MODE | IND 1 | AUTO | I EXC | V | 453 V | I EXC | 100.5 % | |
| 1 L | 104.5 % | II | | | | | | | | | | | | | |
| MODE | IND 1 | AUTO | | | | | | | | | | | | | |
| I EXC | V | 453 V | | | | | | | | | | | | | |
| I EXC | 100.5 % | | | | | | | | | | | | | | |

The most common measured values which can be displayed on the 3rd and 4th lines are listed below:








| Signal name | Signal | | Description | Unit |
|---------------------|--------|--------|---|------|
| | group | number | | |
| I EXC A | 105 | 02 | Excitation current | A |
| U SYN V | 105 | 04 | Converter input voltage | V |
| U EXC V | 105 | 06 | Excitation voltage | V |
| U MACH V | 101 | 02 | Machine voltage | V |
| I MACH A | 101 | 04 | Machine current | A |
| P MACH KW | 101 | 07 | Machine active power ¹⁾ | kW |
| P MACH MW | 101 | 08 | Machine active power ¹⁾ | MW |
| Q MACH KVAR | 101 | 11 | Machine reactive power ¹⁾ | kvar |
| Q MACH MVAR | 101 | 12 | Machine reactive power ¹⁾ | Mvar |
| S MACH KVA | 101 | 13 | Machine apparent power ¹⁾ | kVA |
| S MACH MVA | 101 | 14 | Machine apparent power ¹⁾ | MVA |
| f MACH HERTZ | 101 | 23 | Machine frequency | Hz |
| I COSPHI REL | 101 | 05 | Machine COSPHI +/- = + var output - var consumption | - |

¹⁾ Select MW / Mvar / MVA if kW / kvar / kVA overruns, or vice versa, if the display is not accurate enough.

2.2.3.2 To display fault logger

With the fault logger, the UNITROL® F devices possess a very convenient aid to fault location. However, this requires that the operating personnel check the fault logger each time before a fault is acknowledged and pass on the information to the service personnel.




In double channel systems, the fault message can also originate from the channel with which the panel is not currently communicating. In this case, the connection with the other channel must first be established using the function "Device Selection" (see section 2.2.3.4, p. 19) before the fault logger is read.

| | Function | Key | Display which appears when key is pressed |
|----|---|--|--|
| 1. | To activate actual value display |  | <pre> 1 L 0.0 % 00 MODE IND 1 AUTO U EXC V 0 V I EXC 0.0 % </pre> |
| 2. | To display fault logger |  or  | <pre> 1 L 0.0 % 00 1 LAST FAULT Loss of exc trip xxxx:xx:xx.xx </pre> |
| 3. | To scroll through fault list: up arrow: view older fault message down arrow: view more recent fault message |  or  | <pre> 1 L 0.0 % 00 2 LAST FAULT Loss conv. supply xxxx:xx:xx.xx </pre> |
| 4. | To return to actual value display |  or  | <pre> 1 L 0.0 % 00 MODE IND 1 AUTO U EXC V 0 V I EXC 0.0 % </pre> |

Please refer to the section "Maintenance and fault location" in the Operating Instructions for interpretation of fault messages.

2.2.3.3 Fault resetting

Procedure for single channel systems (SFE) and for dual channel systems (AFT) in case the fault has occurred in the channel, which the operating panel is actually communicating with.







| | Function | Key | Display which appears when key is pressed |
|----|-------------------------------------|--|--|
| | Display after a fault has occurred: | | <pre> 1 0.0 % 00 UNITROL F *** FAULT *** Loss of exc trip </pre> |
| 1. | To switch to LOCAL mode |  | <pre> 1 L 0.0 % 00 UNITROL F *** FAULT *** Loss of exc trip </pre> |
| 2. | To reset fault |  | <pre> 1 L 0.0 % 00 MODE IND 1 AUTO U EXC V 0 V I EXC 0.0 % </pre> |
| 3. | To switch back to remote operation |  | <pre> 1 0.0 % 00 MODE IND 1 AUTO U EXC V 0 V I EXC 0.0 % </pre> |

Procedure for dual channel systems in case the fault has occurred in the channel, which the operating panel is not currently communicating with.














| | Function | Key | Display which appears when key is pressed |
|--|--|-----|--|
| | Display after a fault has occurred: (first line is alternating with the status line at an interval of 1 second) | | <pre> FAULT, ID: 2 MODE IND 1 AUTO U EXC V 0 V I EXC 0.0 % </pre> |
| | Set up communication with the other channel (see chapter 2.2.3.4) | | <pre> 2 0.0 % 00 UNITROL F *** FAULT *** Loss of exc trip </pre> |
| | Reset fault as described above. | | <pre> 2 0.0 % 00 MODE IND 1 AUTO U EXC V 0 V I EXC 0.0 % </pre> |
| | If necessary set up communication with the original channel. | | <pre> 1 0.0 % 00 MODE IND 1 AUTO U EXC V 0 V I EXC 0.0 % </pre> |

2.2.3.4 Device Selection

This function is only relevant in double channel systems.













| | Function | Key | Display which appears when key is pressed |
|----|---|--|---|
| 1. | To activate device selection mode |  | UNITROL F ID-NUMBER 1 |
| 2. | To select preceding or following station on the serial link |   | UNITROL - F ID-NUMBER 2 |
| 3. | To establish connection with the selected device and at the same time select one of the three display modes (press one of the three keys) |    | 2 L 0.0 % 00 MODE IND 1 AUTO U EXC V 0 V I EXC A 0.0 A |

2.2.3.5 Selecting the operating mode (AUTO-MANUAL etc.)

| | Function | Key | Display which appears when key is pressed |
|-----|---|--|--|
| 1. | To activate parameter mode |  | 1 L 0.0 % 00 3 CONTROL LOGIC 01 RELEASE FCB OFF NO |
| 2. | To select signal group 103 "CONTROL LOGIC" |   or | 1 L 0.0 % 00 103 CONTROL LOGIC 01 MODE INDICATION |
| 3. | To select signal 02 "MODE SELECTION" |   or | 1 L 0.0 % 00 103 CONTROL LOGIC 02 MODE SELECTION AUTO ON |
| 4. | To confirm selection (the parameter value appears in square brackets) |  | 1 L 0.0 % 00 103 CONTROL LOGIC 02 MODE SELECTION [AUTO ON] |
| 5. | To change operating mode, e.g. select power factor regulator |   or | 1 L 0.0 % 00 103 CONTROL LOGIC 02 MODE SELECTION [COSPHI SEL] |
| 6a. | Confirm new setting |  | 1 L 0.0 % 00 103 CONTROL LOGIC 02 MODE SELECTION COSPHI SEL |
| 6b. | cancel the new setting by switching to another display mode |     | 1 L 0.0 % 00 103 CONTROL LOGIC 02 MODE SELECTION AUTO ON |

2.2.3.6 Reference value setting













The setting always affects the currently selected regulator (AUTO, MANUAL, COSPHI, Q-CTRL).

| | Function | Key | Display which appears when key is pressed |
|----|--|--|---|
| 1. | Select actual value display The signal 10301 MODE INDICATION (operating mode) normally appears in the second line |  | <pre>1 104.5 % II MODE IND 1 AUTO U MACH V 13500 V I EXC A 1350.5 A</pre> |
| 2. | Select LOCAL mode |  | <pre>1 L 104.5 % II MODE IND 1 AUTO U MACH V 13500 V I EXC A 1350.5 A</pre> |
| 3. | Activate reference value setting The reference value in the status line appears in square brackets |  | <pre>1 L [104.5] % II MODE IND 1 AUTO U MACH V 13500 V I EXC A 1350.5 A</pre> |
| 4. | Change reference value Use arrow keys for small steps, double arrow keys for large steps Caution: the alteration of the reference value becomes effective immediately! |     | <pre>1 L [105.7] % II MODE IND 1 AUTO U MACH V 13635 V I EXC A 1375.9 A</pre> |
| 5. | Exit from reference setting mode by switching to another display mode |     | <pre>1 L 105.7 % II MODE IND 1 AUTO MACH V 13635 V I EXC A 1375.9 A</pre> |
| 6. | To switch to remote operation |  | <pre>1 105.7 % II MODE IND 1 AUTO U MACH V 13635 V I EXC A 1375.9 A</pre> |

The adjustment range of the panel reference value is always -100% to +150%. However, in the UNITROL® F device, this value is limited to the set reference value range, e.g. 90 % to 110 % for the voltage regulator (AUTO).

2.2.3.7 Field breaker- and excitation control

In local operation, separate keys are available for the field breaker control in addition to the commands EXCITATION ON / OFF. After switching over to local operation (LOC / REM key), these four commands are enabled in all operating modes of the control panel and are executed immediately when the key is pressed. Excepted are locking functions in the control system which, for example, prevent excitation being switched off when the machine is connected to the network.

| Control panel key | Name of key | Function |
|---|---|---|
|  |  START  | EXCITATION ON (only effective with closed field breaker) |
|  |  STOP  | EXCITATION OFF ¹⁾ (does not automatically open the field breaker) |
|  |  ON  | FIELD BREAKER ON |
|  |  OFF  | FIELD BREAKER OFF ¹⁾ (switches the excitation off at the same time) |

¹⁾ only possible when the machine is isolated from the network

3 Operation of the installation

Prerequisites for safe operation:

The following conditions must be fulfilled for safe operation:

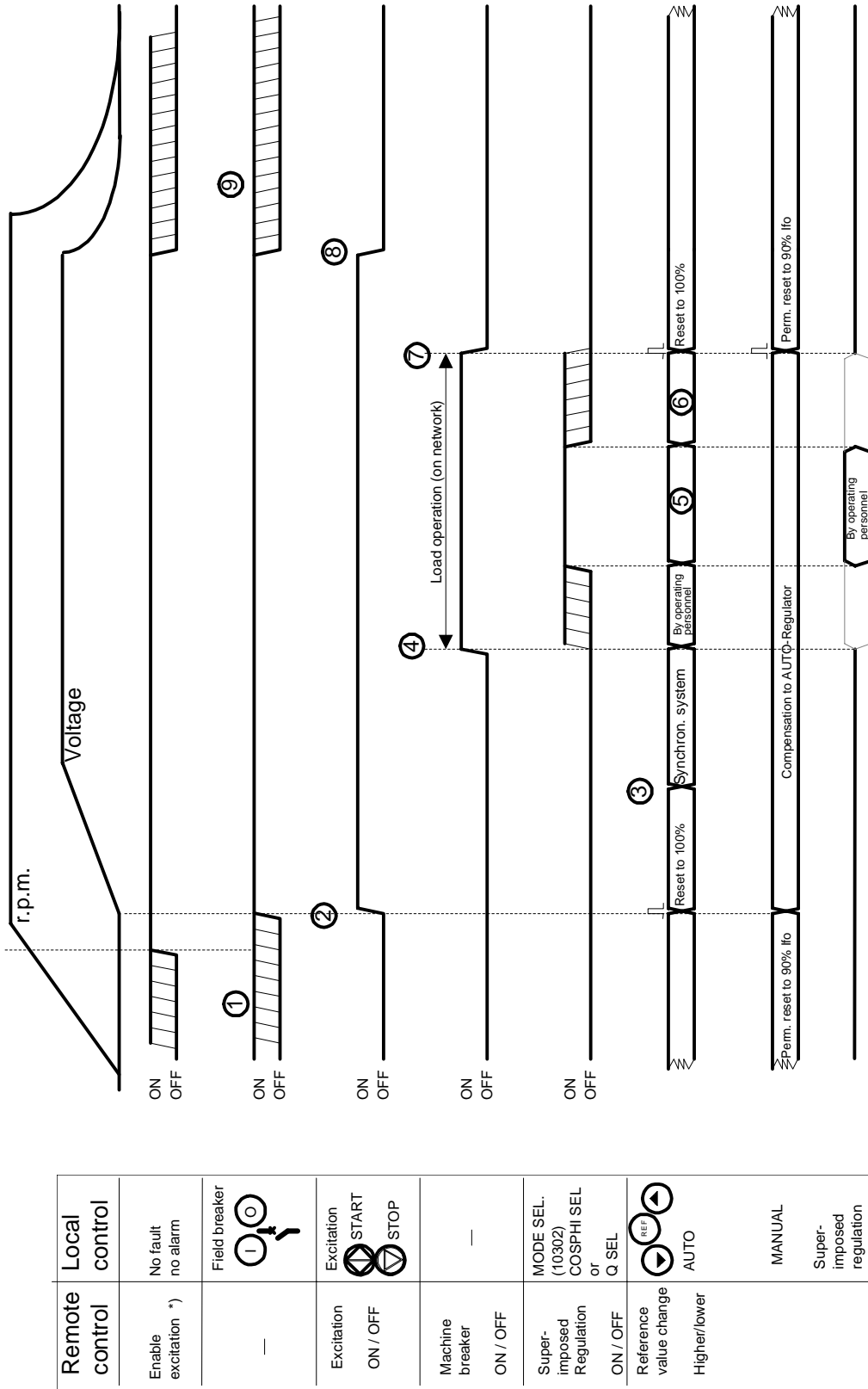
- Commissioning must have been successfully completed
- Periodic maintenance must have been carried out in accordance with the maintenance plan
- Any faults which have occurred must have been properly eliminated
- Any settings (parameters) which have been adjusted must have been checked and tested.

3.1 Checks to be carried out before switching on

Before switching on, it must be ensured that all necessary supply voltages are present and safe start-up is possible. The following checks are to be carried out:

- No maintenance work on the installation in progress
- Control cabinets are ready for operation and properly closed
- Generator output is free, input and output lines to and from the excitation transformer and excitation cabinet are free (short-circuits have been eliminated)
- Battery power supply for the field breaker control and regulator supply is available
- No alarm or fault messages are present
- Excitation is switched to REMOTE
- Excitation is switched to AUTO mode
- Generator at nominal rpm rate (rpm indicator on display instrument)

On / off cycle for generator application
(Standard application without additional application program, no fault or alarm present)



*) Remote operation: Enable via external locking functions

Fig. 5 Switching-on/off cycle

3.2 Sequence for switching on

| No. | Action | Acknowledgement signal | Check |
|-------------------------------------|--|------------------------|--|
| MACHINE AT NOMINAL RPM RATE | | | |
| 1 | Field breaker ON (only with local control) | Field breaker ON | |
| 2 | Excitation ON | Excitation ON | Machine voltage built up within 5 - 20 s |
| MACHINE IN NO-LOAD OPERATION | | | |
| 3 | Prepare synchronisation: Adjust machine voltage with ↑/↓ commands | | Compare generator voltage with network voltage |
| 4 | Synchronisation: Close generator switch through automatic or manual synchronisation | | No noticeable reactive power output or consumption |
| MACHINE CONNECTED TO NETWORK | | | |
| 5 | Adjust reactive power within permissible operating limits using ↑/↓ commands | | Reactive power within operating limits |

3.3 Checks to be carried out during operation

The following checks are to be carried out periodically during operation:

a) In the control room:

- No limiter active
- Reference values of the active regulator not in limit position
- Channels balanced, ready for switchover
- Excitation current, generator voltage and reactive power are stable.

The correct function of the field current regulator for MANUAL mode is continually checked by means of extensive monitoring devices. Nonetheless, it is recommended that this regulator be activated periodically, e.g. after starting up, in order to test its correct function.

b) At the excitation cabinets:

- No alarms present
- No unusual noises.

3.4 Shutdown sequence

| No. | Action | Acknowledgement signal | Check |
|-------------------------------------|--|------------------------|---|
| MACHINE CONNECTED TO NETWORK | | | |
| 6 | Running down the Machine: Run down active power (turbine regulator) Run down reactive power using ↑/↓ commands | | Reactive and active power run down |
| 7 | Open machine switch | | Machine switch open |
| MACHINE IN NO-LOAD OPERATION | | | |
| 8 | Excitation OFF ¹⁾ | Excitation OFF | Field current and machine voltage are run down within a few seconds |
| 9 | Field breaker OFF (if necessary) | Field breaker OFF | |
| MACHINE SWITCHED OFF | | | |

¹⁾ With remote operation, depending on the parameter RELEASE FCB OFF, the field breaker is also opened by the Excitation OFF command (see 2.1.1.1, p. 6).

Excitation System

UNITROL[®] F - Series

Hardware Description

| | | | | | | | | | | | |
|------------|-----------------|---------------|------------------|--------------|--------------------|-----------------------|------------|-----------|-----------|----------|--------------|
| Rev. | A | 03-10-09 / Mo | Rev. | D | 06-12-13 / Mo | Issued:98-05-11 GM/MB | Document | Format | Langue | Page | No. of pages |
| Rev. | B | 04-03-26 / Mo | Rev. | | | Check 1: 98-05-14 | ZAB | A4 | en | 1 | 74 |
| Rev. | C | 06-11-24 / Mo | Rev. | | | Check 2: | | | | | |
| ABB | Dept. 1 ATPE | Dept. 2 | Der.from/Repla.: | Replaced by: | Released: 98-05-14 | 3BHS102402 E83 | | | | | |

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1 Overview

1.1 System components

| Type | Ident-No. | Purpose | Characteristics |
|--|---------------------|-------------------------------------|---------------------------------------|
| General boards | | | |
| SDCS-CON-2 | 3ADT220072R4 | Control Board (i), rev. H and newer | UNF SW 41.222 and newer |
| SDCS-CON-2 | 3BHE004059R4 | Control Board (i), rev. G | UNF SW 41.220 and .221 |
| SDCS-POW-1 | 3ADT220090R3 | Power Supply board (i) coat | Replaced through POW-4 |
| SDCS-POW-4 | 3ADT315100 R1001 | Power Supply board (i) coat | 115 VAC/ 230 VAC, DO8 |
| UNS 0868a V1 | HIEE305120R1 | Power Supply Unit (e) | 24 to 48 VDC |
| UNS 0868a V2 | HIEE305120R2 | Power Supply Unit (e) | 110 to 250 VDC |
| UNS 0868b V1 | 3BHE013940R1 | Power Supply Unit (e) | 24 to 48 VDC |
| UNS 0868b V2 | 3BHE013940R2 | Power Supply Unit (e) | 110 to 250 VDC |
| UNS 0862 | HIEE405179R1 | AC Actual Value Measurement | 3 x 100 to 120 VAC, 1 x 1 or 5 ADC |
| UNS 0863 | HIEE305082R1 | I/O Interface | 16 DI 24 VDC, 18 Relay-DO /4AO/2AI |
| UNS 1860b V1 | 3BHB001336R1 | Signal Processing Device (i) | fE =33 to 300 Hz |
| UNS 1860b V2 | 3BHB001336R2 | Signal Processing Device (i) | fE =17 to 38 Hz |
| Power Interface boards | | | |
| SDCS-PIN-1x Set | | | |
| SDCS-PIN-11 | 3ADT306100R1 | Power Interface Board (i) | 220 to 500 VAC, 25 to 75 ADC |
| SDCS-PIN-12 | 3BSE005716R1 | Power Interface Board (i) | 600 VAC, 50 ADC |
| SDCS-PIN-20xB Set | | | |
| SDCS-PIN-205B | 3ADT312500R1 | Power Interface Board (i) | 220 to 500 VAC, 100 to 1000 ADC |
| SDCS-PIN-206B | 3ADT312500R2 | Power Interface Board (i) | 500 to 600 VAC, 110 to 450 ADC |
| SDCS-PIN-41 | 3BSE004939R1 | Pulse Transformer Board (e) | Replaced through PIN-48 |
| SDCS-PIN-48 | 3BSE004939R2 | Pulse Transformer Board (e) | 220 to 1000 VAC, 900 to 5150 ADC |
| SDCS-PIN-51 | 3BSE004940R1 | Measuring Board (e) | 220 to 1000 VAC, 900 to 5150 ADC |
| SDCS-PIN-52 | 3BSE011316R1 | Measuring Board (e) | 220 to 500 VAC, 900 to 5150 ADC |
| Communication boards | | | |
| SDCS-COM-5 | 3BSE006567R1 | TC Link Communication Board(i) | (connected to X11) |
| UNS 0874 | 3BHB002651R1 | Control Panel | Modbus |
| NMBA-01 V1.7 | 3ADT220066R5 | Fieldbus Interface Modbus | |
| NPBA-12 V1.4 | 3ADT220112R5 | Fieldbus Interface Profibus | |
| NMBP-01 V1.6 | 3ADT220074R4 | FB interface Modbus Plus | |
| Optional boards | | | |
| UNS 0864b V1 | HIEE405227R1 | Diode Failure Monitoring (e) | fE =33 to 300 Hz |
| UNS 0864b V2 | HIEE405227R2 | Diode Failure Monitoring (e) | fE =17 to 38 Hz |
| UNS 0867a V1 | HIEE405246R1 | Extended I/O | 16 DI, 19 DO |
| UNS 0867a V2 | HIEE405246R2 | Extended I/O | 16 DI, 19 DO, 2 AI, 2 AO |
| UNS 0869a V2 | 3BHB001337R2 | PSS Signal Transformer (e) | IEEE-PSS Type 2A |
| (i) internal and (e) external board for the converter module | | | |

Tab. 1 Circuit board summary table

1.2 System identification on the name plate of the converter module

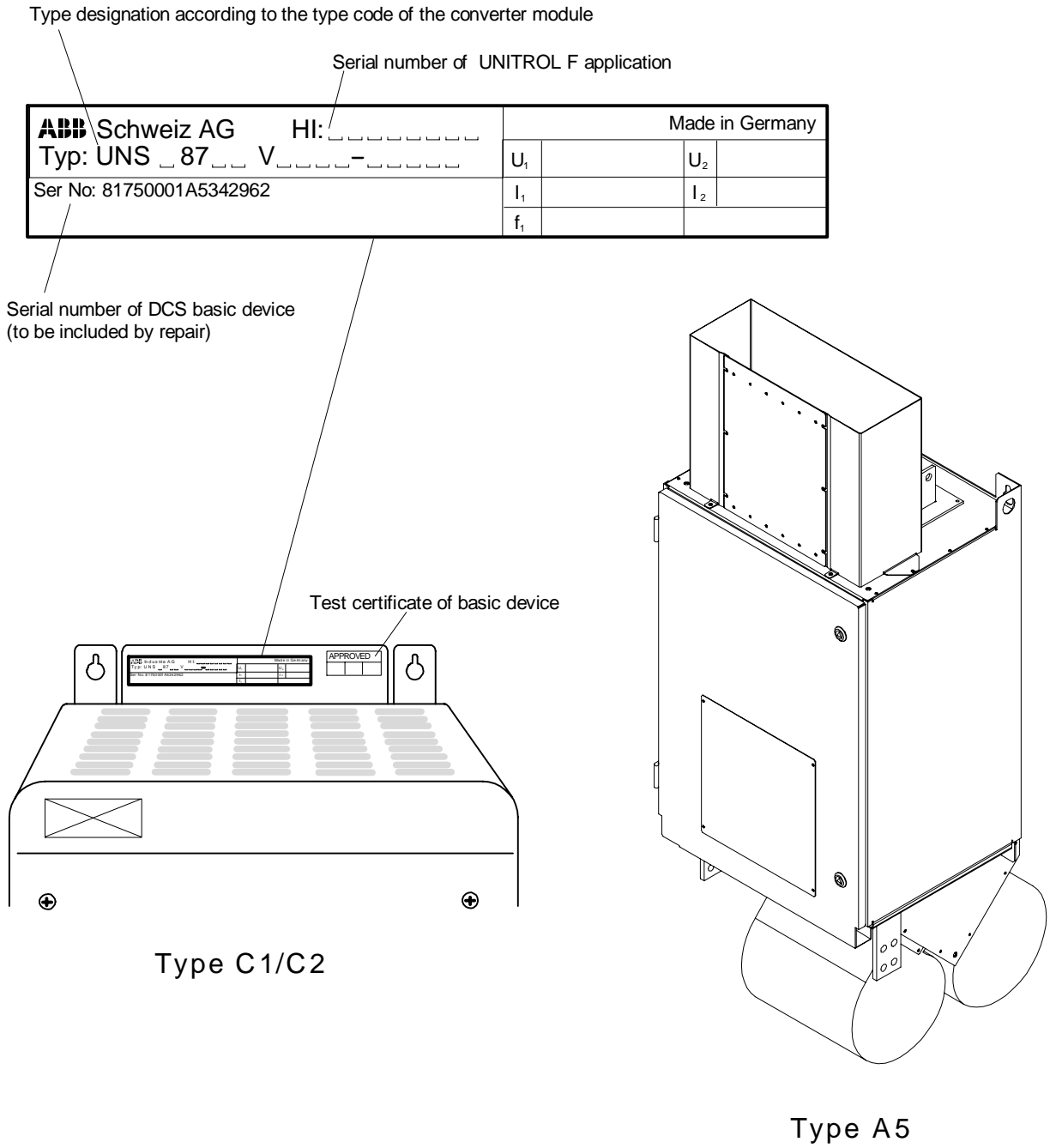
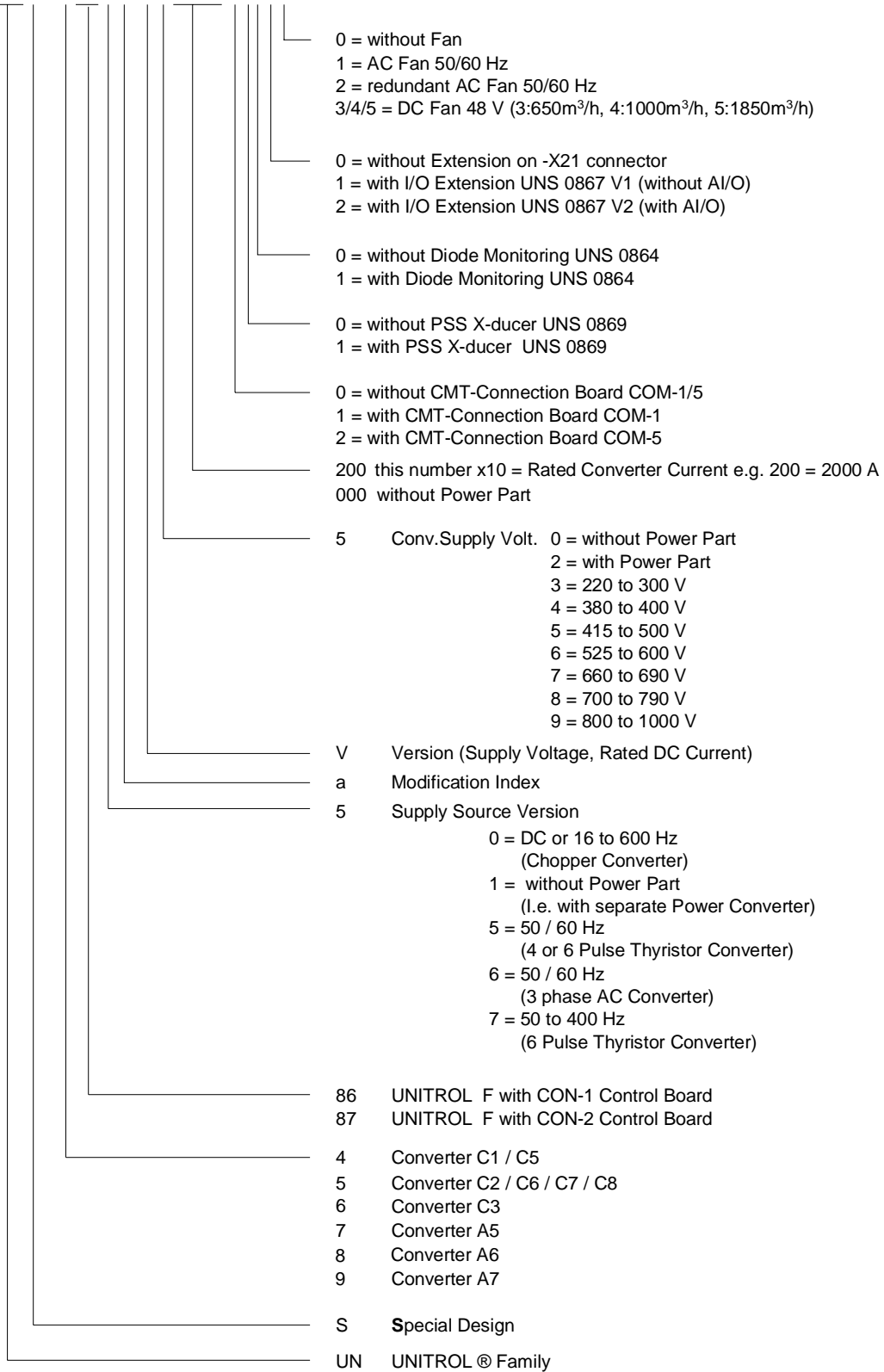


Fig. 1 Name plate on C1/C2 and A5

1.3 Type code of the converter module

UNS 4875 a V5200-10001



1.4 Interconnections in the excitation system

Fig. 2 shows all the interconnections in a 2-channel system, including all possible options.

A distinction is made between single wire- and flat cable connections. The number in the middle of the cable corresponds to the number of wires per cable.

In a 1-channel system, the connections to the second channel are not used.

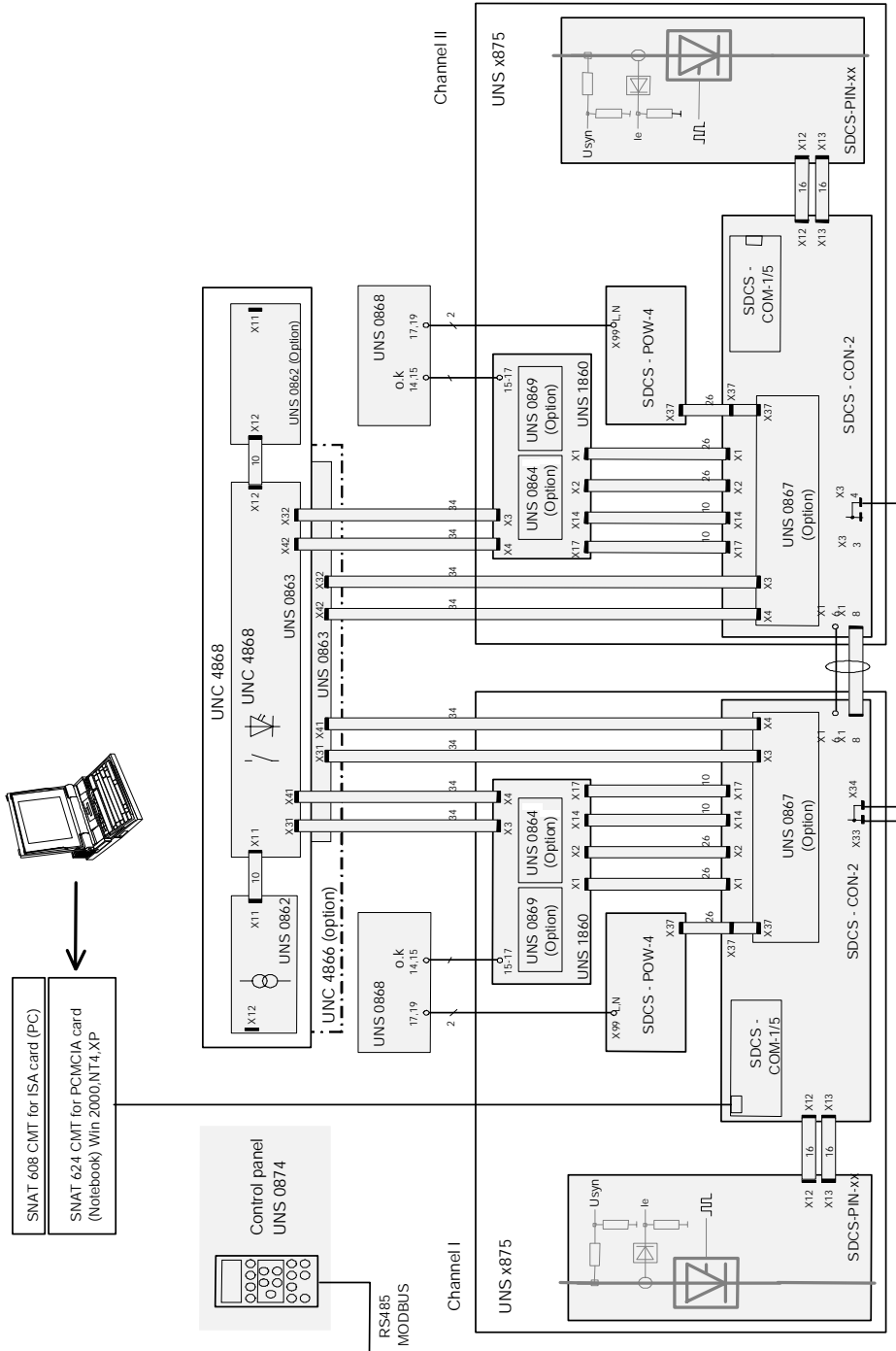


Fig. 2 SDCS-CON-2 External connections

2 Control board SDCS-CON-2

The control board is based on a microprocessor of type 80C186 (AM 186 EM with 32 MHz clock) and the ASIC circuit DC94L01.

The system program is downloaded into the ROM D33. Application parameters are stored in the Flash PROM D35. During normal operation, application parameters are held in a static RAM circuit which has a back-up capacitor of 1 F. This backs up the content of the RAM for a minimum of 8 hours, typically several days.

It takes about 30 minutes to charge the backup capacitor.

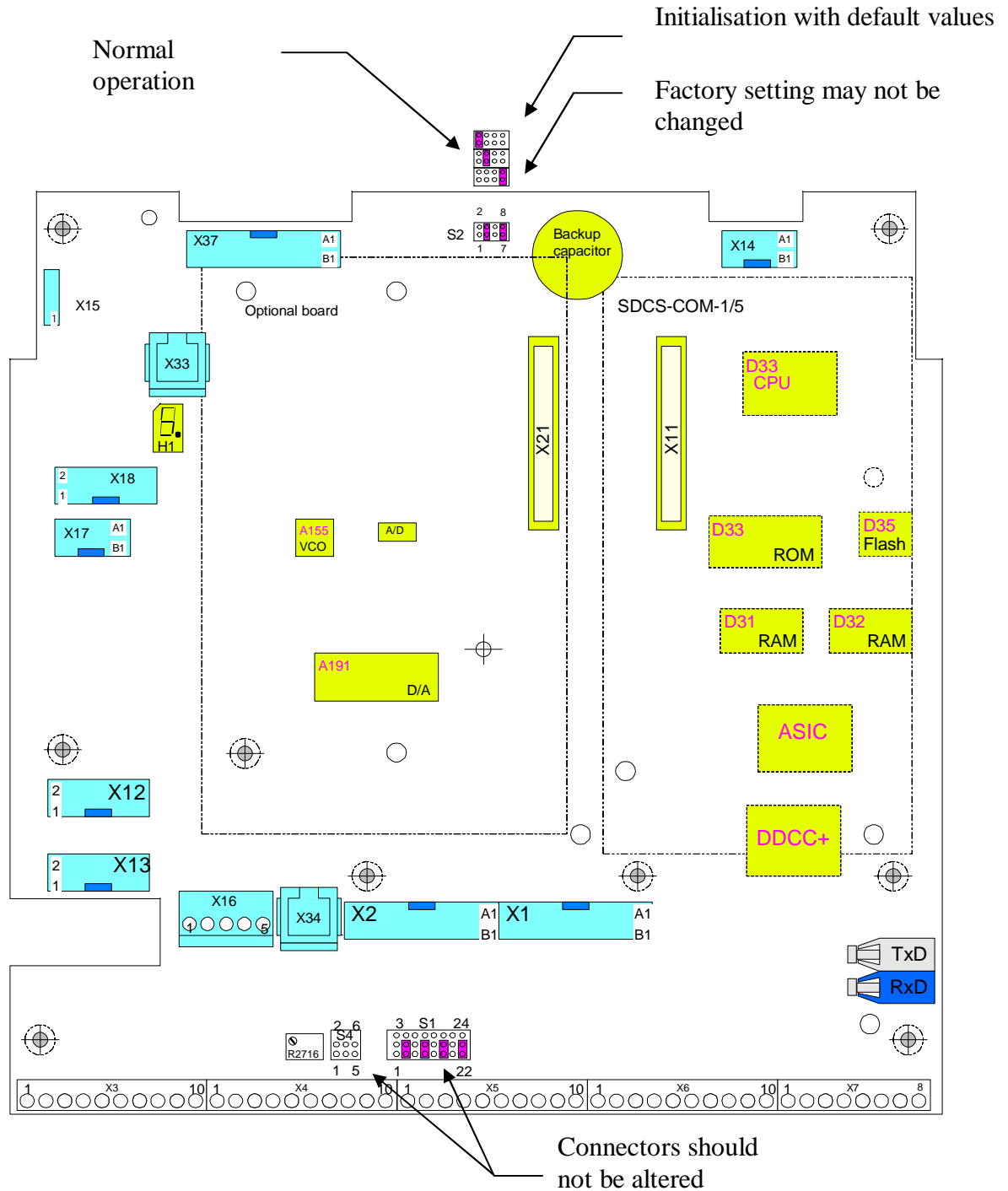


Fig. 3 Layout of the SDCS-CON-2 board

ASIC functions

ASIC = Application Specific Integrated Circuit

Most of the measurements and control functions for the UNITROL[®] F system are carried out in the ASIC:

- communication with the control panel UNS 0874
- communication with the second channel in a double channel system
- measurement
- watchdog function
- A/D and D/A conversion control
- thyristor firing pulse generation

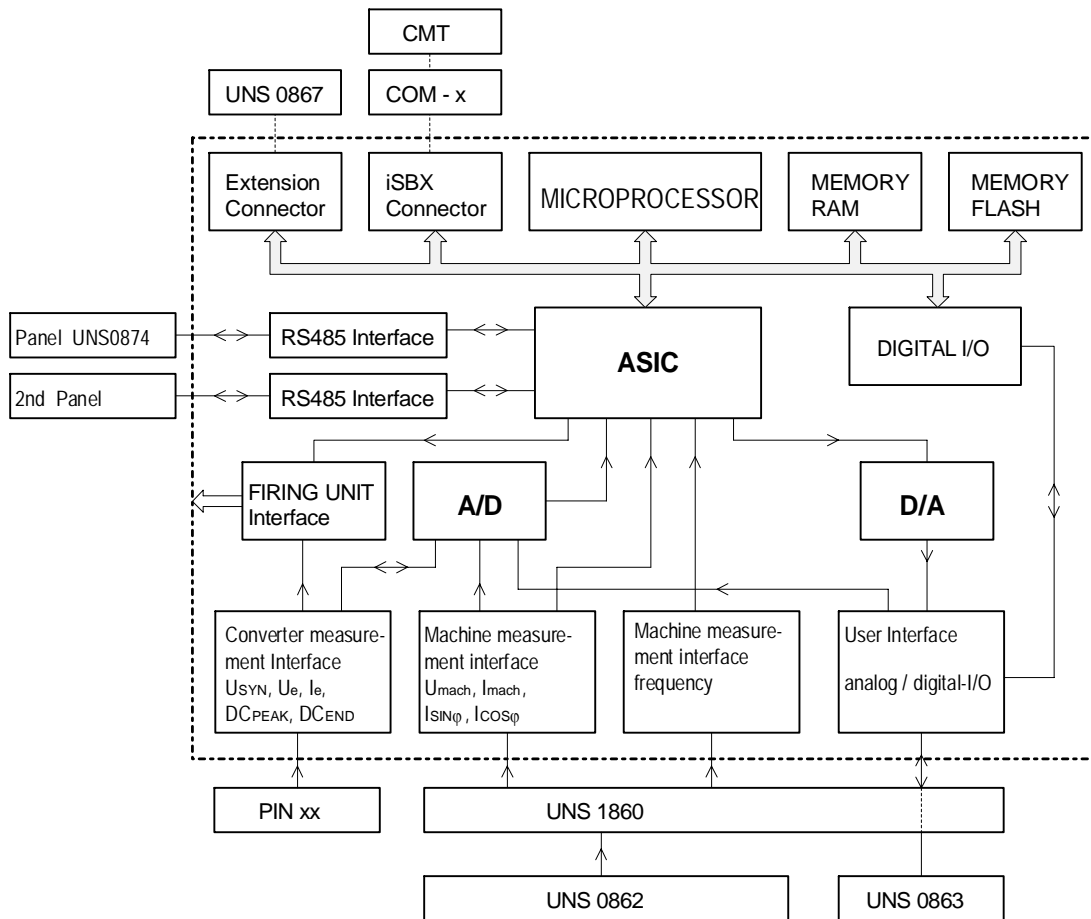


Fig. 4 Block diagram of the SDCS-CON-2 board

Seven segment display

The control board features a seven segment display H1 (see Fig. 5) which indicates the current operating status of the system.

Alarms and faults are indicated in coded form, with a flashing display, in a periodic sequence with a cycle of 0.7 seconds. The coding takes the form of an identification letter followed by a two- or three-digit number.

| | |
|---------------------|---|
| 0.7s 0.7s 0.7s 0.7s | |
| E | Initialisation error (see “Maintenance and fault tracing“) |
| B | Program is not running |
| L | Downloading the program |
| . | Normal operation, no faults, no alarm |
| A | Alarm, number of the alarm in fault logger |
| F | Fault, number of the fault in fault logger (faults have priority in the display) |

Fig. 5 Seven segment display of the SDCS-CON-2 board

Supply voltage monitoring

The control board monitors the following voltage levels:

| | | | | | |
|------------------------------------|---------|---------|---------|---------|---------|
| Supply Voltage | +5 V | +15 V | -15 V | +24 V | +48 V |
| Undervoltage Tripping Level | +4.55 V | +12.4 V | -12.0 V | +19.0 V | +38.0 V |

If the +5 V supply drops below the monitoring level, the system is reset by the hardware. All I/O registers are set to 0 and the firing pulses for the thyristors are suppressed.

Watchdog function

The control board features a monitoring function, the so-called watchdog. The watchdog monitors the cyclical running of the program by the CPU. If the watchdog detects a malfunction, the following actions are initiated:

- FEPROM programming voltage is reduced
- the firing pulses for the thyristors are blocked
- all digital outputs are set to “0“, which drops the relay for the signal “channel OK“, which causes channel transfer in a dual channel system or trips the field breaker in a single channel system.
- all programmable analog outputs are reset to 0 V.

RS 485 communication interface

The control board features 2 RS 485 interfaces. The first communication channel is used for exchanging data with the second channel in dual channel operation (terminals X16:1 to 3), while the second interface is used for communication with the control panel UNS 0874 (terminals X33 and X34).

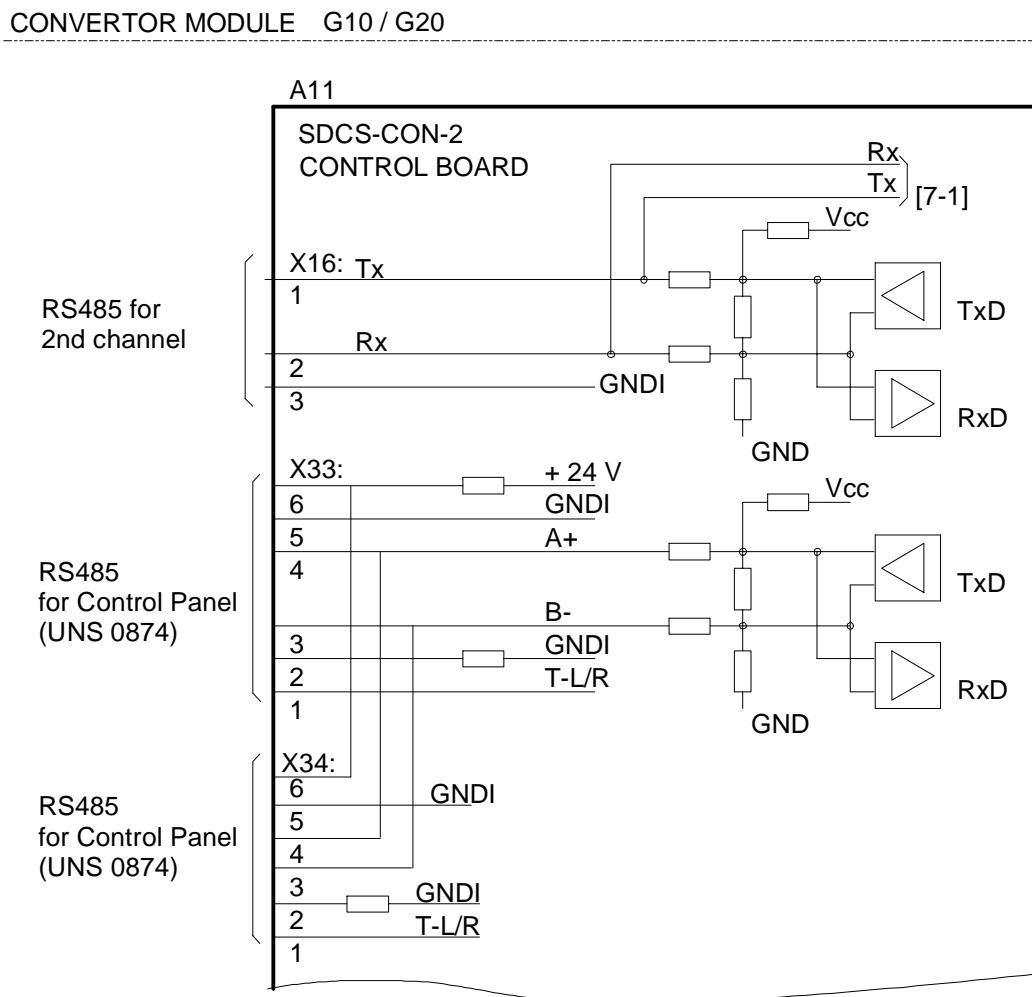


Fig. 6 RS 485 communication channel terminals

3 Power supply board SDCS-POW-4

The SDCS-POW-4 board is an integrated power supply for all converter modules of the type UNS X86X. It supplies all necessary DC voltages both for the control board SDCS-CON-2 and for the signal processing device. The input voltage is automatically detected and set to either 230 VAC to 115 VAC. In the UNF system, only the input X99 (contains EMC-protection and current limiter) is used, which is connected with the output of the external power supply unit UNS 0868 (230 VDC). The relay output X96 is not served in the UNF system (wire number 1 in the flat cable to connector X37 is disconnected). The setting of the jumpers S3 to 5 is not relevant in the UNF application.

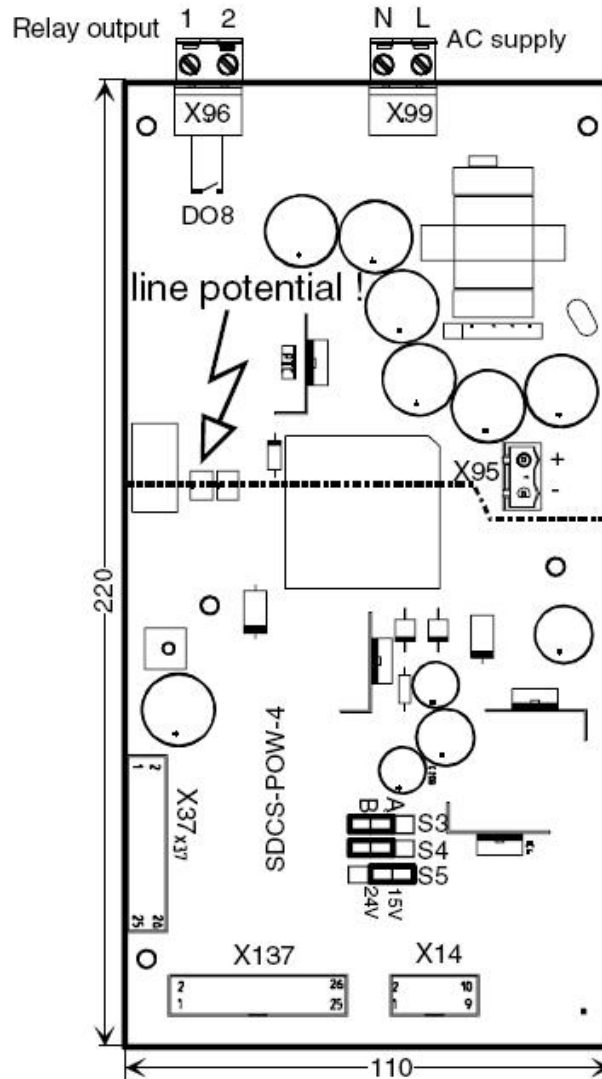


Fig. 7 SDCS-POW-4 board layout

3.1 Auxiliary power distribution on the SDCS-CON-2 board

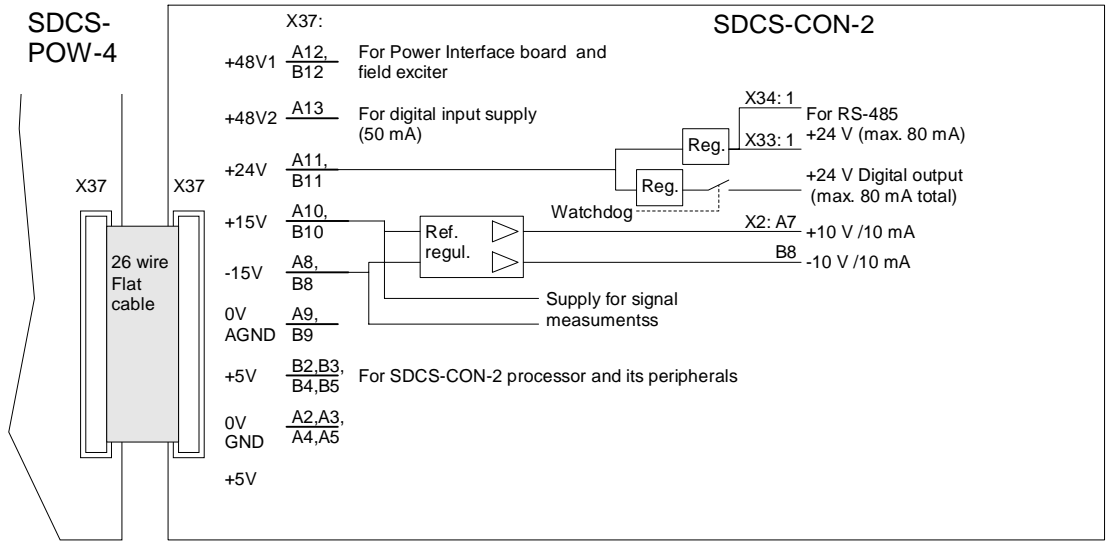


Fig. 8 Auxiliary power distribution on the SDCS-CON-2 board

4 Power supply unit UNS 0868a, b

Features

- 240 VDC voltage power supply unit with variable input voltage:
 - Version 1: for 24 V / 48 VDC / 34 VAC input voltage
 - Version 2: for 110 V / 250 VDC / 170 VAC input voltage
- Monitoring of the DC and AC input voltages
- Galvanically isolated 24 VDC contact interrogation voltage (6, 8)
- Parallel connection of the 24 V output of 2 power supply units allowed
- "Stand-alone" device for assembly board installation
- Undervoltage lockout (b-version)

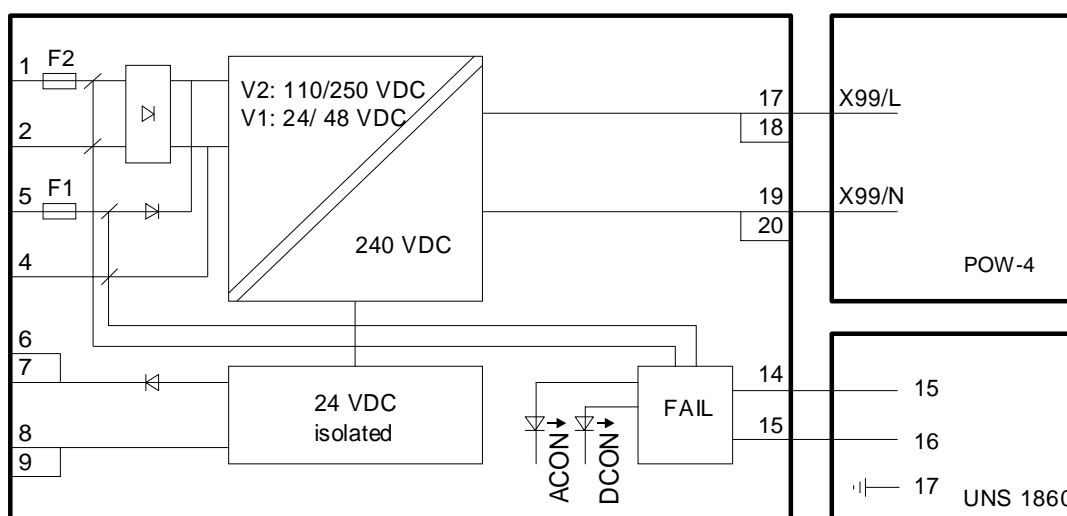


Fig. 9

Short description

The external power supply unit UNS 0868 provides the voltage supply to the POW-4 module integrated in the main UNITROL® F unit. The device is responsible for adapting the battery voltages present on the customer side to the DC input range of the POW-4 module.

In order to achieve a redundant voltage supply, in addition to the DC voltage at terminals 4 and 5, an AC voltage is also connected to terminals 1 and 2 on the power supply unit UNS 0868. The AC and DC current supplies are decoupled via diodes before the step-up transformer.

The device is available in the following two variants:

- V1: for 24 / 48 VDC and 34 VAC nominal input voltage
- V2: for 110 / 250 VDC and 170 VAC nominal input voltage.

The input voltages (1, 2 and 4, 5) are monitored. A failure of the AC voltage is clocked with 1 Hz and a failure of the DC voltage is indicated by a continuous FAIL signal at output 14, 15. The presence of the corresponding output voltages is indicated by means of the AC ON and DC ON LED's. An external capacitor on the outputs 18 and 20 allows the 250 VDC output voltage to be sustained in the event of brief interruptions to the DC supply voltage. The fuses F1 and F2 in the input protects the device in the event of internal defects.

In addition to the 240 VDC voltage, the power supply unit UNS 0868 generates a galvanically isolated 24 VDC contact interrogation voltage. The parallel connection of this contact interrogation voltage with a second UNS 0868 is allowed where 2-channel systems are used. A decoupling diode and two terminals 6, 7 and 8, 9 are provided for this purpose. The 24 VDC output is short-circuit-proof.

Device connections

2.5 mm² spring-clamp terminals are used for all connections.

Only one conductor (wire or strand) may be connected per terminal.

The connections are divided into 3 blocks:

- Terminals 1, 2, 4, 5 Supply voltage
- Terminals 6, 7, 8, 9 +24 V contact interrogation voltage
- Terminals 11 to 20 Output voltages to POW-4 and
signal processing device UNS 1860

The 3 connection blocks can be pulled out.

4.1 Functional description

4.1.1 Schematic diagram

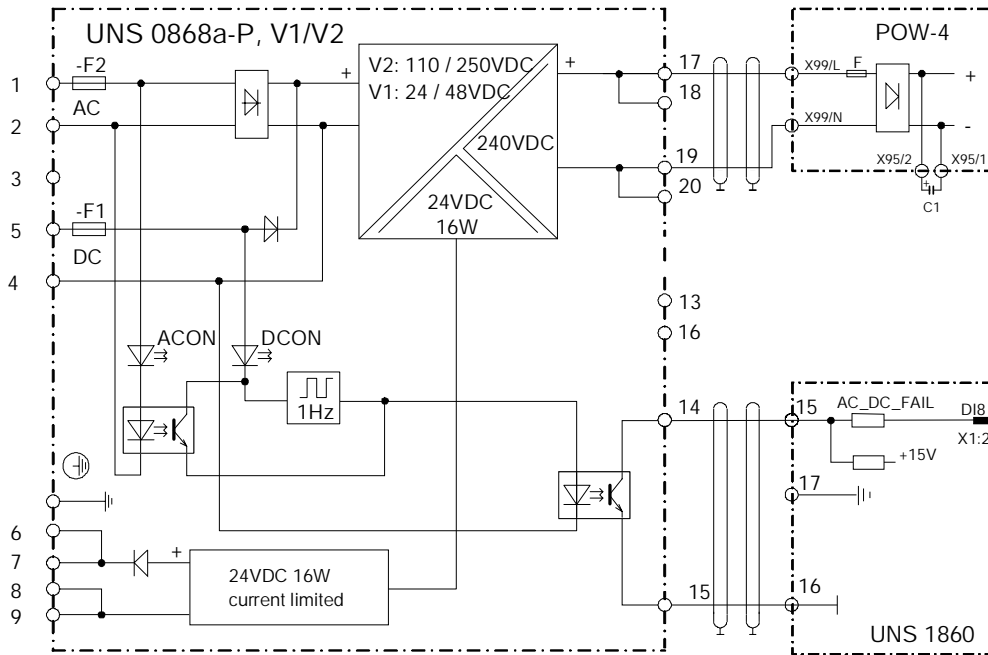


Fig. 10 Block diagram of UNS 0868

4.2 Main data

4.2.1 Input values

| | | | | |
|---|------------|-----|-----------|-----|
| Input voltage range V.1 | 25 to 43 | VA | 18 to 60 | VDC |
| | | C | | |
| Minimum required voltage change rate | ≥ 3.5 | V/s | ≥ 5 | V/s |
| Input voltage range V.2 | 127 to 213 | VA | 82 to 312 | VDC |
| | | C | | |
| Minimum required voltage change rate | ≥ 25 | V/s | ≥ 17 | V/s |
| Frequency range | | | 50 to 600 | Hz |
| Maximum power consumption | 100 | VA | 75 | W |
| Test voltage (against all other connections and ground) | | | 2120 | VDC |

4.2.2 Output voltage (connection 17/18 - 19/20)

| | | |
|---|-----|------|
| Nominal output voltage | 240 | VDC |
| Voltage tolerance | ±10 | % |
| Output power | 40 | W |
| Required capacitance C1 where supply is interrupted | 2.2 | mF/s |

4.2.3 Contact interrogation voltage (connection 6/7 - 8/9)

| | | |
|------------------------|-----|-----|
| Nominal output voltage | +24 | VDC |
| Voltage tolerance | ±10 | % |
| Output power | 16 | W |

4.3 Configuration

Two shielded cables must be used for the following associated input/output signals:

- 14, 15 Fail signal of the voltage monitoring
- 17, 19 Supply cable to POW-4

The ends of the shielded cable are mounted on the corresponding metal sheet by hose clamp.

4.4 Commissioning and function check

Version check

Check which device version is used:

- V1: input DC voltage at connection 5(+), 4(-): 24 / 48 V
 input AC voltage at connection 1 (L), 2(N): 34 V
- V2: input DC voltage at connection 5(+), 4(-): 110 / 250 V
 input AC voltage at connection 1 (L), 2(N): 170 V

Function check

The presence of the input voltages is indicated by activation of the corresponding LED's AC ON and DC ON.

The voltage between connection 15(+) and 14(-) must be between 0 and 2 V when both input voltages are present.

The 240 VDC output voltage should be checked at terminals 17(+) and 19(-), the 24 VDC voltage at terminals 6(+) and 8(-).

The following procedure is recommended in the event of a malfunction:

- Check for correct connections
- Check size and polarity of the input voltages
- Check fuses F1 and F2 in the power supply unit UNS 0868
- Check fuse F1 in the POW-4 module
- Check output voltages

4.5 Location of control elements

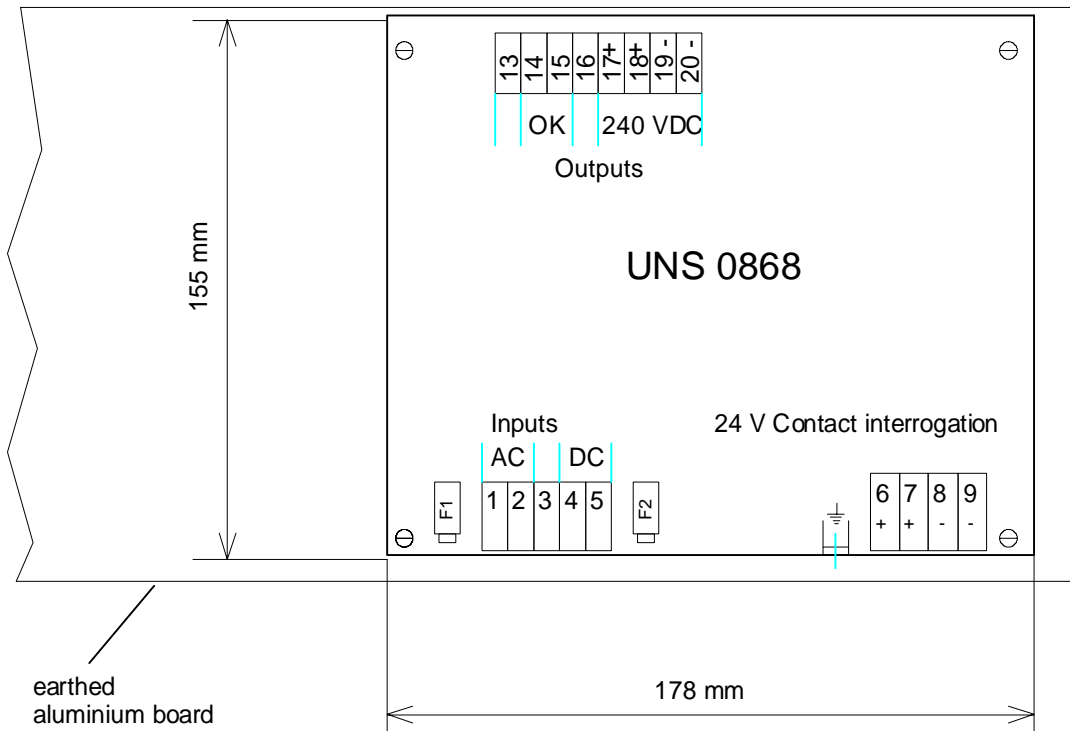


Fig. 11 Location of the control elements on the power supply unit UNS 0868

5 Power interface boards

5.1 Overview

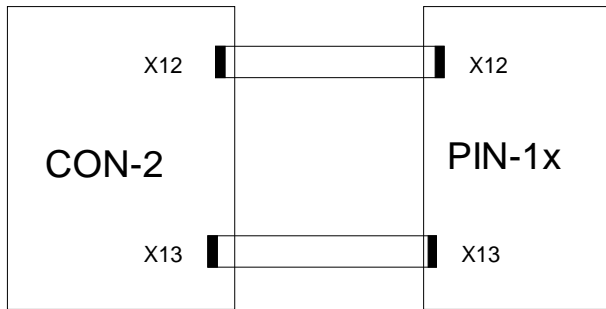
The power interface boards are used in the following combinations with the converter modules:

Size C1

UNS 4875

V5000 / 5001 / 5002 / 5005 / 5007 = PIN-11

V6005 = PIN-12

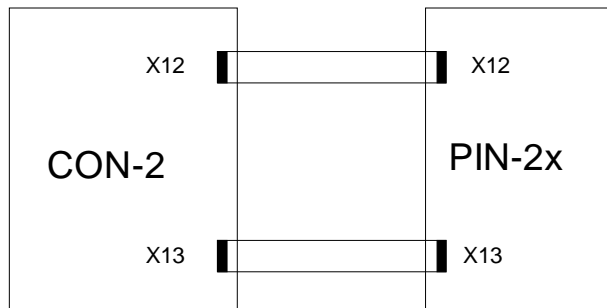


Size C2 and C1 ≥ 100 A

UNS X875

V50xx = PIN-205B

V60xx = PIN-206B



Size A5

UNS 7875

Vx090 to Vx200 = PIN-51 + PIN-48

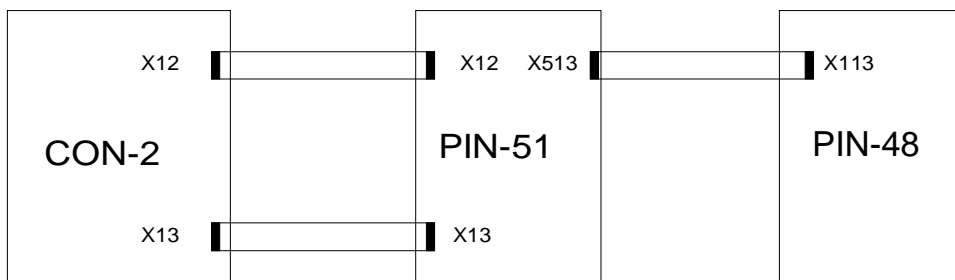


Fig. 12 Power interface board configurations

5.2 Power interface boards of the SDCS-PIN-1x series

- The SDCS-PIN-11 power interface board is used for all converters of type UNS 4875 (for 25 A, 50 A and 75 A at 500 V)
- The SDCS-PIN-12 interface is used for 50 A at 600 V.

Features

Firing pulse circuits with pulse transformers

- Measurement of the field current with current transformers
- RC circuits for thyristor protection
- AC- and DC high ohmic voltage measurement
- Interface for heat sink temperature measurement with an NTC sensor
- Scaling for rated current, zero current detection and hardware coding for maximum supply voltage

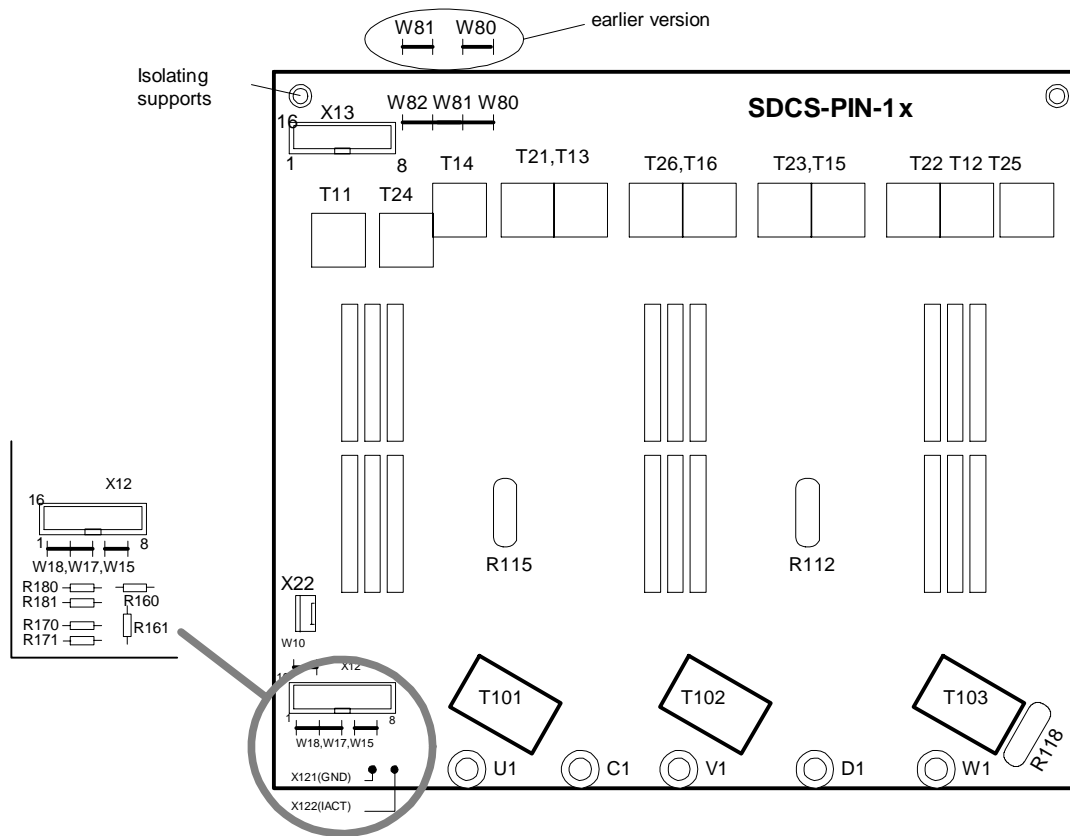


Fig. 13 Location of control elements on the SDCS-PIN-1x board

The standard power interface board SDCS-PIN-1x is designed for a rated current of 50 A.

Applications where the rated current for the converter is less than 50 A must be modified according to Tab. 2a.

Settings of the SDCS-PIN-1x board

| PIN-Type | PIN-11 | | | | | | | PIN-12 |
|---|--------|------|------|-------|-----|-----|-----|--------|
| Max. Converter Supply [V] | | 500 | 500 | 500 | 500 | 500 | 500 | 600 |
| Rated Converter Current I_N [A] | Def. | 4*** | 6* | 12.5* | 25 | 50 | 75 | 50 |
| W10 OUT=2Q, IN = 4Q** | IN | OUT | OUT | OUT | OUT | OUT | OUT | OUT |
| W15 Zero current detection | IN | OUT | OUT | OUT | OUT | OUT | IN | OUT |
| W17 Burden scaling | IN | OUT | OUT | OUT | OUT | IN | IN | IN |
| W18 Burden scaling | IN | OUT | OUT | OUT | OUT | OUT | IN | OUT |
| W80 HW coding voltage | IN | OUT | OUT | OUT | OUT | OUT | IN | OUT |
| W81 HW coding voltage | IN | OUT | OUT | OUT | OUT | IN | OUT | IN |
| W82 HW coding voltage | IN | IN | IN | IN | IN | IN | IN | IN |
| R160 Burden resistor | IN | 680R | 390R | OUT | IN | IN | IN | IN |
| R161 Burden resistor | IN | 3k3 | 10k | IN | IN | IN | IN | IN |
| <p>Caution If Parameter SET 1 CONV A value = 0 (default) the software reads the rated current values from HW-code (normal condition).</p> <p>* In these cases the value must be set by altering SET 1 CONV A to the value given in the table "no HW-code available"</p> <p>*** For other current value $R160/R161 = 1.5V * (1500/I_n)$</p> <p>** ⌚ X = 4Q (4 Quadrant operation; not applicable with AVR)</p> | | | | | | | | |
| <p>IN = Do not remove resistor OUT = cut out resistor 680R = replace resistor with that value</p> | | | | | | | | |

Tab. 2a Settings for lower rated current

5.3 Power interface boards of the SDCS-PIN-20xB series

- The SDCS-PIN-205B power interface board is used on converter modules rated for 100 A, 125 A, 180 A, 225 A, 315 A, 405 A, 470 A, 610 A, 700 A, 740 A, 900 A at 500 V.
- The SDCS-PIN-206B for 100 A, 245 A, 405 A at 600 V

Features

- Firing pulse circuits with pulse transformers
- Measurement of the field current
- Snubber circuits for thyristor protection (RC parallel to thyristor plus combined snubber)
- AC and DC high ohmic voltage measurement
- Interface for heat sink temperature measurement with an PTC sensor
- Fuses for overvoltage protection and voltage measurement
- Scaling for rated current, zero current detection and hardware coding for maximum supply voltage

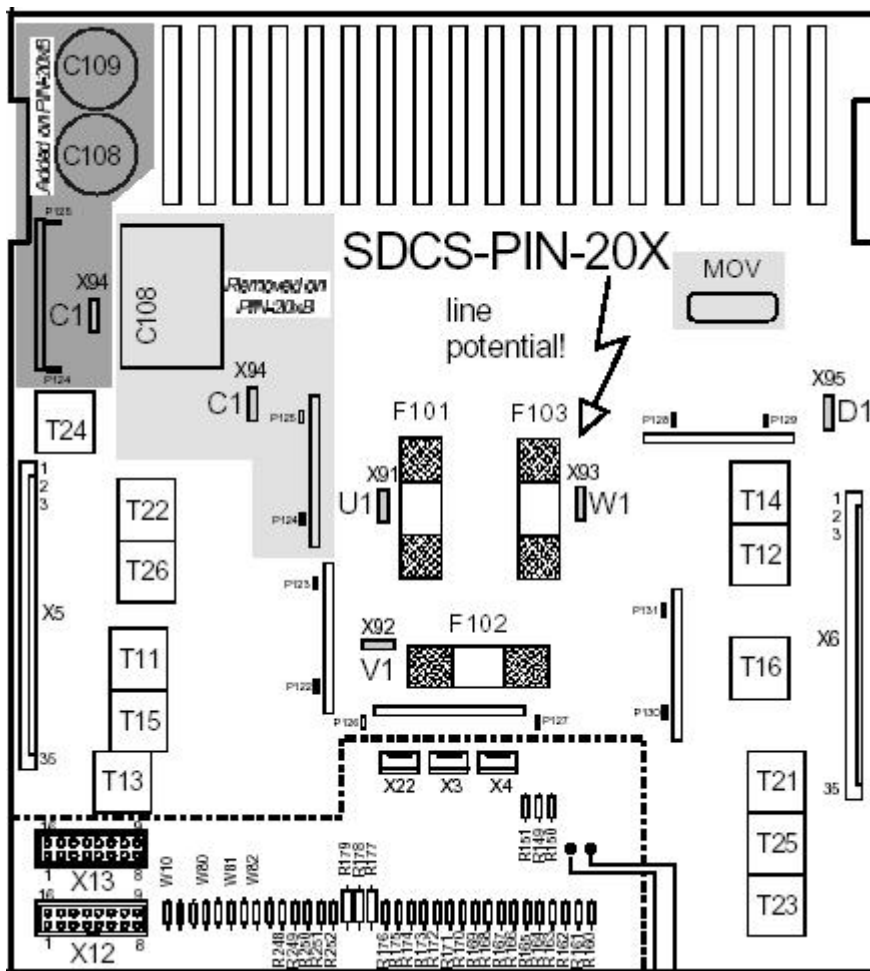


Fig. 14 Layout of the SDCS-PIN-20xB board.

Settings of the SDCS-PIN-205B board

| Interface Type | | | PIN-205B | | | | | | | |
|--|-------|----------------------|------------|-----|-----|-----|-----|-----|-----|--|
| Max Converter. Supply [V] | | | 500 | | | | | | | |
| Converter Type | | C1/2 | C1 | C1 | C1 | C2 | C2 | C2 | C2 | |
| Rated Converter Current I _N [A] | | Def. | 100 | 125 | 180 | 225 | 315 | 405 | 470 | |
| C. T. secondary | | -- | 1 | | | | | 1 | | |
| C. T. primary | | -- | 1000 | | | | | 600 | | |
| W10 | | OUT = 2Q | IN | OUT | OUT | OUT | OUT | OUT | OUT | |
| W80 | | HW type coding | IN | IN | OUT | OUT | IN | OUT | OUT | |
| W81 | | HW type coding | IN | IN | IN | IN | OUT | OUT | IN | |
| W82 | | HW type coding | IN | OUT | IN | OUT | IN | IN | IN | |
| R248 | | HW type coding | IN | IN | IN | IN | IN | IN | IN | |
| R249 | | HW type coding | IN | IN | IN | IN | IN | IN | IN | |
| R250 | | HW type coding | IN | IN | IN | IN | IN | IN | IN | |
| R251 | | HW type coding | IN | IN | IN | IN | IN | IN | OUT | |
| R252 | | HW type coding | IN | IN | IN | IN | IN | IN | OUT | |
| R149 | 33R | Zero curr. detection | IN | OUT | OUT | OUT | OUT | IN | IN | |
| R150 | 47R | Zero curr. detection | IN | OUT | OUT | IN | IN | OUT | IN | |
| R151 | 100R | Zero curr. detection | IN | IN | IN | OUT | OUT | OUT | OUT | |
| R160 | 1kR | Rated curr. scalling | IN | OUT | OUT | OUT | OUT | OUT | OUT | |
| R161 | 1kR | Rated curr. scalling | IN | IN | OUT | IN | IN | IN | OUT | |
| R162 | 332R | Rated curr. scalling | IN | IN | IN | OUT | IN | OUT | IN | |
| R163 | 332R | Rated curr. scalling | IN | IN | OUT | OUT | IN | OUT | OUT | |
| R164 | 332R | Rated curr. scalling | IN | OUT | OUT | OUT | IN | OUT | OUT | |
| R165 | 332R | Rated curr. scalling | IN | OUT | OUT | OUT | OUT | OUT | OUT | |
| R166 | 332R | Rated curr. scalling | IN | OUT | OUT | OUT | OUT | OUT | OUT | |
| R167 | 47R | Rated curr. scalling | IN | OUT | IN | OUT | IN | OUT | OUT | |
| R168 | 33.2R | Rated curr. scalling | IN | IN | IN | IN | IN | IN | IN | |
| R169 | 33.2R | Rated curr. scalling | IN | IN | IN | IN | IN | IN | IN | |
| R170 | 33.2R | Rated curr. scalling | IN | OUT | OUT | IN | IN | IN | IN | |
| R171 | 33.2R | Rated curr. scalling | IN | OUT | OUT | IN | IN | IN | IN | |
| R172 | 33.2R | Rated curr. scalling | IN | OUT | OUT | OUT | OUT | IN | IN | |
| R173 | 33.2R | Rated curr. scalling | IN | OUT | OUT | OUT | OUT | IN | OUT | |
| R174 | 33.2R | Rated curr. scalling | IN | OUT | OUT | OUT | OUT | IN | OUT | |
| R175 | 33.2R | Rated curr. scalling | IN | OUT | OUT | OUT | OUT | OUT | OUT | |
| R176 | 33.2R | Rated curr. scalling | IN | OUT | OUT | OUT | OUT | OUT | OUT | |
| R177 | 10R | Rated curr. scalling | IN | OUT | OUT | OUT | OUT | OUT | IN | |
| R178 | 10R | Rated curr. scalling | IN | OUT | OUT | OUT | OUT | OUT | IN | |
| R179 | 10R | Rated curr. scalling | IN | OUT | OUT | OUT | OUT | OUT | IN | |
| IN = Do not remove resistor | | | | | | | | | | |
| OUT = cut out resistor | | | | | | | | | | |

Tab. 2b Table of settings on the SDCS-PIN-20xB board

Settings of the SDCS-PIN-205B and PIN-206B board

| Interface Type | | | PIN-205B | | | | | PIN-206B | | |
|--|-------|----------------------|----------|-----------|----------|----------|----------|----------|-----|-----|
| Max. Converter Supply [V] | | | 500 | | | | | 600 | | |
| Converter Type | | | C1/2 | C2 | C2 | C2 | C2 | C1 | C2 | C2 |
| Rated Converter Current I _N [A] | | | Def. | 700 ** | 610 * | 740 * | 900 * | 100 | 245 | 405 |
| C. T. secondary | | | -- | 1 | 1 | | | | 1 | |
| C. T. primary | | | -- | 2330 | 3000 | | | 1000 | | 600 |
| W10 | | OUT = 2Q | IN | OUT | OUT | OUT | OUT | OUT | OUT | OUT |
| W80 | | HW type coding | IN | IN | IN | OUT | IN | OUT | OUT | IN |
| W81 | | HW type coding | IN | OUT | IN | IN | OUT | IN | OUT | OUT |
| W82 | | HW type coding | IN | IN | IN | IN | IN | IN | IN | IN |
| R248 | | HW type coding | IN | OUT | OUT | OUT | OUT | IN | IN | IN |
| R249 | | HW type coding | IN | OUT | IN | IN | IN | IN | IN | OUT |
| R250 | | HW type coding | IN | OUT | IN | IN | IN | OUT | OUT | OUT |
| R251 | | HW type coding | IN | OUT | IN | IN | IN | OUT | OUT | OUT |
| R252 | | HW type coding | IN | OUT | OUT | OUT | OUT | OUT | OUT | OUT |
| R149 | 33R | Zero curr. detection | IN | IN | OUT | OUT | OUT | OUT | OUT | IN |
| R150 | 47R | Zero curr. detection | IN | OUT | IN | IN | IN | OUT | IN | IN |
| R151 | 100R | Zero curr. detection | IN | OUT | OUT | OUT | OUT | IN | OUT | OUT |
| R160 | 1kR | Rated curr. scalling | IN | OUT | OUT | IN | OUT | OUT | IN | OUT |
| R161 | 1kR | Rated curr. scalling | IN | OUT | OUT | IN | OUT | IN | IN | OUT |
| R162 | 332R | Rated curr. scalling | IN | OUT | IN | IN | IN | IN | IN | IN |
| R163 | 332R | Rated curr. scalling | IN | OUT | IN | IN | IN | IN | IN | OUT |
| R164 | 332R | Rated curr. scalling | IN | OUT | IN | IN | IN | OUT | IN | OUT |
| R165 | 332R | Rated curr. scalling | IN | OUT | IN | IN | IN | OUT | IN | OUT |
| R166 | 332R | Rated curr. scalling | IN | OUT | IN | OUT | OUT | OUT | OUT | OUT |
| R167 | 47R | Rated curr. scalling | IN | IN | OUT | OUT | OUT | OUT | OUT | OUT |
| R168 | 33.2R | Rated curr. scalling | IN | IN | IN | IN | IN | IN | IN | IN |
| R169 | 33.2R | Rated curr. scalling | IN | IN | IN | IN | IN | IN | IN | IN |
| R170 | 33.2R | Rated curr. scalling | IN | IN | IN | IN | IN | OUT | IN | IN |
| R171 | 33.2R | Rated curr. scalling | IN | IN | IN | IN | OUT | OUT | IN | IN |
| R172 | 33.2R | Rated curr. scalling | IN | IN | OUT | IN | OUT | OUT | IN | IN |
| R173 | 33.2R | Rated curr. scalling | IN | IN | OUT | OUT | OUT | OUT | OUT | OUT |
| R174 | 33.2R | Rated curr. scalling | IN | OUT | OUT | OUT | OUT | OUT | OUT | OUT |
| R175 | 33.2R | Rated curr. scalling | IN | OUT | OUT | OUT | OUT | OUT | OUT | OUT |
| R176 | 33.2R | Rated curr. scalling | IN | OUT | OUT | OUT | OUT | OUT | OUT | OUT |
| R177 | 10R | Rated curr. scalling | IN | OUT | OUT | OUT | IN | OUT | OUT | IN |
| R178 | 10R | Rated curr. scalling | IN | OUT | OUT | OUT | OUT | OUT | OUT | IN |
| R179 | 10R | Rated curr. scalling | IN | OUT | OUT | OUT | OUT | OUT | OUT | IN |

IN = Do not remove resistor, OUT = cut out resistor

Tab. 2c Table of settings on the SDCS-PIN-20xB board

* Notes to Power Interface Board PIN-20XB (for Converter Types C2b):
The parameters have to be set. There is no HW code available up to SW 41.222.2.

| Parameter | Text | Adjustment | | |
|-----------|-----------------|------------|-------|-------|
| 507 | SET_I_CONV_A | 610 A | 740 A | 900 A |
| 508 | SET_U_CONV | 500 V | 500 V | 500 V |
| 509 | SET_MAX_BR_TEMP | 75°C | 85°C | 82°C |
| 510 | SET_CONV_TYPE | 4 | 4 | 4 |
| 511 | SET_QUADR_TYPE | 1 | 1 | 1 |

Tab. 2d HV code for converter types C2b

** no longer available

5.4 Pulse transformer board SDCS-PIN-48

This board is used together with the SDCS-PIN-51 on converter modules rated for 900 A to 5150 A. The board contains 6 pulse transformers with amplifiers.

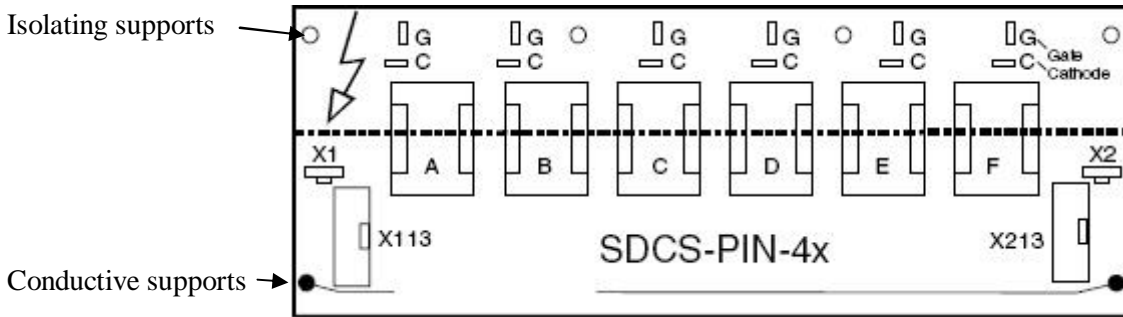


Fig. 15 Layout of the SDCS-PIN-48 board

5.5 Measuring board SDCS-PIN-51 and 52

This board is used together with the SDCS-PIN-48 and contains the measuring circuits for excitation current and voltage. Current is measured by current transformers on the AC supply, rectified by a diode bridge and scaled with load resistors to 1.5 V at rated current.

The value for the rated current is set by removing resistors (R1 to R21), see Table 4a.

The AC and DC voltages U1, V1, W1, C1(+) and D1(-) are measured by the voltage dividing circuits. Scaling of voltages is done by activating 1 MΩ resistors (= cutting out short circuit wires, U1: W1-W5, V1: W6-W11, W1: W12-W16, C1: W17-W21, D1: 22-W26).

When galvanically isolated measurement is used, the short circuit wires are not cut.

Note! The actual voltage signals U1, V1, W1, C1(+) and D1(-) of the main circuit are not galvanically isolated from the control board SDCS-CON-2.

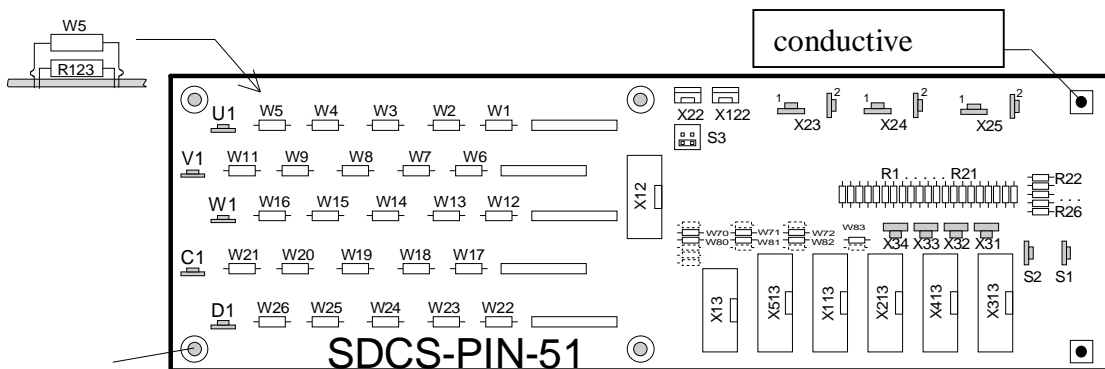


Fig. 16 Layout of the SDCS-PIN-51 board

PIN-52: All resistors on the left side of the board are replaced by wire links (≤ 500 V)

Settings of the SDCS-PIN-51 and PIN-52 boards

| Current Burden | | | | | | | | | | | | | |
|------------------|------|----------------|------|------|------|------------|------|------|------|------|------|------|------|
| Type | | A5/12300/13300 | | | | C4/13300** | | | | | | | |
| I_N [A] | Def. | 900 | 1200 | 1500 | 2000 | 2050 | 2500 | 2650 | 3200 | 3300 | 4000 | 4750 | 5150 |
| C.T. I_1 | -- | 2500 | 2500 | 2500 | 2500 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 |
| Burden I_{DC} | | | | | | | | | | | | | |
| R1 | IN | IN | IN | IN | IN | IN | IN | IN | IN | IN | IN | IN | IN |
| R2 | IN | IN | IN | IN | IN | IN | IN | IN | IN | IN | IN | IN | IN |
| R3 | IN | IN | IN | IN | IN | IN | IN | IN | IN | IN | IN | IN | IN |
| R4 | IN | IN | IN | IN | IN | IN | IN | IN | IN | IN | IN | IN | IN |
| R5 | IN | OUT | IN | IN | IN | IN | IN | IN | IN | IN | IN | IN | IN |
| R6 | IN | OUT | OUT | IN | IN | IN | IN | IN | IN | IN | IN | IN | IN |
| R7 | IN | OUT | OUT | IN | IN | OUT | IN | IN | IN | IN | IN | IN | IN |
| R8 | IN | OUT | OUT | OUT | IN | OUT | OUT | OUT | IN | IN | IN | IN | IN |
| R9 | IN | OUT | OUT | OUT | IN | OUT | OUT | OUT | IN | IN | IN | IN | IN |
| R10 | IN | OUT | OUT | OUT | OUT | OUT | OUT | OUT | OUT | OUT | IN | IN | IN |
| R11 | IN | OUT | OUT | OUT | OUT | OUT | OUT | OUT | OUT | OUT | IN | IN | IN |
| R12 | IN | OUT | OUT | OUT | OUT | OUT | OUT | OUT | OUT | OUT | IN | IN | IN |
| R13 | IN | OUT | OUT | OUT | OUT | OUT | OUT | OUT | OUT | OUT | OUT | IN | IN |
| R14 | IN | OUT | OUT | OUT | OUT | OUT | OUT | OUT | OUT | OUT | OUT | IN | IN |
| R15 | IN | OUT | OUT | OUT | OUT | OUT | OUT | OUT | OUT | OUT | OUT | OUT | IN |
| R16 | IN | OUT | OUT | OUT | OUT | OUT | OUT | OUT | OUT | OUT | OUT | OUT | OUT |
| R17 | IN | OUT | IN | OUT | IN | OUT | OUT | IN | IN | IN | OUT | OUT | OUT |
| R18 | IN | IN | OUT | OUT | OUT | OUT | IN | IN | OUT | IN | OUT | OUT | IN |
| R19 | IN | OUT | IN | IN | OUT | IN | IN | IN | OUT | OUT | OUT | IN | IN |
| R20 | IN | IN | IN | IN | IN | OUT | IN | OUT | IN | IN | OUT | IN | IN |
| R21 | IN | OUT | OUT | OUT | OUT | OUT | IN | OUT | OUT | IN | OUT | IN | IN |
| Burden I_{DCM} | | | | | | | | | | | | | |
| R22 | IN | IN | IN | IN | IN | IN | IN | IN | IN | IN | IN | IN | IN |
| R23 | IN | OUT | OUT | IN | IN | OUT | IN | IN | IN | IN | IN | IN | IN |
| R24 | IN | OUT | OUT | OUT | OUT | OUT | OUT | OUT | OUT | OUT | IN | IN | IN |
| R25 | IN | OUT | OUT | OUT | OUT | OUT | OUT | OUT | OUT | OUT | OUT | OUT | IN |
| R26 | IN | OUT | IN | OUT | IN | IN | OUT | OUT | IN | IN | OUT | IN | OUT |

IN = Do not remove resistor
 OUT = cut out resistor

Tab. 3a Table of settings on the SDCS-PIN-51 and PIN-52 board

Notes see next page

Voltage Divider for Types A5/C4/UNL12300/13300

| Rated Converter Supply U_N [V] | Default | 500* PIN-52 | 600 PIN-51 | 690 PIN-51 | 790 PIN-51 | 1000 PIN-51 | external Trans- ducer |
|----------------------------------|---------|----------------|---------------|---------------|---------------|----------------|-----------------------------|
| W1,6,12,17,22 | IN | IN | OUT | OUT | OUT | OUT | IN |
| W2,7,13,18,23 | IN | IN | IN | OUT | OUT | OUT | IN |
| W3,8,14,19,24 | IN | IN | IN | IN | OUT | OUT | IN |
| W4,9,15,20,25 | IN | IN | IN | IN | IN | OUT | IN |
| W5,11,16,21,26 | IN | IN | IN | IN | IN | OUT | IN |

Tab. 3b Voltage divider for converter types A5, C4 and UNL..

- HW coding
- 2Q -4Q coding
- Temp. sensor coding

| Type A5 (including UNL12300/13300) | | | | | | | | C4/ 13300** |
|------------------------------------|---------|------|------|-----|------|-----|------|-----------------|
| Rated Converter Current I_N [A] | Default | 1200 | 2000 | 900 | 1500 | 900 | 1500 | other values |
| Rated Converter Supply U_N [V] | | 500 | 500 | 500 | 500 | 690 | 690 | other values |
| W70 | IN | IN | IN | IN | IN | OUT | OUT | IN |
| W71 | IN | IN | IN | IN | IN | IN | IN | IN |
| W72 | IN | IN | IN | IN | IN | IN | IN | IN |
| W80 | IN | IN | IN | OUT | OUT | OUT | OUT | IN |
| W81 | IN | OUT | IN | IN | OUT | IN | OUT | IN |
| W82 | IN | IN | OUT | IN | IN | IN | IN | IN |
| W83 | IN | IN | IN | IN | IN | IN | IN | IN |
| W10 *** | IN | OUT | OUT | OUT | OUT | OUT | OUT | IN |
| S3 (R57) | 1-2 | 1-2 | 1-2 | 1-2 | 1-2 | 1-2 | 1-2 | 1-2 |

Tab. 3c HV code for converter types A5, C4 and UNL..

Note:

- * All A5-type until $U_N = 500$ V will be delivered with PIN-52 boards
- ** Param. 507 SET_I_CONV_A has to be set to rated converter current (no HW code available)
 Param. 508 SET_U_CONV has to be set to rated converter voltage (no HW code available)
 Param. 509 SET_MAX_BR_TEMP has to be set to max inlet air temp. 45°C (no HW code available)
 Param. 510 SET_CONV_TYPE has to be set to C4 (no HW code available)
 Param. 511 SET_QUADR_TYPE has to be set to 1 = 2 Quadrant (no HW code available)
- ** IN = 4-Quadrant operation, which is not applicable for excitation systems.
- *

5.6 Power converter bridges

Construction:

Module-type thyristors are used in power converter bridges for rated currents up to 910 A (500 V, 2Q). Disc-type thyristors are used for rated currents from 900 A (690 V).

Monitoring:

The thyristors are monitored in operation by supervision of the voltage signal over the load resistor in the current measuring circuit.

Protection concept:

External line fuses are used to protect the thyristor modules against overcurrents which can be caused by internal or external short circuits. Ultra-fast internal branch fuses are used for disc-type thyristors.

In systems with rated currents of 12.5 A to 910 A (500 V, 2Q), varistors are used for protection against overvoltages.

In addition to temperature monitoring, each UNITROL[®] F converter features RC snubber circuits.

The technical data for the most important elements of the power converter parts are shown in the following tables.

Thyristor modules

| In Converter [A], Q | U _{in} max [V] | Board Type | UNITROL [®] F Type | Thyristor Type | Basic device DCS501B | Torque [Nm] | Current transformer | Max. extern. line fuse | Ventilation (noise = noise level) |
|----------------------|-------------------------|------------|-----------------------------|--------------------------------|----------------------|-------------|---|---------------------------------------|---|
| 50.0, 4Q 50.0, 2Q | 500 | PIN-11 | UNS4875 V5005 | SKKT42/16E 1600 V / 850 A | 0050-51 | 5 ± 15% | L1 / L 2 / L3 1500/1 A | 170M 1566 80 A/660 V Ultrafast | natural convection |
| 75.0, 4Q 75.0, 2Q | 500 | PIN-11 | UNS4875 V5007 | SKKT57/16E 1600 V / 1.25 kA | 0075-51- | 5 ± 15% | L1 / L 2 / L3 1500/1 A | 170M 1568 125 A/660 V Ultrafast | CN52B2 230V 50/60 Hz 14 W ≤375/440 m ³ /h (Noise = 59 dB) |
| 100, 4Q 100, 2Q | 500 | PIN-205B | UNS4875 V5010 | SKKT106/16E 1600 V / 1.9 kA | 0100-51- | 5 ± 15% | L1 / L3 PWS 3003 300/0.3 A 1.5 VA | 170M 3815 200 A/660 V Ultrafast | W2E143-AA09-25 230V 50/60 Hz 24/26 W ≤375/440 m ³ /h (Noise = 59 dB) |
| 110, 4Q 100, 2Q | 600 | PIN-206B | UNS4875 V6010 | SKKT72/20E 2000 V / 1.45 kA | 0110-61 | 5 ± 15% | L1 / L3 PWS 3003 300/0.3 A 1.5 VA | 170M 3815 200 A/660 V Ultrafast | W2E143-AA09-25 230V 50/60 Hz 24/26 W ≤375/440 m ³ /h (Noise = 59 dB) |
| 140, 4Q 125, 2Q | 500 | PIN-205B | UNS4875 V5014 | SKKT106/16E 1600 V / 1.9 kA | 0140-51- | 5 ± 15% | L1 / L3 PWS 3003 300/0.3 A 1.5 VA | 170M 3815 200 A/660 V Ultrafast | W2E143-AA09-25 230V 50/60 Hz 24/26 W ≤375/440 m ³ /h (Noise = 59 dB) |

Tab. 4a Thyristor modules size C1

Thyristor modules, continued

| Thyristor modules, size C2 | | | | | | | | | |
|-----------------------------|-------------------------|------------|-----------------------------|--------------------------------|-----------------------|-------------|---|--|--|
| In Converter [A], Q | U _{in} max [V] | Board Type | UNITROL [®] F Type | Thyristor Type | Basic device DCS501B- | Torque [Nm] | Current transformer | Max. extern. line fuse | Ventilation (noise = noise level) |
| 200, 4Q 180, 2Q | 500 | PIN-205B | UNS5875 V5018 | SKKT106/16E 1600 V / 1.9 kA | 0200-51- | 5 ± 15% | L1 / L3 PWS 3003 300/0.3 A 1.5 VA | 170M 3819 400 A/660 V Ultrafast | EBM W2E200-HH38-06 230V 50/60 Hz 67/79 W ≤925/1030 m ³ /h (Noise = 71 dB) |
| 250, 4Q 225, 2Q | 500 | PIN-205B | UNS5875 V5022 | SKKT106/16E 1600 V / 1.9 kA | 0250-51- | 5 ± 15% | L1 / L3 PWS 3003 300/0.3 A 1.5 VA | 170M 3819 400 A/660 V Ultrafast | EBM W2E200-HH38-06 230V 50/60 Hz 67/79 W ≤925/1030 m ³ /h (Noise = 71 dB) |
| 270, 4Q 245, 2Q | 600 | PIN-206B | UNS5875 V6025 | SKKT132/20E 2000 V / 4 kA | 0270-61- | 5 ± 15% | L1 / L3 PWS 3003 300/0.3 A 1.5 VA | 170M 5810 500 A/660 V Ultrafast | EBM W2E200-HH38-06 230V 50/60 Hz 67/79 W ≤925/1030 m ³ /h (Noise = 71 dB) |
| 350, 4Q 315, 2Q | 500 | PIN-205B | UNS5875 V5032 | SKKT162/16E 1600 V / 4.4 kA | 0350-51- | 5 ± 15% | L1 / L3 PWS 3003 300/0.3 A 1.5 VA | 170M 5810 500 A/660 V Ultrafast | EBM W2E200-HH38-06 230V 50/60 Hz 67/79 W ≤925/1030 m ³ /h (Noise = 71 dB) |
| 450, 4Q 405, 2Q | 500 | PIN-205B | UNS5875 V5041 | SKKT250/16E 1600 V / 7 kA | 0450-51- | 5 ± 15% | L1 / L3 HF3B 600/1A 600/1 A 5 VA | 170M 6811 700 A/660 V Ultrafast | EBM W2E200-HH38-06 230V 50/60 Hz 67/79 W ≤925/1030 m ³ /h (Noise = 71 dB) |
| 450, 4Q 405, 2Q | 600 | PIN-206B | UNS5875 V6041 | SKKT210/20E 2000 V / 7.5 kA | 0450-61- | 5 ± 15% | L1 / L3 HF3B 600/1A 600/1 A 5 VA | 170M 6811 700 A/660 V Ultrafast | EBM W2E200-HH38-06 230V 50/60 Hz 67/79 W ≤925/1030 m ³ /h (Noise = 74 dB) |
| 520, 4Q 470, 2Q | 500 | PIN-205B | UNS5875 V5047 | SKKT250/16E 1600 V / 7 kA | 0520-51- | 5 ± 15% | L1 / L3 HF3B 600/1A 600/1 A 5 VA | 170M 6811 700 A/660 V Ultrafast | EBM W2E200-HH38-06 230V 50/60 Hz 67/79 W ≤925/1030 m ³ /h (Noise = 74 dB) |
| Thyristor modules, size C2b | | | | | | | | | |
| 680, 4Q 610, 2Q | 500 | PIN-205B | UNS5875 V5061 | TT425N16KOF | 0680-51- | 6 ± 15% | L1 / L3 3000/1 A | 170M 6813 900 A/660 V Ultrafast | EBM W2E200-HH38-06 230V 50/60 Hz 67/79 W ≤925/1030 m ³ /h (Noise = 74 dB) |
| 820, 4Q 740, 2Q | 500 | PIN-205B | UNS5875 V6074 | TT570N16KOF | 0820-51- | 6 ± 15% | L1 / L3 3000/1 A | 170M 6813 900 A/660 V Ultrafast | EBM W2E200-HH38-06 230V 50/60 Hz 67/79 W ≤925/1030 m ³ /h (Noise = 74 dB) |
| 1000, 4Q 900, 2Q | 500 | PIN-205B | UNS5875 V5090 | TT570N16KOF | 1000-51- | 6 ± 15% | L1 / L3 3000/1 A | 170M 6166 1250 A/660 V Ultrafast | EBM W2E250-HL06-08 230V 50/60 Hz 135/185 W ≤1860/1975 m ³ /h |

Tab. 4b Thyristor modules, size C2 and C2b

Disc-type thyristors

| In Converter [A] | U _{in} max [V] | Board Type | UNITROL [®] F Type | Thyristor Type | Basic device DCB505- | ∅ S ["] | Force [kN] | Current transformer | Branch fuse | RC-Snubber (per branch) | Ventilation |
|------------------|-------------------------|------------|-----------------------------|--|----------------------|---------|------------|--|---|-----------------------------|---|
| 900 | 690 | PIN-48/51 | UNS7875 V7090 | T459N24TOF 2400 V / 6.75 kA | 0903-61- | 1.5 | 10 - 15 | L1 / L3 HF7A 2500/1 A 2500/1 A 30 VA | 170M 6144 630 A/1250 V Ultrafast | R=10 Ω/400 W C=1nF/850 V | D2E160 230 V 50/60 Hz 653/860 W 1100 m ³ /h |
| 1200 | 500 | PIN-48/51 | UNS7875 V5120 | T589N18TOF 1800 V / 8 kA | 1203-51- | 1.5 | 8 - 12 | L1 / L3 HF7A 2500/1 A 2500/1 A 30 VA | 170M 6162 800 A/660 V Ultrafast | | |
| 1500 | 500 | PIN-48/51 | UNS7875 V5150 | 5STP18F1800 1800 V / 21 kA T1509N18TOF | 1503-51- | 2 | 14.4 - 24 | L1 / L3 HF7A 2500/1A 2500/1 A 30 VA | 170M 6166 1250 A/660 V Ultrafast | | |
| 1500 | 690 | PIN-48/51 | UNS7875 V7150 | 5STP16F2400 2400 V / 18 kA | 1503-61- | 2 | 14.4 - 24 | L1 / L3 HF7A 2500/1 A 2500/1 A 30 VA | 170M 6149 1100 A/1250 V Ultrafast | | |
| 2000 | 500 | PIN-48/51 | UNS7875 V5200 | 5STP1818F003 1800 V / 21 kA | 2003-51- | 2 | 14.4 - 24 | L1 / L3 HF7A 2500/1 A 2500/1A 30 VA | 170M 6169 1600 A/660 V Ultrafast | | |
| 2000 | 690 | PIN-48/51 | UNS7875 V7200 | 5STP24H2800 | 2003-61- | 2 | 14.4 - 24 | L1 / L3 HF7A 2500/1 A 2500/1 A 30 VA | 170M 6151 1400 A/1100 V Ultrafast | | |

Tab. 3 Disc-type thyristors size A5

6 Signal processing device UNS 1860a/b

Features

- Transducer for the reception of input signals from the interface UNS 0862
- 2 spare analog inputs AITAC, AI2; 2 spare analog outputs AO1, AO2
- Logic level transformers 24 V ↔ 5 V and 5 V ↔ 15 V for the connections to the processor unit
- Multiplexer for digital-I/O, demultiplexer and driver for relay outputs
- Diode failure monitoring (sub-board UNS 0864, option)
- Power system stabiliser (PSS) (sub-board UNS 0865, option for UNS 1860a)
- Power system stabiliser (PSS) (sub-board UNS 0869, option for UNS 1860b)
- Permanently assigned analog outputs I_e and P_{out} , if PSS is installed
- Buffered actual value outputs for measurement on the I/O interface UNS 0863
- 50 Hz / 60 Hz machine frequency with version 1 (V1), 16 2/3 Hz with version 2 (V2).

Short description

The UNS 1860 signal processing device establishes the connection between the analog and binary I/O devices AC actual value measurement UNS 0862 and I/O interface UNS 0863 and the processor. At the same time, a number of analog actual values are pre-processed, which accelerates their subsequent processing in the software of the processor.

On the whole, the device provides the following functions:

- 16 binary inputs are combined in two multiplexers.
- 19 binary outputs are buffered and amplified by means of short-circuit-proof driver modules.
- The three-phase machine voltage actual value is rectified, filtered, and its level is adjusted.
- The machine current IR is rectified, filtered and adjusted.
- The frequency is measured by a PLL circuit and fed, multiplied, to the appropriate circuit in the processor unit.
- At the same time, the PLL, in combination with a programmable circuit (EPLD) is used to calculate the active and reactive components of the machine current IR.
- Two spare analog inputs AITAC and AI2 and two spare analog outputs AO1 and AO2 are provided.

Option UNS 0864 "Diode failure monitoring" see chapter 11 ___
 UNS 0869 "PSS measurement transducer" see chapter 10 ___

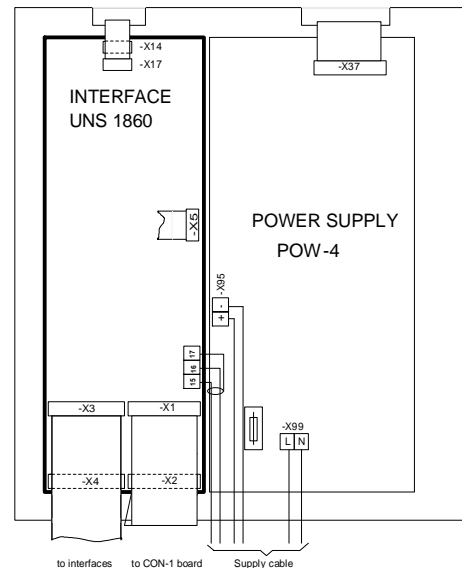


Fig. 17 View of the UNS 1860 board

6.1 Functional description of the signal processing device UNS 1860

6.1.1 Schematic diagram

Digital inputs

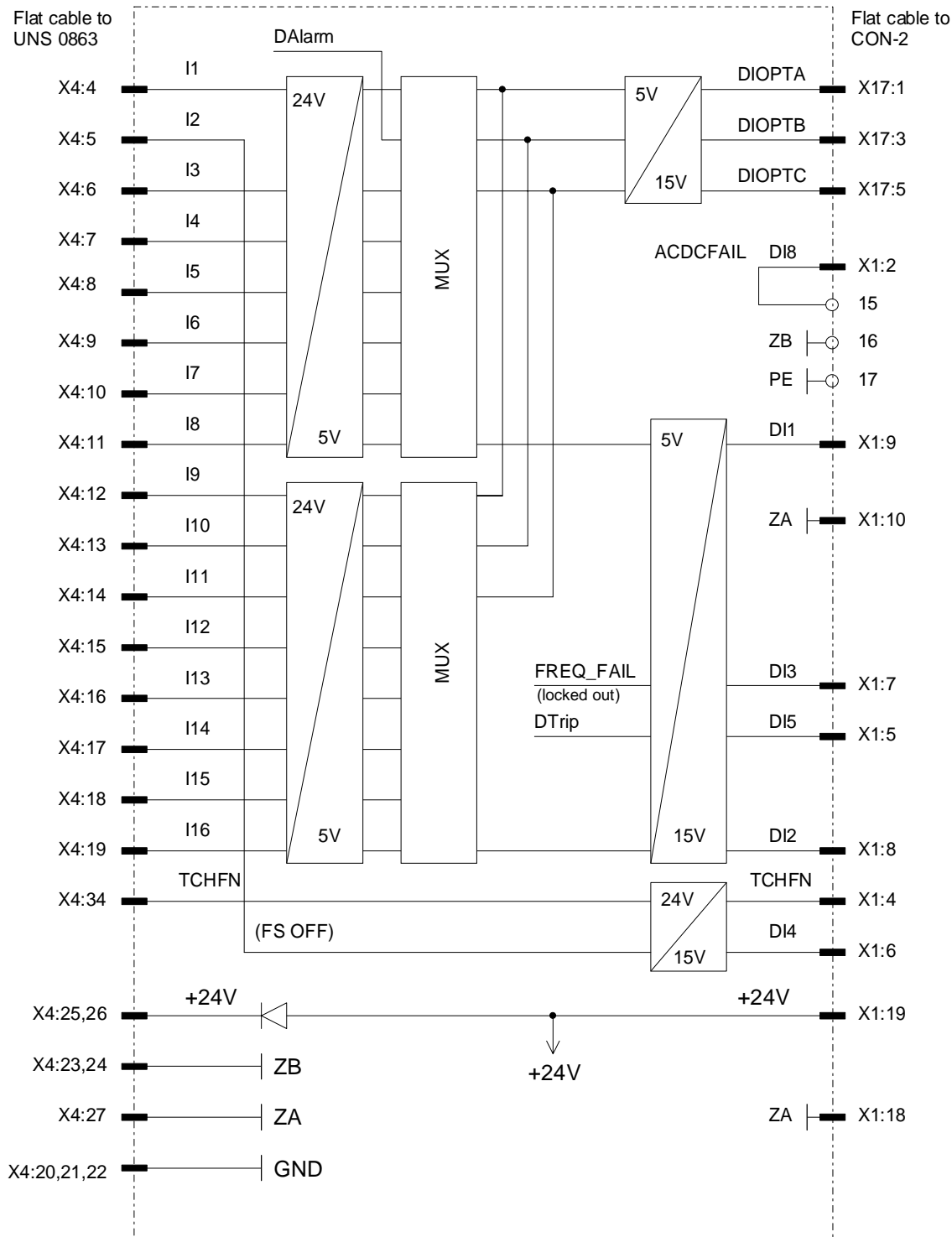


Fig. 18 Block diagram digital inputs of the signal processing device UNS 1860

Signal processing

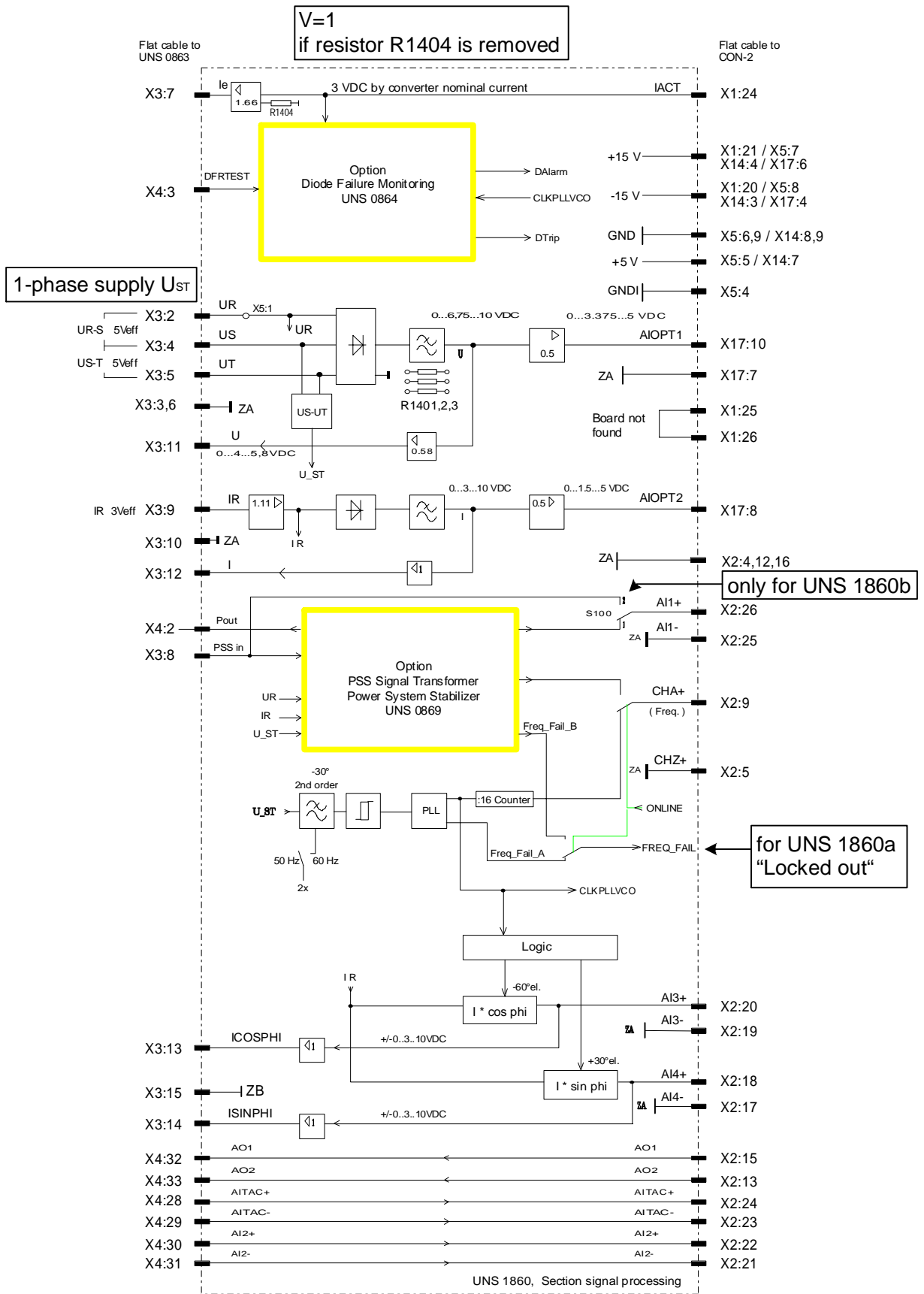


Fig. 19 Block diagram of signal processing device UNS 1860

Digital outputs

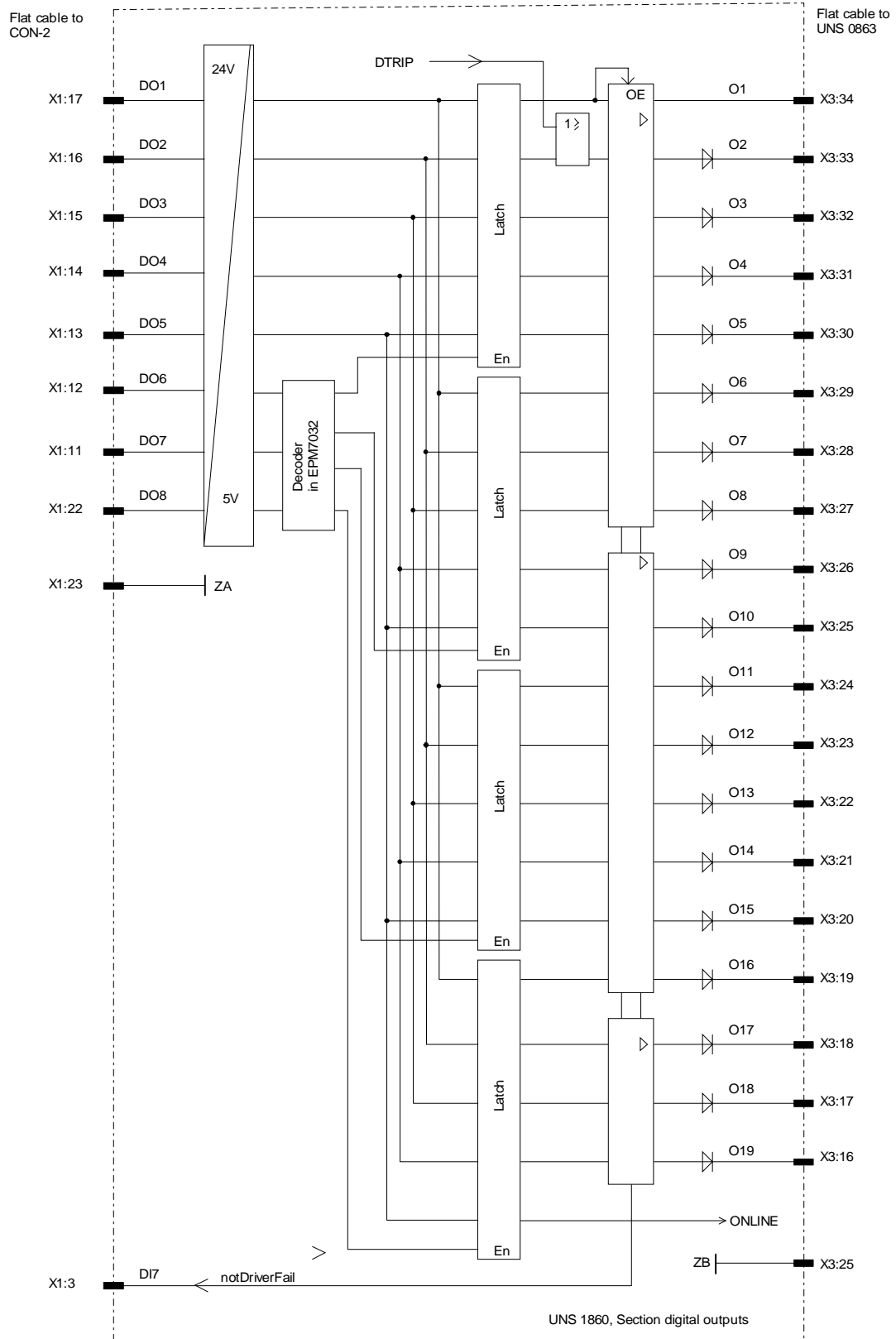


Fig. 20 Block diagram digital outputs of the signal processing device UNS 1860

Drivers for digital outputs

The output drivers are monitored for short circuits. If a fault occurs, K-fault 32 “D/O driver fault“ is generated via D17, i.e. all digital outputs are set to logical “0“ and a channel switch over takes place (shutdown in 1-channel system).

6.1.2 Signal processing

Machine voltage (see Fig. 19)

The actual value signal for the machine voltage is formed by a three-phase precision rectification of the input voltages UR, US, UT. The DC actual value signal AIOPT1 is generated from this signal with a 3rd order active low-pass filter. This is then fed to the control board SDCS-CON-2.

In $16^{2/3}$ Hz applications (V2), the machine voltage input is also three-phase ($3 \times 16^{2/3}$ Hz by means of external R,C,L network). If only one interlinked voltage of the 3-phase machine is available, this is connected to X3:4/5. In this case, the current must be measured in the 3rd phase (see section 7). The filtering effect must be amplified with R1401 - R1403 (see section 6.4)

Machine current (see Fig. 19)

The machine current IR is measured in single phase and rectified. The DC actual value signal AIOPT2 is generated from this signal with a 3rd order active low-pass filter. This is then fed to the control board SDCS-CON-2.

Machine frequency (see Fig. 19)

The machine frequency is measured in the control board SDCS-CON-2 by the incremental encoder interface (IEI). At nominal frequency (50/60 Hz) this requires an input signal of 51.2 / 61.44 kHz. Consequently, the 50/60 Hz square-wave signal generated from U ST must first be prepared for further processing in the control board. This frequency adaptation is performed by a PLL module.

To ensure zero-crossing detection, the machine voltage U ST is processed by an active 30°-filter. Jumpers are used for switching between 50/60 Hz, which ensures a constant phase shift at different operating frequencies.

The permissible range of frequency measurements is 20 to 120 Hz (UNS 1860a), 8 to 80 Hz (UNS 1860b, V1) or 4 to 26 Hz (UNS 1860b, V2). This relatively wide range is necessary in order to guarantee the V/Hz limitations in "off line" operation, i.e. when the machine is not connected to the network. Because of this wide frequency range, a measurement time constant of around 150 ms (UNS 1860a) or 120 ms (UNS 1860b) results. Any disengagement of the PLL circuit (FREQ FAIL) is signalled so that procedures required for safe operation can be initiated by the software. If the power system stabiliser option PSS signal transformer (UNS 0869) is provided, frequency measurement during network operation takes place exclusively by means of the PSS signal transformer UNS 0869 (switchover with ON LINE signal). See section 10 for details on power system stabilisation.

The processed frequency signal (CHA+) is fed to the connectors X2:9/10 on the SDCS-CON-2 control board.

Measurement of active and reactive current (see Fig. 19)

Two signals, shifted by -60° el. and $+30^\circ$ el., are generated at the same time by the PLL module. These signals control the current discriminators for the generation of $I \cdot \cos \varphi$ (active current) and $I \cdot \sin \varphi$ (reactive current).

- The active current signal (AI3+ / AI3-) is fed to the connectors X2:20/19 on the control board SDCS-CON-2.
- The active current signal (AI4+ / AI4-) is fed to the connectors X2:18/17 on the control board SDCS-CON-2.

Active power measurement with UNS 0865 (PSS option on UNS 1860a)

The active power signal Pout is formed by multiplication of the phase current IR and phase voltage UR and is also available to the user at the output X2:4. The Pout signal is then rectified; this allows the necessary stabilisation effect in both motor and machine operation. The dP/dt signal is formed by an adjustable isolating element with a time constant of 1 to 15 s. An external stabilisation signal can be connected via X3:8 instead of the internal active power signal.

Active power measurement with PSS signal transformer UNS 0869 (PSS option on signal processing device UNS 1860b)
(see Fig. 19 and section 10)

The active power signal Pout is formed by multiplication of the phase current IR and phase voltage UR and is output via the I/O interface UNS 0863. The Pout signal is then processed appropriately and passed on to the board SDCS-CON-2. An external stabilisation signal can be connected instead of the internal active power signal.

If the P signal is not used, the input for the external stabilisation signal can be used as an additional analog input.

The frequency measurement function is continually monitored. The status is switched over according to the active measurement and is provided at output DI3 (alarm 121 - Frequency measurement failure).

6.2 Configuration

Connections

Pre-fabricated flat cables are used exclusively for the connections between the signal processing device UNS 1860 and the I/O interface UNS 0863 and the control board SDCS-CON-2. It is essential that the cables specified below to be used:

| UNS 1860 | Connection to | Cable (female) | Ident-No. |
|--|--------------------------|----------------|-------------------|
| X1 | X1 / CON-2 | 26-pole FC | 3BHB002784 P1 * |
| X2 | X2 / CON-2 | 26-pole FC | 3BHB002784 P2 * |
| X1 | X1 / CON-1 | 26-pole FC | HIEE 405177 P1 * |
| X2 | X2 / CON-1 | 26-pole FC | HIEE 405177 P2 * |
| X3 (channel I) | X3 / UNS 0863 | 34-pole FC | HIER 466818 P.. |
| X4 (channel I) | X4 / UNS 0863 | 34-pole FC | HIER 466818 P.. |
| X3 (channel II) | X32 / UNS 0863 | 34-pole FC | HIER 466818 P.. |
| X4 (channel II) | X42 / UNS 0863 | 34-pole FC | HIER 466818 P.. |
| X5 | only for C5 applications | 10-pole FC | HIEE 405248 R0001 |
| X14 | X14 / CON-2 | 10-pole FC | HIEE 405177 P3 * |
| X17 | X17 / CON-2 | 10-pole FC | HIEE 405177 P4 * |
| 15,16,17 | 15, 14 / UNS 0868 | 2-pole cable | cable shielded |
| 15,16,17 | 15, 14 / UNS 0861 | 2-pole cable | cable shielded |
| (*) These cables are supplied with the Signal Processing Device UNS 1860 | | | |

Tab. 4

IMPORTANT: It is essential that the cable between the power supply unit POW-4 and the control board SDCS-CON-2 / (1) (X37) is replaced with the cable X37 which is included with the delivery.

X3/X4: The position number corresponds to the cable length in cm.

6.3 Commissioning and function check

Check all connections in accordance with section 6.2 and settings in accordance with section 6.4, ~~6.5~~. The function check is carried out together with that for the entire system.

6.4 Setting values

Setting the operating frequency (S401, S402)

50 Hz operation, S401 **and** S402 open
 60 Hz operation, S401 **and** S402 closed and soldered

UNS 1860 b, V2:
 16²/₃ Hz operation, S401 **and** S402 open

Both solder bridges must be set to **the same position**, otherwise function is not guaranteed.

Factory setting 50 Hz

Machine voltage measurement, (1/3-phase)

3-phase measurement 50/60 Hz: R1401, R1402, R1403 68 kΩ

Single-phase measurement 50/60 Hz: R1401, R1402, R1403 150 kΩ
 at X3:4 and X3:5

3- phase measurement 16²/₃ Hz: R1401, R1402, R1403 182 kΩ

6.5 Control and configuration elements

2 solder bridges for selection of the machine frequency

R1401 to R1403 resistors 0.25 W / ±2 % according to ABB standard GJTN163010

Analog input AI 1

P or ΔP-signal from PSS signal transformer

UNS 0869 or UNS 0865 PSSin-Signal S100 = Pos1

or other analog input from I/O interface

UNS 0863 (X3:8) S100 = Pos2

Excitation current measurement to I/O interface UNS 0863 (X3:7)

I_e = 5V at nominal converter current R1404 = ON

I_e = 3V at nominal converter current (replacement for UNS 1860a) R1404 = OFF

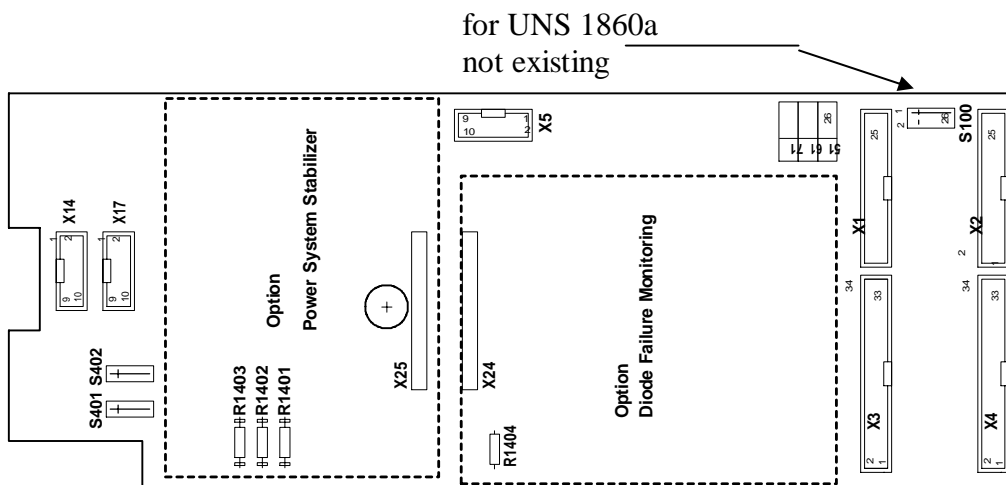


Fig. 21 Location of the control and adjustable elements on the UNS 1860 board

7 AC actual value measurement interface UNS 0862

Features

- 3-phase voltage measurement with galvanic isolation
100 to 110 to 120 V / 4.55 to 5 to 5.45 V, 50/60 Hz
- Single-phase current measurement 5 or 1 A at 3 V (AC voltage)
- Used in combination with the digital I/O interface UNS 0863
 - Connection with I/O interface UNS 0863 via flat cable
 - Inputs via spring-clamp terminals
 - Standard dimensions for screwing onto aluminium board

Short description

The AC actual value measurement interface UNS 0862 is used for measuring the machine voltage and the machine current within the UNITROL[®] F excitation system.

In order to measure the actual voltage value, the 3-phase machine voltage is galvanically isolated by means of transformers in V-connection and adapted to electronics level.

The single-phase current is also measured by means of transformers for galvanic isolation and adaptation to electronics level.

A variable load is present on the secondary side which converts the current signal into a proportional voltage.

The signals generated in this way are fed in parallel to the two connectors X11 and X12.

Spring-clamp terminals are provided on the input side.

Connection to the I/O interface UNS 0863 is by flat cable.

Signal connections

4 mm² double spring-clamp terminals are used for the input connections for machine voltage and machine current.

Two conductors (wire or strand) may be connected per terminal.

7.1 Functional description

Schematic diagram

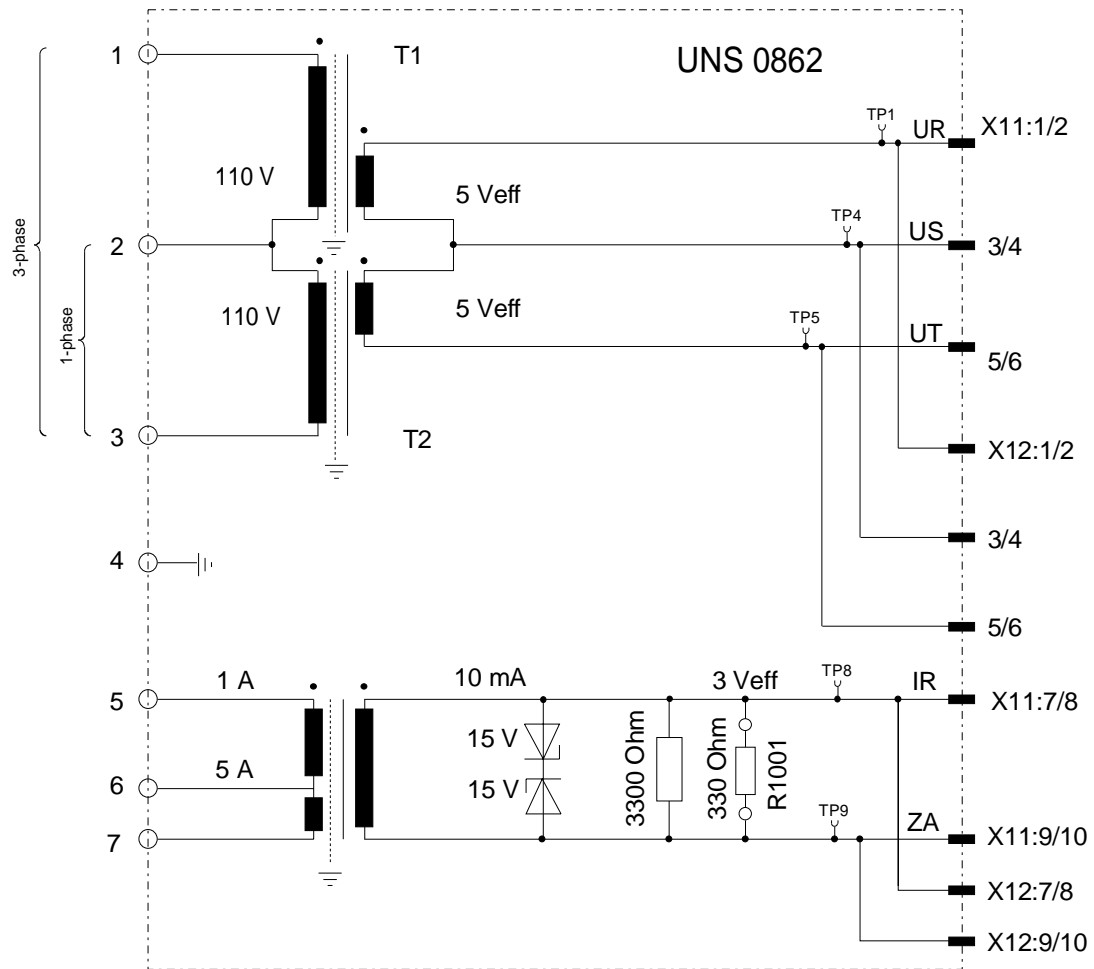


Fig. 22 Block diagram of AC actual value measurement interface UNS 0862

7.1.1 Main data

Machine voltage 50/60Hz

| | |
|---------------------------------------|---------------------------------|
| Cl. 1 to 3 (3-phase) Cl 1-2 (1-phase) | 3(1)x100 to <u>110</u> to 120 V |
| continuous | ≤130% |
| linear up to | 150% |
| Power consumption (per phase) | ≤0.5 VA |

Machine nominal current 50/60Hz

| | |
|-------------------------------|---------|
| Cl. 5-7 (1A) to Cl 6-7 (5A) | 1/5 A |
| continuous | ≤150% |
| linear up to | 300% |
| Power consumption (per phase) | ≤0.5 VA |

7.2 Configuration

Load for current measurement

In the basic configuration, a load resistor of 330 Ω is used for current measurement. Together with the permanently installed parallel 3.3 kΩ resistor, this results in a total load of 300 Ω. The load resistor, which can be soldered in place, must comply with the standard XN 400323.

7.3 Commissioning and function check

At a primary nominal AC voltage of 110 V, the secondary nominal AC voltage is 5 V.

At a primary nominal AC current of 1 or 5 A, the load AC voltage is 3 V (applies to basic configuration).

The output signals are passed to test points.

The test points are arranged in such a way that a 10-pin flat cable plug connector in accordance with HETT 401363 P1 can be plugged in.

The connector in accordance with HETT 400060 P3 is to be used for individual connections.

High-impedance instruments should be used for the measurements.

7.4 Setting values

Current measurement

| | |
|--|---|
| Output voltage | $(I_p/5(1A)) * 10 \text{ mA} * R_{\text{load}}$ |
| Max. load per resistor | 0.33 W |
| Resistor type | XN 400323 |
| Factory configuration | R1001 = 330 Ω |
| (permanently soldered-in parallel resistor 3.3 kΩ) | |

$$R_{\text{load}} = 1 / (1/3300 + 1/R1001)$$

with R1001 = 330 Ω -> 300 Ω

7.5 Location of control elements

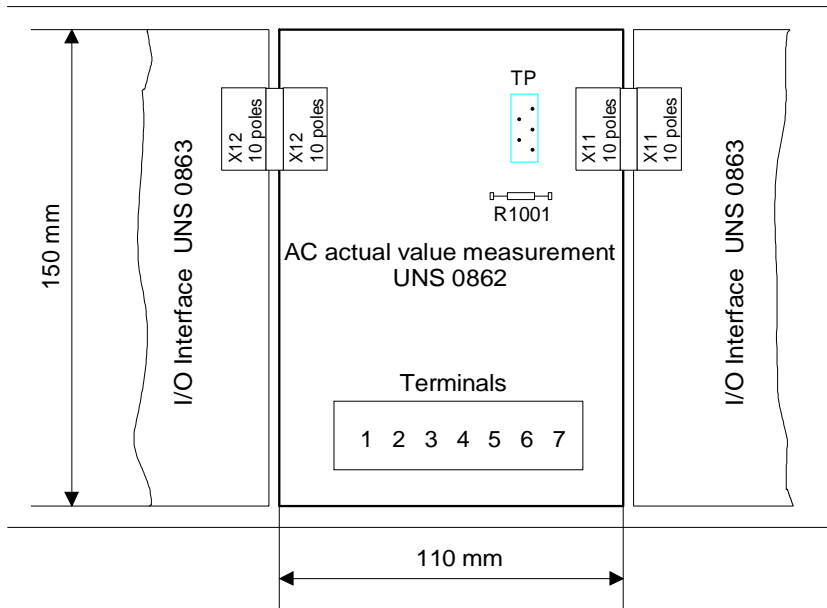


Fig. 23 Location of control elements

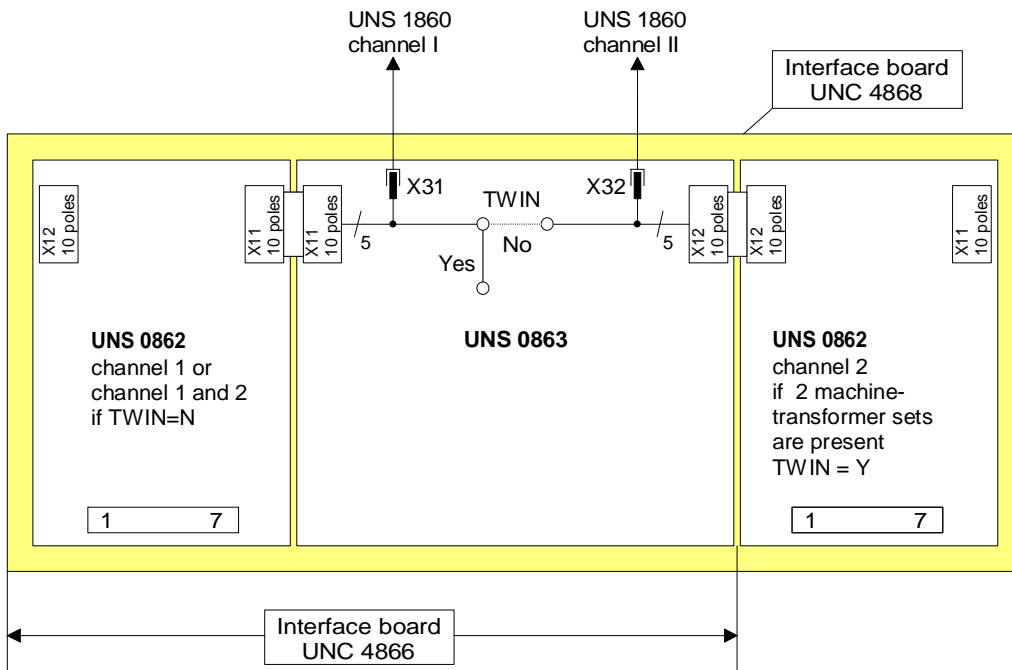


Fig. 24 Positioning on the different interface boards

8 I/O interface UNS 0863

Features

- I/O interface device between process and signal processing device UNS 1860
- 16 galvanically isolated digital inputs for 24 VDC nominal voltage
- 18 output relays with switchover contacts for 250 VDC and AC voltage
- 4 analog outputs from the active channel
- 2 analog inputs (voltage or current inputs) ± 10 V or ± 20 mA
- Analog input for external stabilisation signal
- Test points for checking the analog actual values of the signal processing device UNS 1860

Short description

The I/O interface UNS 0863 provides the connection between the binary process signals and the signal processing device UNS 1860, which is part of the entire converter unit. The AC measured values, 3x U and 1x I from the first machine transformer set are picked up by the AC actual value measurement interface UNS 0862 at connector X11 and fed to channel I. If only one machine transformer set is provided for a 2-channel system, the same measured values are also fed to channel II; the jumper TWIN must be set to position N for this purpose.

If two machine transformer sets are provided in a 2-channel system, a second AC actual value measurement interface UNS 0862 is connected to connector X12. This means that both channels receive independent AC measurement signals; the jumper TWIN must be set to position Y for this purpose.

A total of 4 analog outputs are provided. With the option PSS signal transformer UNS 0869 V2, two outputs are used for excitation current and machine power. The two others can be parameterised and are available for the output of signals for customer use. In 2-channel systems, the signals are taken from the currently active channel.

2 parameterisable analog inputs are provided, e.g. for reference values of superimposed regulators.

Connections

X4, X5, X6 (customer terminals) 2.5mm² cage spring-clamp terminals

Only one conductor (wire or strand) may be connected per terminal!

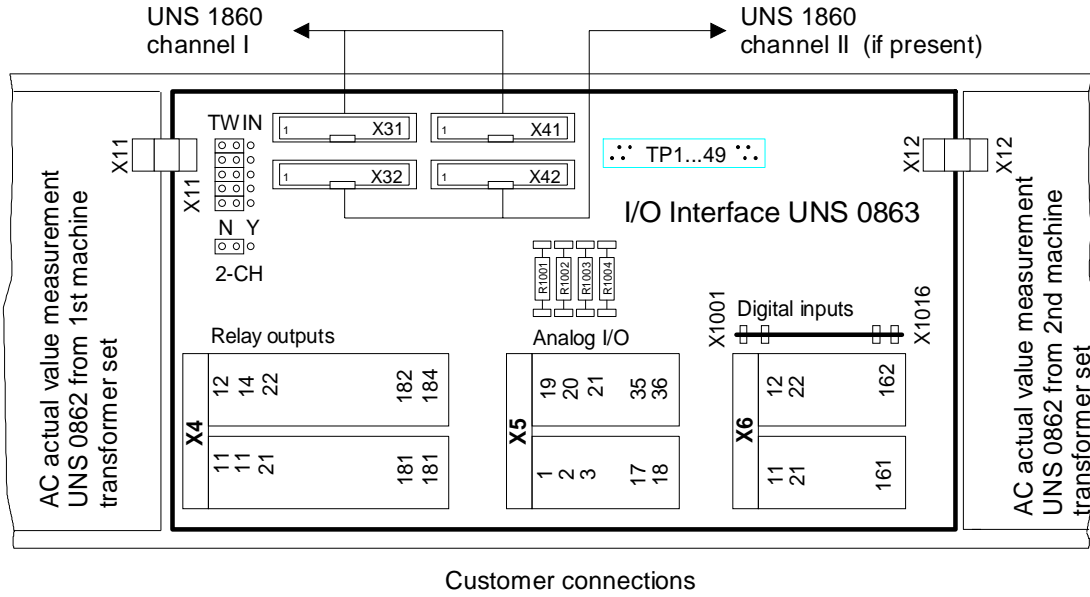


Fig. 25 Configuration of the connections

8.1 Functional description

8.1.1 Schematic diagram

Digital inputs

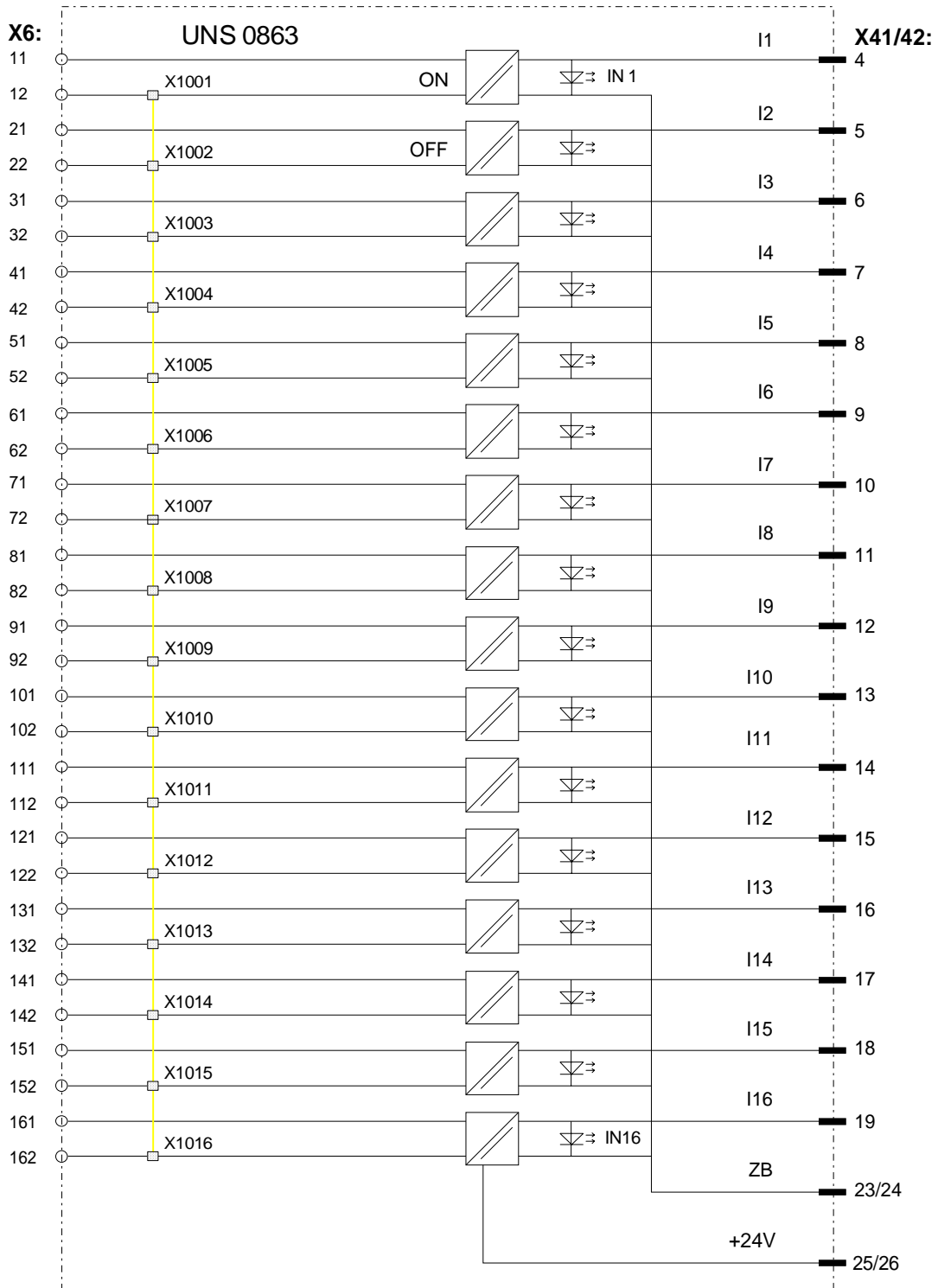


Fig. 26 Block diagram of digital inputs

Analog signals

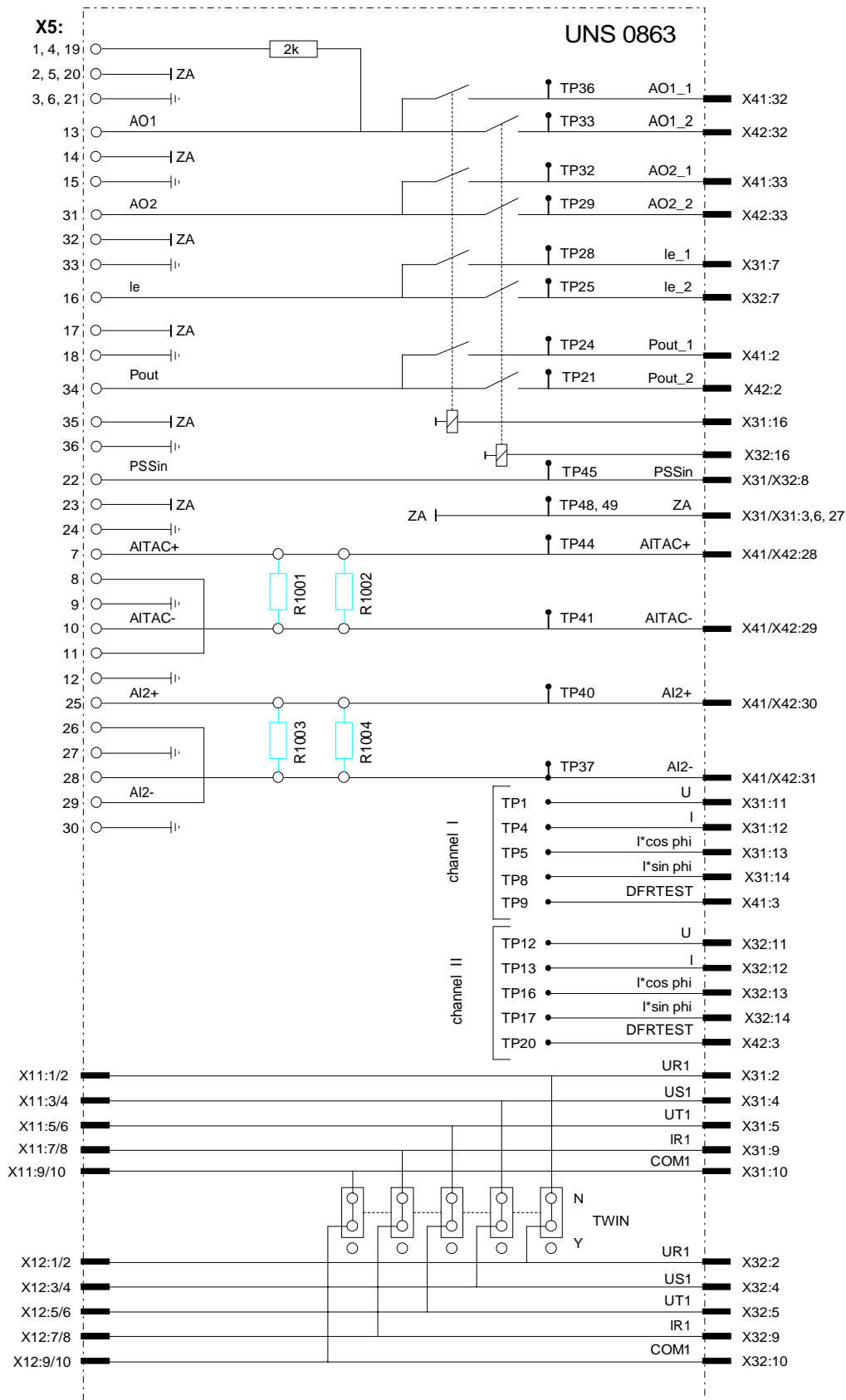


Fig. 27 Block diagram of analog signals

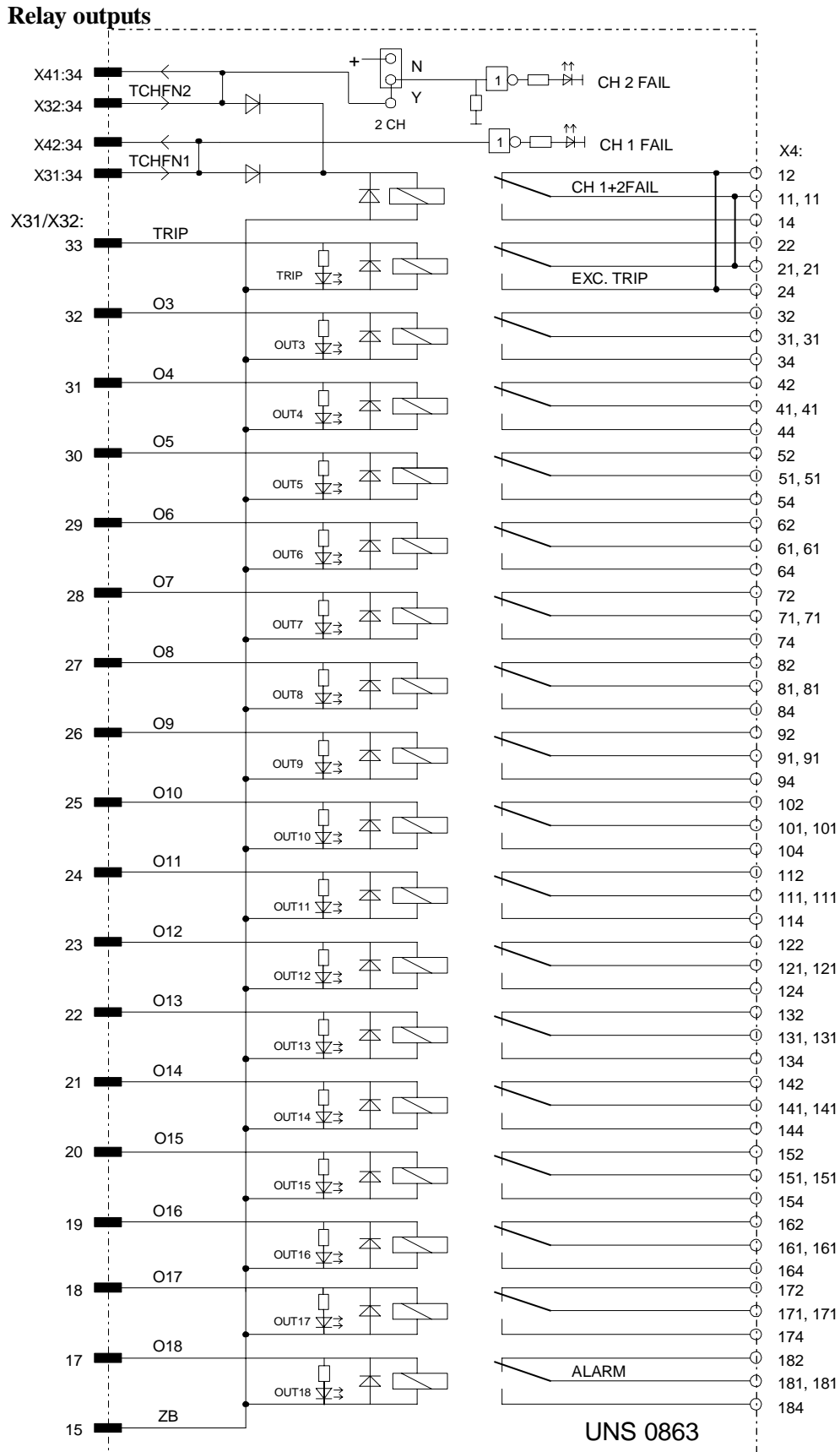


Fig. 28 Block diagram of relay outputs

8.1.2 Signal processing

Digital inputs (see Fig. 26)

Number: 16 digital inputs for 24 V; galvanically isolated.

Main data

| | |
|-------------------------------|----------------------|
| Input voltage | 20.5 to 24 to 28 VDC |
| logical 1 | ≥18 V |
| logical 0 | ≤10 V |
| Power consumption (per phase) | ≤0.5 VA |
| Input delay | 3.6 ms ±20% |
| Test voltage | 1.5 kV 1 min |

The +24 VDC interrogation voltage for the 16 external customer contacts is supplied by the power supply unit UNS 0868. The LED's IN 1 to 16 indicate activated inputs. Each input is galvanically isolated by means of an optocoupler. In the basic version of the device, all digital inputs have the same reference potential, i.e. all the soldered bridges X1001 to X1016 are connected to one another. If independent inputs with send and return conductors are required (e.g. from SPS drivers), then the corresponding inputs can be configured by disconnecting (cutting out) the reference potential connection.

The +24 VDC supply voltage for the optocouplers is provided by the output (6, 7) of the power supply unit UNS 0868, which is decoupled by means of a diode. This allows redundant voltage supply in 2-channel configurations.

Relay outputs (see Fig 28)

Number: 18 relays with switchover contacts.

The LED's OUT 3 to OUT18 indicate activated relays.

Main data

| | |
|----------------------|---|
| Relay outputs | ≤250 VAC/DC |
| Inrush current ≤16 A | |
| Continuous current | ≤2 A |
| Switch-off power | ≤1000 VA at cosφ ≥0.3 ≤50 W at L/R ≤0 ms |

The following outputs are assigned special functions:

- X4:11, 12, 14
CHANNEL I & II FAIL (relays breaks off if both channels are defective)
Individual faults are indicated by the LED's CH I FAIL and CH II FAIL
- X4:21, 22, 24
EXCITATION TRIP (relays and LED TRIP activated if TRIP signal is present)
- X4:181, 182, 184
COMMON ALARM (relays and LED OUT18 are activated if alarm signal is present)

Analog inputs (see Fig. 27)

The analog inputs are not galvanically isolated.

Main data

| | |
|-----------------------------------|---|
| Analog inputs AITAC / AI2 / PSSin | ±10 VDC max ±15 VDC |
| Input resistance | 200 kΩ |
| Analog input AI1 | ±10 VDC corresponds to ±10'000 DEZ can only be scaled via FB's |

The following input signals are provided for both channels:

- AITAC, AI2 are differential inputs and can be assigned to internal SP inputs by means of parameters in the UNITROL® F software. (SP = Standard Program blocks)
For current input signals, the associated load resistors R1001 to R1004 must be adapted.
- Analog input PSSin for an external stabilisation signal (only with the option PSS signal transformer UNS 0869).

Analog outputs (see Fig. 27)

The analog outputs are not galvanically isolated, the reference potential is ZA.

Main data

| | |
|---|---|
| Analog outputs AO1 / AO2 | ±10 VDC ≤4 mA |
| Ie at nominal converter current (UNS 1860, R1404 ON) | +5 VDC ≤4 mA |
| Ie at nominal converter current (UNS 1860, R1404 OFF) | +3 VDC ≤4 mA |
| Analog output Pout | $U_A = U_{PT}/110 \text{ V} \times I_{CT}/1(5) \text{ A} \times R_B/300 \text{ W} \times 5 \text{ V}$ |

UPT: Voltage of the secondary transformer at Un

ICT: Current of the secondary transformer at In

RB: $1 / [1/R1001(\text{UNS } 0862) + 1/3300]$ factory setting R1001= 330 Ω

The output signals are always generated by the active channel. The necessary selection is made, through relay, by the UNITROL® F software.

The following analog output signals are provided:

- AO1 and AO2 can be defined by parameters. The AO1 output is additionally provided as an output with 2 kΩ internal resistance. This output is used for self-regulation, compensation circuits, joint control, etc.
- Ie Field current
- Pout Active power signal (only with the option PSS signal transformer UNS 0869 on signal processing device UNS 1860)

Test points

All analog signals are fed to test points. These signals are mainly used for commissioning and maintenance work. The test points are arranged in such a way that a 50-pole flat cable connector (female) in accordance with HETT 401363 P6 can be plugged in. The connector in accordance with HETT 400060 P3 is used for individual connections.

8.2 Configuration

Conventional flat cables are used for the connections between the I/O interface UNS 0863 and the signal processing device UNS 1860.

It is essential that the cables specified below to be used:

- Connectors X31, X32, X41, X42:
34-pole flat cable in accordance with HIER 466818 P...
The position number represents the cable length in cm, e.g. P0100 corresponds to a cable length of 1 meter.
- Connectors X11, X12
10-pole flat cable in accordance with HIEE 405181 P1
This flat cable is supplied with the UNS 0862 delivery.

Where two UNS 0862 AC actual value measurement devices are used, the bridges TWIN must be set to position Y.

In 2 channel systems, the bridge 2-CH must be set to position Y.

Where current signals are used for the analog inputs, the load resistors R1001 to R1004 must be adapted accordingly. In the basic configuration, R1001 to R1004 are not soldered in.

The device is grounded via the fixing bolts on the interface carrier UNC 4866 (600 mm system with one I/O interface UNS 0862) or the interface carrier UNC 4868 (800 mm system with one or two I/O interfaces UNS 0862). The interface carrier is grounded in accordance with the installation instructions.

8.3 Commissioning and function check

Connections

Check all connections to the devices:

- I/O interface UNS 0862
- signal processing device UNS 1860

Check the flat cables specified in section 8.2.

TWIN configurations

Check for two machine transformer sets.

If two UNS 0862 AC actual value measurement devices are used, the TWIN bridges must be set to position Y.

In 2-channel systems, the bridge 2-CH must be set to position Y.

Reference potential of the digital inputs:

Only one return conductor can be used for digital inputs with the same reference potential. In the basic configuration, the bridges X1001 to X1016 are connected with one another. If separate input channels are required, these are to be disconnected from the others.

Example: input 121-122 is isolated.

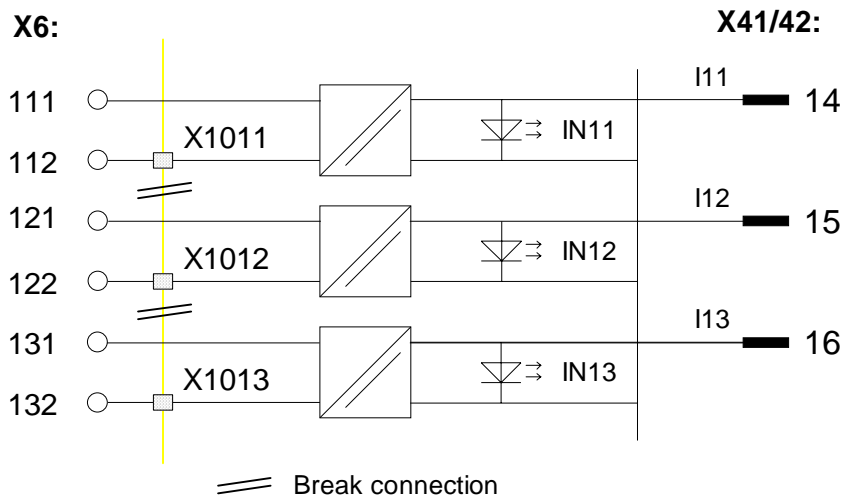


Fig. 29 Configuration of the digital inputs on the I/O interface board UNS 0863

Inputs/outputs

The correct parameterisation of the following analog signals is to be checked by the software:

- AO1 Analog output 1
- AO2 Analog output 2
- AITAC Analog differential input with load resistor R1001/R1002
- AI2 Analog differential input with load resistor R1003/R1004

Activated digital inputs are indicated on the secondary side by the LED's IN1 to IN16.

Activated digital outputs (relays) are indicated by the LED's OUT3 to OUT18, TRIP and CH I FAIL. In 2-channel configurations, the LED CH II FAIL is also activated.

High-impedance instruments with galvanically isolated power supply should be used for the measurement of all analog signals.

8.4 Setting values

Load resistors of the analog inputs AITAC and AI2

Approved load resistors in accordance with ABB standard XN 400 323
 Max. power loss per load resistor 0.3 W

2-CH and TWIN bridges

In 2-channel systems (2x UNS X87X) the bridge 2-CH must be set to position Y.

For operation with two UNS 0862 AC actual value measurement devices, the bridge TWIN must be set to position Y.

The factory setting for both bridges is position N.

8.5 Location of control elements

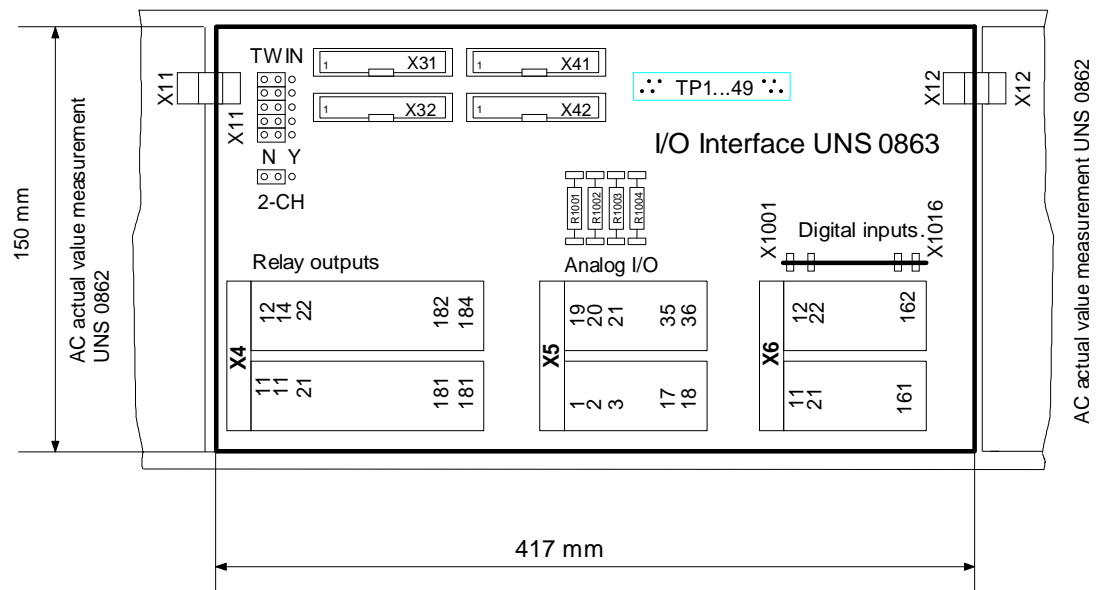


Fig. 30 Location of control elements on I/O interface UNS 0863

9 Extended I/O card UNS 0867 V1/V2 (option)

FEATURES

- Extended I/O card between I/O interface UNS 0863 and SDCS-CON-2 board
- 16 digital inputs for 24 VDC voltage
- 19 digital outputs for 24 VDC voltage
- 1 analog differential input in version 2
- 1 analog differential input (electrometer circuit) in version 2
- 2 analog outputs in version 2

SHORT DESCRIPTION

The extended I/O card UNS 0867a-P provides an additional connection between the SDCS-CON board and the I/O interface UNS 0863 for additional process signals. The card features 16 digital inputs, 19 digital outputs and, in section 2, also 2 analog differential inputs and 2 analog outputs. The card is plugged into connector X21 of the SDCS-CON-2 board and is supplied with power from connector X37 via flat cable.

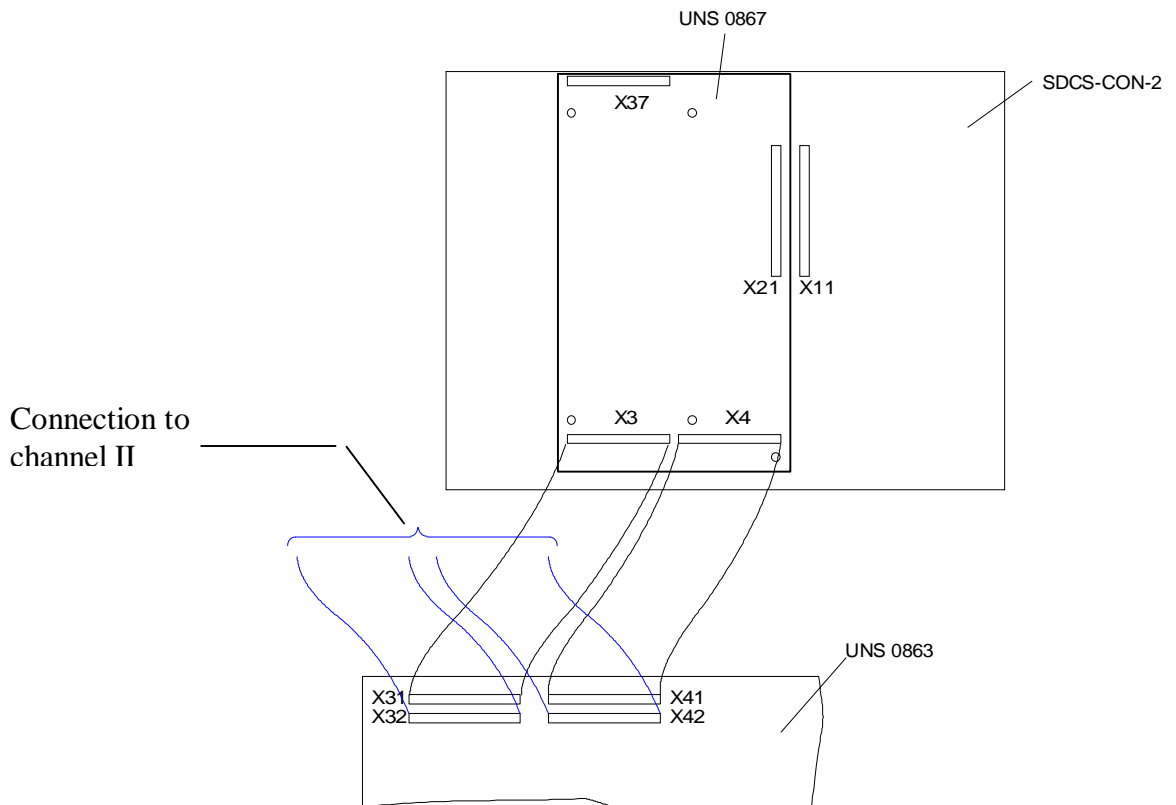


Fig. 31 Connections to extended I/O card UNS 0867

9.1 Functional description

9.1.1 Schematic diagram of extended I/O card UNS 0867

The analog section shown is only featured in version 2

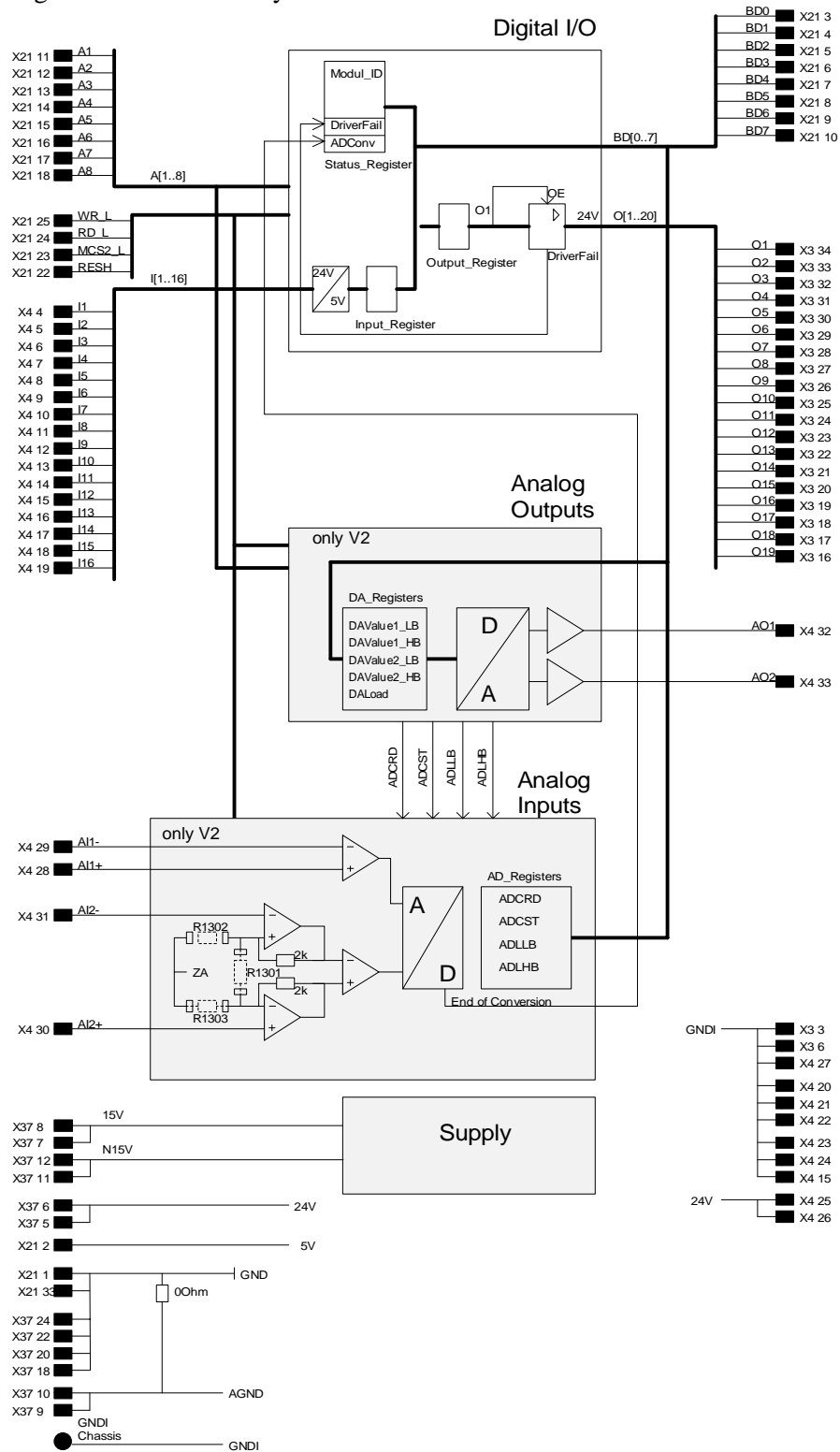


Fig. 32 Schematic diagram of extended I/O card UNS 0867

9.1.2 Digital 24 V input/output signals

Digital 24 V input signals

The 16 digital 24 V input signals are stored in two buffers and can be read via two 8-bit registers in the address range IRegLB and IRegHB.

Digital 24 V-output signals

The 19 digital 24 V output signals are fed via a buffer to short-circuit-proof drivers. The digital output O1 serves as Output Enable for the 24 V drivers, output O19 switches the relay to the I/O interface UNS 0863, which in turn switches over the analog signals in 2-channel systems.

9.1.3 Analog input / output signals

(only with extended I/O card UNS 0867a-P, V2)

Analog input signal +AI1, -AI1

This analog input is provided via the differential inputs AI1-, AI1+. The analog voltage value within the range +/-10 V is fed to a 12-bit analog-digital converter. The converter can be read in the address range ADCRD, ADCST, ADLLB and ADLHB. The conversion time per channel is 8 us.

Analog input signal +AI2, -AI2

This analog input is provided via two impedance transformers on the inputs AI2-, AI2+ (electrometer circuit). The conversion ratio can be set by means of the exchangeable resistor R1301. The resistors R1302 and R1303 are not fitted (see section on Configuration).

Input AI2 can also be used as a normal differential amplifier input, in which case R1301 is not fitted. The amplification of the inputs -AI2 and +AI2 can be adjusted by means of the resistors R1302 and R1303 (see Configuration).

The converter can be read in the address range ADCRD, ADCST, ADLLB and ADLHB. The conversion time per channel is 8 us.

Analog output signals

The 2 analog output signals are fed via a 12-bit digital-analog converter and output via an operational amplifier within the range +/-10 V. The digital-analog converter is addressed via the address area DAValue1_LB, DAValue1_HB, DAValue2_LB, DAValue2_HB and DALoad.

9.2 Configuration

(only with extended I/O card UNS 0867a-P, V2)

The analog input AI2+, AI2- is designed as a differential amplifier (instrumentation amplifier). The amplification can be predetermined with the resistor R1301, the resistors R1302 and R1303 are not fitted;

$$U_a = 1 + \left(\frac{2 * 2kOhm}{R1301} \right) * (U_{AI2+} - U_{AI2-})$$

If AI2 is used as a normal differential input, R1301 is not fitted and the read voltage value is calculated as follows:

$$U_a = U_{AI2+} * \left(1 + \frac{2kOhm}{R1303} \right) - U_{AI2-} * \left(1 + \frac{2kOhm}{R1302} \right)$$

In the standard configuration, R1301, R1302 and R1303 are not fitted.

9.3 Commissioning and function check

The extended I/O card UNS 0867 is fitted to the connector X21 while the device is switched off and fixed in place with 4 screws (screw attachment is important because of the electrical connections). The power supply is provided, via the special flat cable which is supplied, from connector X37 on the power supply unit POW-4.

The I/O interface UNS 0863 is connected via the connectors X3 and X4. Now the power supply can be switched on.

The function check must be carried out by actuating the extended I/O card UNS 0867 by means of the application software. The I/O signals can also be controlled or forced using the terminal or the CMT software tool.

If a short circuit occurs in the digital output signals, the signal DriverFail is generated. This status is stored and leads to all 19 outputs being switched off by the software. The user can reset this status by software, from the terminal, using the CMT software tool or through a logical 0 signal at output O1.

9.4 Monitoring functions

The drivers of the digital output signals are short-circuit-proof. If a short-circuit occurs, the driver is switched off. The signal DriverFail indicates this status and is read via the Status_Register (DriverFail = log. 0 means that a digital output has detected a short circuit).

The signal ADConv indicates that the analog-digital converter is ready to read the converted analog input voltages (ADConv = log. 0 means that the converter holds the data ready for reading).

9.5 Configuration elements

Configuration elements: R1301 to R1303 resistors 0.25 W/ 2% in accordance with ABB standard GJTN 163010

9.6 Connections

X3: flat cable connector, 34-pole
X4: flat cable connector, 34-pole
X21: extension card connector, 36-pole
X37: special flat cable connector, 26-pole

Note: Where the extended I/O card UNS 0867 is used in the UNITROL[®] F system, the cable connector must be used with connector 1 interrupted.
In all other applications, this connector on the cable must be cut off and the remaining connector plugged into the power supply unit (POW-4).

10 PSS signal transformer UNS 0869 (option)

Features

- Optional module for the attenuation of rotor oscillation
- Sub-board, can be plugged onto the signal processing board UNS 1860
- Formation of active power P
- Vectorial formation of rotor voltage $E_{p'}$
- Formation of frequency signal of rotor voltage

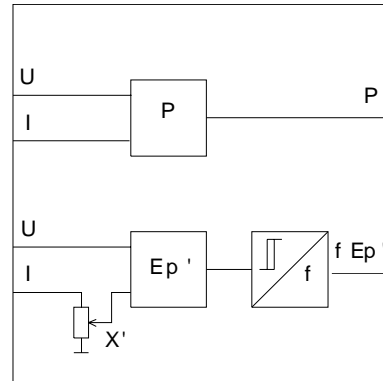


Fig. 33 Overview of function

Short description

The power system stabiliser is used to attenuate rotor oscillations in synchronous machines through additional influencing of the excitation. The power system stabiliser is preferably used with static excitation systems.

The power system stabiliser essentially consists of the following functions:

- **P signal**

The DC voltage signal P proportional to the active power is generated by multiplication of the voltage signal U_R and the current signal I_R . This signal is provided at output X25:8 for the analog input AI1 and is available to the user at output X25:12.

- **Frequency signal of the machine terminal voltage or rotor voltage**

The frequency value of the machine or rotor voltage is calculated internally by the software in the CON-2 board. A frequency signal with $f = f_n * 1024$ i.e. 51.2 / 61.44 kHz for $f_n = 50/60$ Hz is provided at output X25:11 for frequency calculation in the CON-2 board. The frequency measurement only functions for 50/60 Hz operation. Operation outside of the permitted limits is indicated by means of the `FREQ_FAIL_B` signal at connection X25:9.

The rotor voltage is formed by addition of the vectors U_{S-T} and $I_R * X'$. The value of the vector $I_R * X'$ is set using DIL switch S101.

10.1 Functional description

10.1.1 Schematic diagram

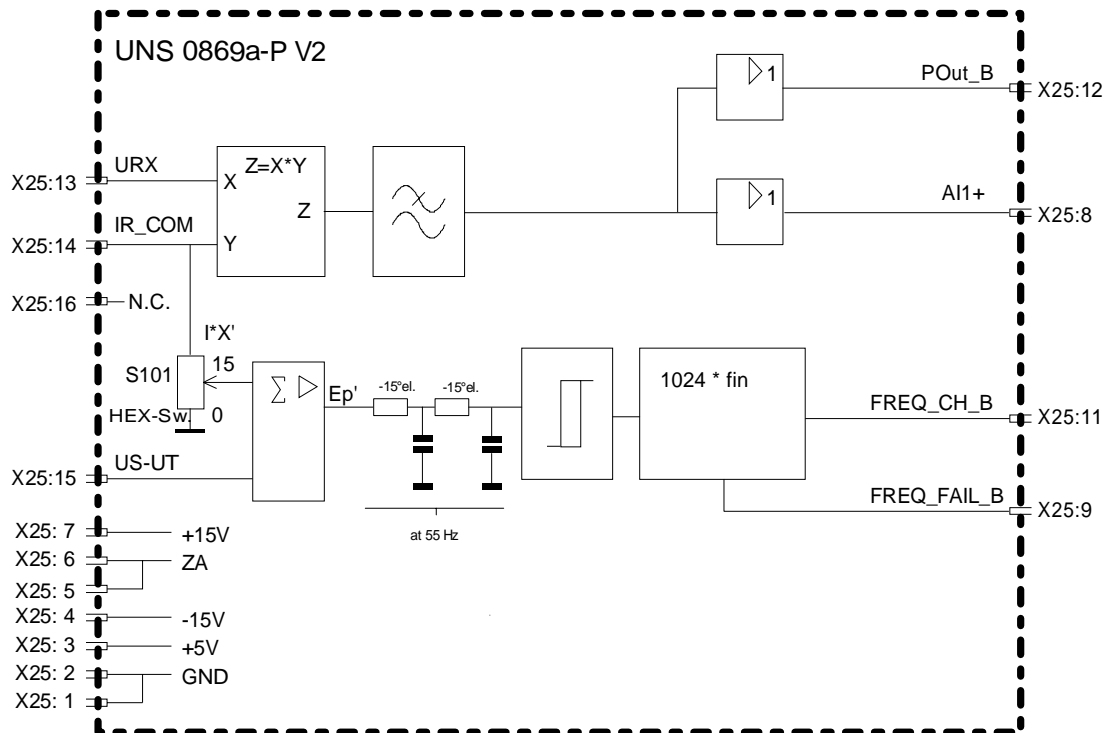


Fig. 34 Block diagram of PSS signal transformer UNS 0869

Explanation of signal names

| Signal name | I/O | Description |
|-------------|--------|--|
| US_UT | Input | Machine voltage US-T |
| IR_COM | Input | Machine current IR |
| URX | Input | Phase voltage UR |
| POut_B | Output | Active power $P = UR * IR$ |
| FREQ_CH_B | Output | Machine frequency * 1024 = 51.2 / 61.44 kHz |
| FREQ_FAIL_B | Output | Signals whether the input frequency is too low |
| AI1+ | Output | Active power $P = UR * IR$ |

Tab. 5 Signal names for PSS signal transformer UNS 0869

10.2 Configuration

Positioning of the sub-board

The PSS signal transformer UNS 0869 sub-board is plugged into the basic board, the signal processing device UNS 1860b, at connector X25 and fixed in place with the screws provided.

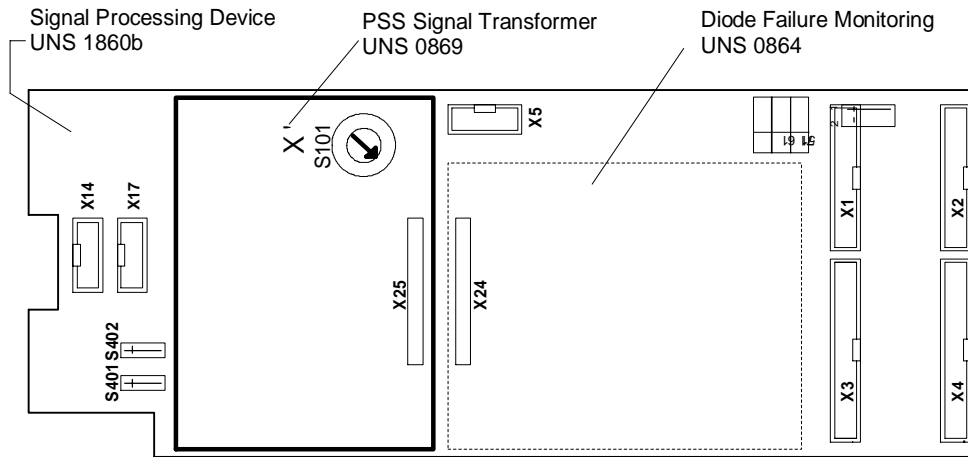


Fig. 35 Installation position of the PSS signal transformer UNS 0869 sub-board

10.3 Commissioning and function check

The function of the power system stabiliser can only be checked along with the entire system. A separate PC program is required for calculation of the parameters.

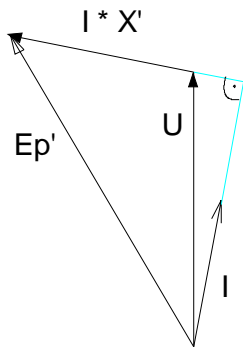
The PSS signal transformer UNS 0869 is not accessible from the front; No measurements need to be carried out on the sub-board.

Checking on network: see commissioning instructions

10.4 Setting values

Vectorial formation of the rotor voltage

Formation of vector $E_{p'}$



General

$$\vec{E}_{p'} = \vec{U} + \vec{I} * X_q$$

Special in UNITROL-F system

$$\vec{E}_{p'} = \frac{5V * U_{w \text{ sek}}}{110 V} + \frac{3V * I_{w \text{ sek}}}{5A/1A} * \frac{R_b}{300 \text{ Ohm}} * X'$$

- E_p Rotor voltage of the machine
- $E_{p'}$ Internal rotor voltage generated by transformer
- X_q Longitudinal reactance of the synchronous machine
- $U_{w \text{ sek}}$ Secondary voltage of the machine voltage transformer at nominal machine voltage
- $I_{w \text{ sek}}$ Secondary current of the machine current transformer at nominal machine current
- 5 A/1 A Corresponding current transformer input in the AC actual value measurement interface UNS 0862a-P
- R_b Current load resistance in the AC actual value measurement interface UNS 0862a-P
- X' Effective machine reactance during rotor oscillations, adjustable with S101

| | | | | | | | | | | | | | | | | |
|-------------|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| S101 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F |
| X' [p.u.] | 0 | 0.2 | 0.4 | 0.6 | 0.8 | 1.0 | 1.2 | 1.4 | 1.6 | 1.8 | 2.0 | 2.2 | 2.4 | 2.6 | 2.8 | 3.0 |

Tab. 6 Setting of X' with DIL switch S101

10.5 Control and configuration elements

DIL switch (formation of rotor voltage) S101

10.6 Monitoring

FREQ_FAIL_B

input frequency (US_UT, IR_COM) <38.2 Hz (TTL level) >2.40 V
 input frequency (US_UT, IR_COM) ≥38.2 Hz (TTL level) <0.45 V

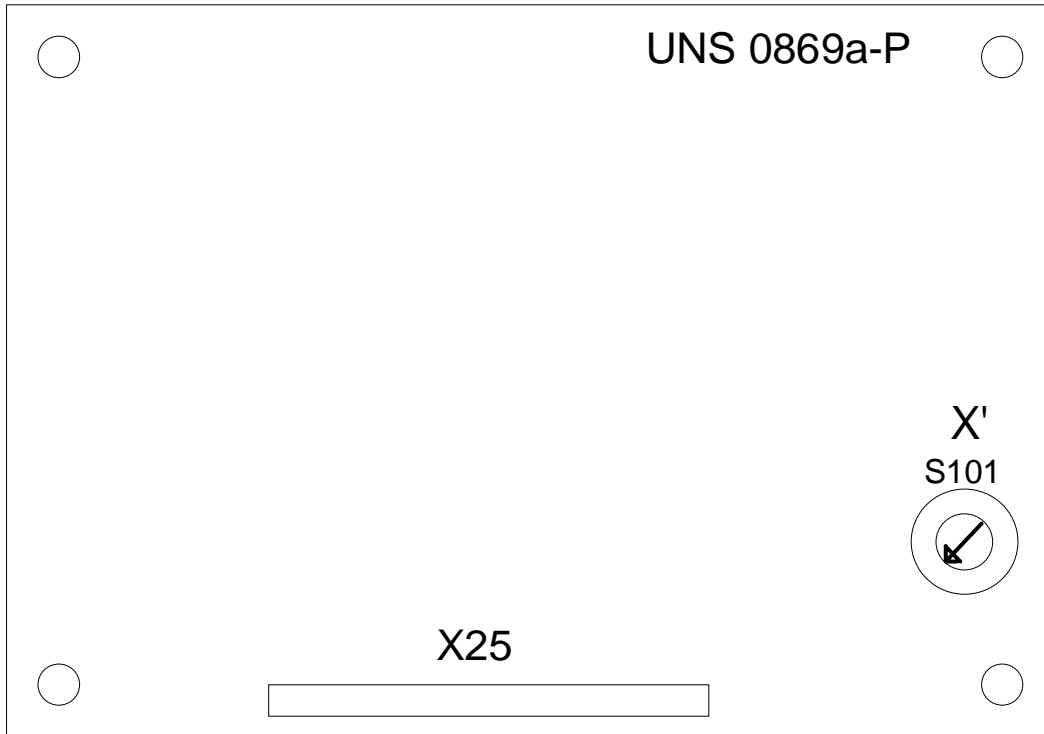


Fig. 36 Location of control elements on PSS signal transformer UNS 0869

11 Diode failure monitoring UNS 0864 V1/V2 (OPTION)

Features

- Monitoring of defective rotating diodes in the exciter circuit
- Sub-board, can be plugged onto signal processing board UNS 1860
- Adjustable level for triggering of alarm signal in relation to IACT
- Adjustable level for triggering of trip signal in relation to IACT
- Frequency divider adjustable using DIL switch
- Delay time adjustable using DIL switch
- Adjustment of band pass filter proportional to speed
- Adjustable bandwidth, 8th order
- Exciter frequency: V1 -> $f_E = 33$ to 300 Hz
V2 -> $f_E = 17$ to 38 Hz

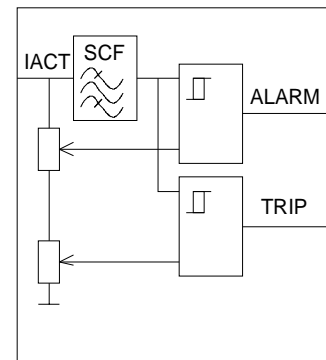


Fig. 37 Overview of function

Short description

The diode failure monitoring is used with brushless exciter machines for monitoring the rotating diodes.

The device evaluates the alternating current induced in the field circuit of the exciter in the event of a fault in the rotating rectifier.

The ALARM is triggered in the event of a broken branch in the rotating exciter (or after the branch fuse has blown due to a diode short circuit).

The TRIP is triggered in the event of a branch short circuit in the rotating exciter (no branch fuse present).

The frequency of the induced alternating current corresponds to the exciter machine frequency f_E .

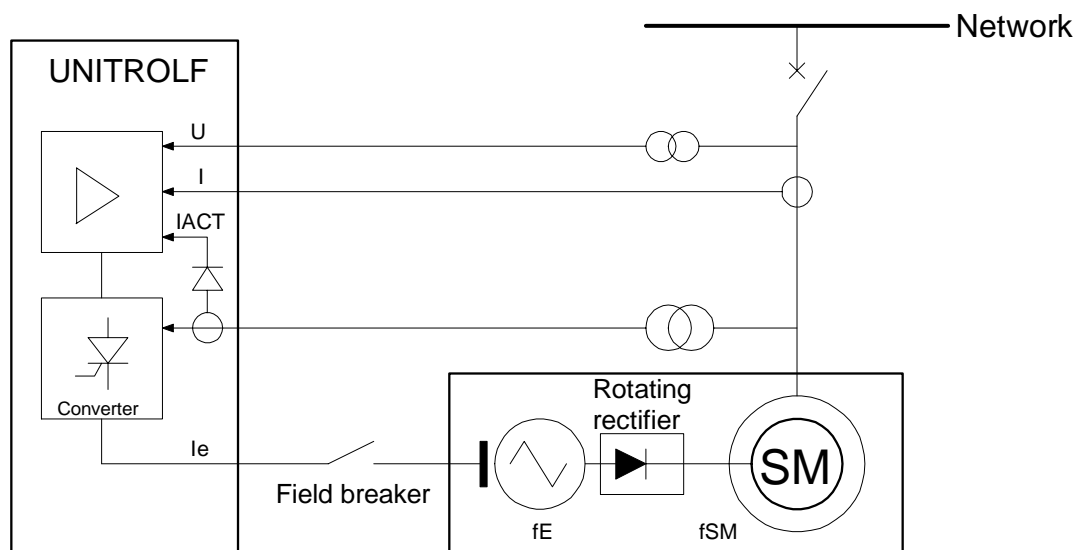


Fig. 38 Basic circuit diagram of the diode failure monitoring UNS 0864

11.1.2 Signal processing

Selective filter

A selective band pass filter of the eighth order, designed with a Switched Capacitor Filter (SCF), filters the frequency which is to be evaluated out of the exciter current signal. This is identical to the exciter machine frequency f_E . This filtering-out is necessary in order to prevent a false response in the event of 2-phase short circuits or earth faults in the synchronous machine. At the same time, this filter suppresses other harmonics in the exciter current which, for example, are caused by the converter itself. The SC filter is clocked in synchronisation with the machine frequency (rotational speed). The mid-frequency of the band pass filter is thus always adjusted to the exciter machine frequency f_E . This guarantees correct function over a wide frequency range from 20 to 200% f_n . Since the number of pole pairs in the exciter machine is usually greater than or equal to the number of pole pairs in the machine, the nominal clock frequency of the SC filter must be set by means of a frequency divider (4-pole DIL switch S15). This allows exciter machines in the frequency range of 30 to 300 Hz to be monitored. The output of the filter (DFRTEST) is passed via the bridge S21 (Pos1) to X24:16 and is available on the I/O interface UNS 0863 (TP9(K1)/TP20(K2)). Conversely, a test signal can be sent to the filter input via S21 (Pos2).

Trigger level

Since the amplitude of the induced ripple signal is proportional to the exciter current of the machine, the trigger levels of the signals DALARM and DTRIP can be derived from the actual current value I_{ACT} of the exciter machine. For this purpose, the I_{ACT} signal is first processed through a low pass filter; the time constant of this filter must correspond to the exciter time constant. The filter time constant can be set using R1001/R1002.

Evaluation

In the event of a fault, a distinction can be made, from the amplitude of the induced ripple signal, between a broken connection (diodes with fuses) and short circuit in a rectifier branch. In the event of a broken connection, the DALARM signal is generated; the synchronous machine can continue to be operated. A large relative ripple current is interpreted as a short circuit. The DTRIP signal is generated and, in order to protect against internal damage, the synchronous machine must be de-excited as quickly as possible. The DTRIP signal directly controls the EXCITATION TRIP relay, independently of the software, which ensures immediate shutdown. At the same time, the DTRIP signal is processed in the software and indicated as fault 39 (Rot. rect. short circuit). The DALARM signal is used in the software to start up an alarm timer and is indicated as alarm 115 (Rot. rect. break).

Function Range

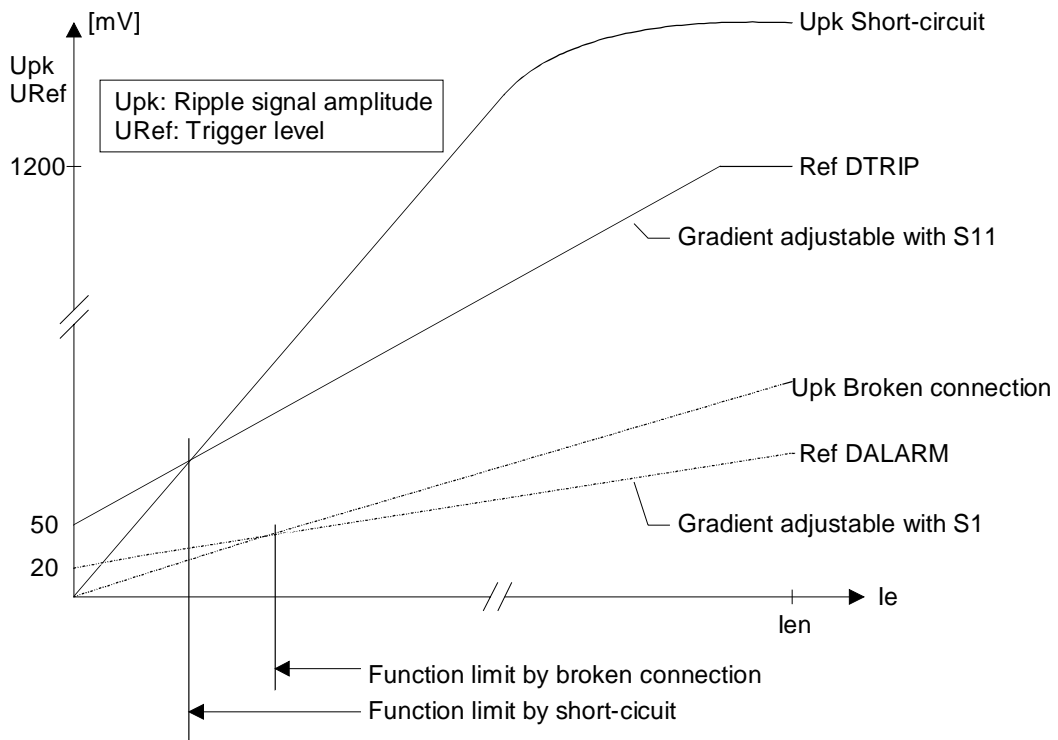


Fig. 40 Functional range

11.2 Configuration

Positioning of the sub-board

The sub-board UNS 0864 is to be plugged onto the basic board UNS 1860 at connector X24 and fixed in place using the provided screws.

Adjustment elements

See section chapter 11.4 Setting Values

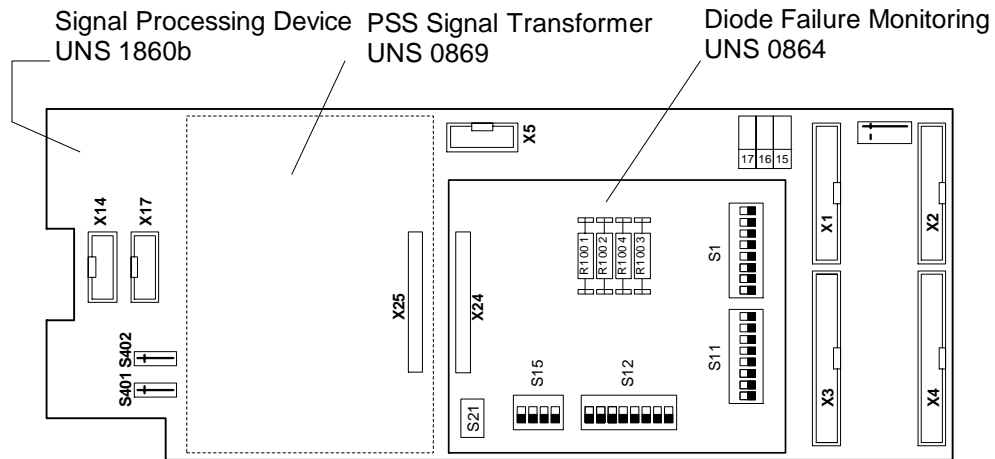


Fig. 41 Installation position of the diode failure monitoring sub-board UNS 0864

11.3 Commissioning and function check

The function of the diode failure monitoring can only be checked in connection with the entire system in operation.

The diode failure monitoring UNS 0864 is not accessible from the front; measurements on the sub-board are not required. The following tests can be carried out via TP9 (channel 1) and TP20 (channel 2) on the I/O interface UNS 0863, depending on the setting of S21:

- Pos1: Measure filter output (ripple < characteristic)
- Pos2: Feed frequency signal with $f=f_E$ and test triggering of ALARM and TRIP.

11.4 Setting Values
Exciter frequency UNS 0864b V1 (fE = 33 to 300 Hz)

| DIL switch S15 position | | | | Setting No. | Relative divider | Exciter Pole pairs | Exciter frequency fE 50 Hz systems [Hz] | Exciter frequency fE 60 Hz systems [Hz] |
|-------------------------|---|---|---|-------------|------------------|--------------------|---|---|
| 4 | 3 | 2 | 1 | | | | | |
| x | x | x | x | 1 | 2/3 | 2n/3 | 33.33 | 40 |
| x | x | x | - | 2 | 5/7 | 5n/7 | 35.714 | 42.857 |
| x | x | - | x | 3 | 3/4 | 3n/4 | 37.5 | 45 |
| x | x | - | - | 4 | 4/5 | 4n/5 | 40 | 48 |
| x | - | x | x | 5 | 5/6 | 5n/6 | 41.66 | 50 |
| x | - | x | - | 6 | 1 | 1n | 50 | 60 |
| x | - | - | x | 7 | 5/4 | 5n/4 | 62.5 | 75 |
| x | - | - | - | 8 | 4/3 | 4n/3 | 66.66 | 80 |
| - | x | x | x | 9 | 3/2 | 3n/2 | 75 | 90 |
| - | x | x | - | 10 | 5/3 | 5n/3 | 83.33 | 100 |
| - | x | - | x | 11 | 2 | 2n (*) | 100 | 120 |
| - | x | - | - | 12 | 7/3 | 7n/3 | 116.66 | 140 |
| - | - | x | x | 13 | 5/2 | 5n/2 | 125 | 150 |
| - | - | x | - | 14 | 3 | 3n | 150 | 180 |
| - | - | - | x | 15 | 4 | 4n | 200 | 240 |
| - | - | - | - | 16 | 5 | 5n | 250 | 300 |

Exciter frequency UNS 0864b V2 (fE = 17 to 38 Hz)

| | | | | | | | | |
|---|---|---|---|----|-------|--------|----|------|
| x | x | x | x | 1 | 17/50 | 17n/50 | 17 | 20.4 |
| x | x | x | - | 2 | 9/25 | 9n/25 | 18 | 21.6 |
| x | x | - | x | 3 | 19/50 | 19n/50 | 19 | 22.8 |
| x | x | - | - | 4 | 2/5 | 2n/5 | 20 | 24 |
| x | - | x | x | 5 | 21/50 | 21n/50 | 21 | 25.2 |
| x | - | x | - | 6 | 11/25 | 11n/25 | 22 | 26.4 |
| x | - | - | x | 7 | 23/50 | 23n/50 | 23 | 27.6 |
| x | - | - | - | 8 | 12/25 | 12n/25 | 24 | 28.8 |
| - | x | x | x | 9 | 1/2 | 1n/2 | 25 | 30 |
| - | x | x | - | 10 | 13/25 | 13n/25 | 26 | 31.2 |
| - | x | - | x | 11 | 27/50 | 27n/50 | 27 | 32.4 |
| - | x | - | - | 12 | 14/25 | 14n/25 | 28 | 33.6 |
| - | - | x | x | 13 | 29/50 | 29n/50 | 29 | 34.8 |
| - | - | x | - | 14 | 3/5 | 3n/5 | 30 | 36 |
| - | - | - | x | 15 | 31/50 | 31n/50 | 31 | 37.2 |
| - | - | - | - | 16 | 16/25 | 16n/25 | 32 | 38.4 |

Tab. 8 Setting of frequencies on switch S15

x closed

- open

n number of pole pairs of the synchronous machine

***** factory setting

(*) In order to prevent a false response of the monitoring of 2-phase short circuits and earth faults by the synchronous machine, exciter machines with twice the nominal frequency of the synchronous machine should preferably not be used. If this is nevertheless the case, then the trigger levels for DALARM and DTRIP should be set higher, or false response is to be expected in the event of asymmetrical load and 2-phase short circuit!

Trigger level: ALARM

$$U \text{ Ref ALARM} = 3 \text{ V} * I_{en} / I \text{ Conv Nom} * 1 \text{ k}\Omega / (R1003+R1) + 20 \text{ mV}$$

| | | | | | | | | |
|-------------------|------|--------|---------|---------|--------|--------|--------|--------|
| S1: Amount | 1 | 1+2 | 1 to 3 | 1 to 4 | 1 to 5 | 1 to 6 | 1 to 7 | 1 to 8 |
| Closed contacts ⊗ | | * | | | | | | |
| R1: [Ω] | 47 k | 23.5 k | 15.66 k | 11.75 k | 9.4 k | 7.83 k | 6.7 k | 5.87 k |

Tab. 9 Setting of the gradients U Ref ALARM on switch S1

Conditions:

I_{en}: Nominal excitation current of the exciter machine

I Conv Nenn: Nominal current of the converter

Default configuration: R1003 = 2.2 kΩ

* Default setting S1: 2 switches (1+2) closed

⊗ The **amount** of closed contacts is important, not the no. of the contacts.

Trigger level: TRIP

$$U \text{ Ref TRIP} = 3 \text{ V} * I_{en} / I \text{ Conv Nenn} * 1 \text{ k}\Omega / (R1004+R11) + 50 \text{ mV}$$

| | | | | | | | | |
|--------------------|------|-----|--------|--------|--------|--------|--------|--------|
| S11: Amount | 1 | 1+2 | 1 to 3 | 1 to 4 | 1 to 5 | 1 to 6 | 1 to 7 | 1 to 8 |
| Closed contacts ⊗ | | * | | | | | | |
| R11: [Ω] | 10 k | 5 k | 3.3 k | 2.5 k | 2 k | 1.66 k | 1.43 k | 1.25 k |

Tab. 10 Setting of the gradients U Ref TRIP on switch S11

Conditions:

I_{en}: Nominal excitation current of the exciter machine

I Conv Nenn: Nominal current of the converter

Default configuration: R1004 = 1 kΩ

* Default setting S11: 2 switches (1+2) closed

⊗ The **amount** of closed contacts is important, not the no. of the contacts.

Delay Time t set

Adjustable using DIL switch S12

Setting to 2 to 5 x Td" of the exciter machine

| S12: Contact No. closed ⊗ | Delay time t set [s] |
|---------------------------|----------------------|
| all open | 1.39 |
| 1 | 1.24 |
| 2 | 1.08 |
| 3 | 0.93 |
| 4 | 0.77 |
| 5 | 0.62 |
| 6 | 0.46 |
| 7* | 0.31 |
| 8 | 0.15 |

Tab. 11 Setting the delay time on switch S12

⊗ Where several contact are closed, the highest contact no. is always dominant.

* Default setting

Reference value time constant

The reference value time constant must be equal to the exciter time constant and can be set with the resistors R1001, R1002.

Setting R1001//R1002

Default setting

R1001 = R1002 = 47 kΩ parallel = 23.5 kΩ

TE / 10 μF

235 ms

11.5 Operating and configuration elements

| | | | |
|-------------|-------------------|--------|--------------------------|
| S15: | DIL switch 4-fold | fE set | Frequency divider |
| S12: | DIL switch 8-fold | t set | Delay time |
| S1: | DIL switch 8-fold | | ALARM level |
| S11: | DIL switch 8-fold | | TRIP level |
| R1003 | | | ALARM level |
| R1004 | | | TRIP level |
| R1001/R1002 | | | Excitation time constant |
| S21 | Solder bridge | Pos1: | Filter output |
| | | Pos2: | Test signal input |

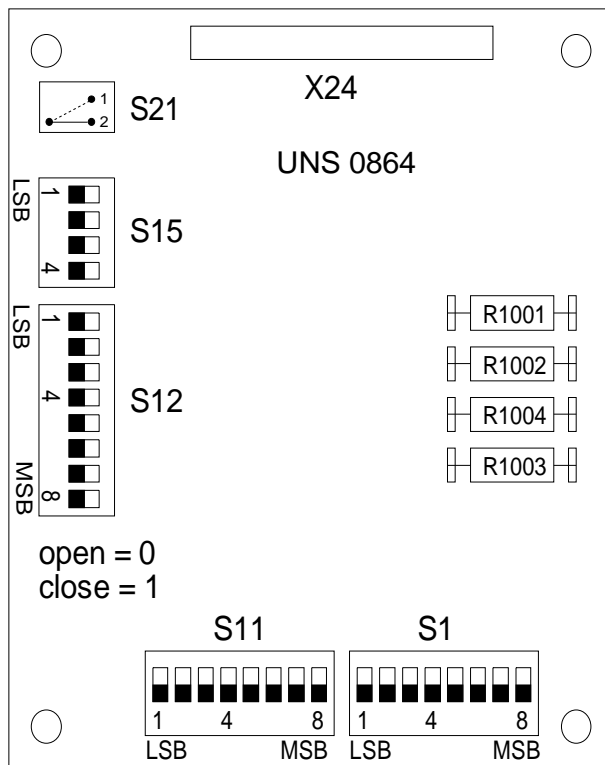


Fig. 42 Location of the control elements on the diode failure monitoring UNS 0864

12 Communication Board SDCS-COM5

12.1 Block diagram

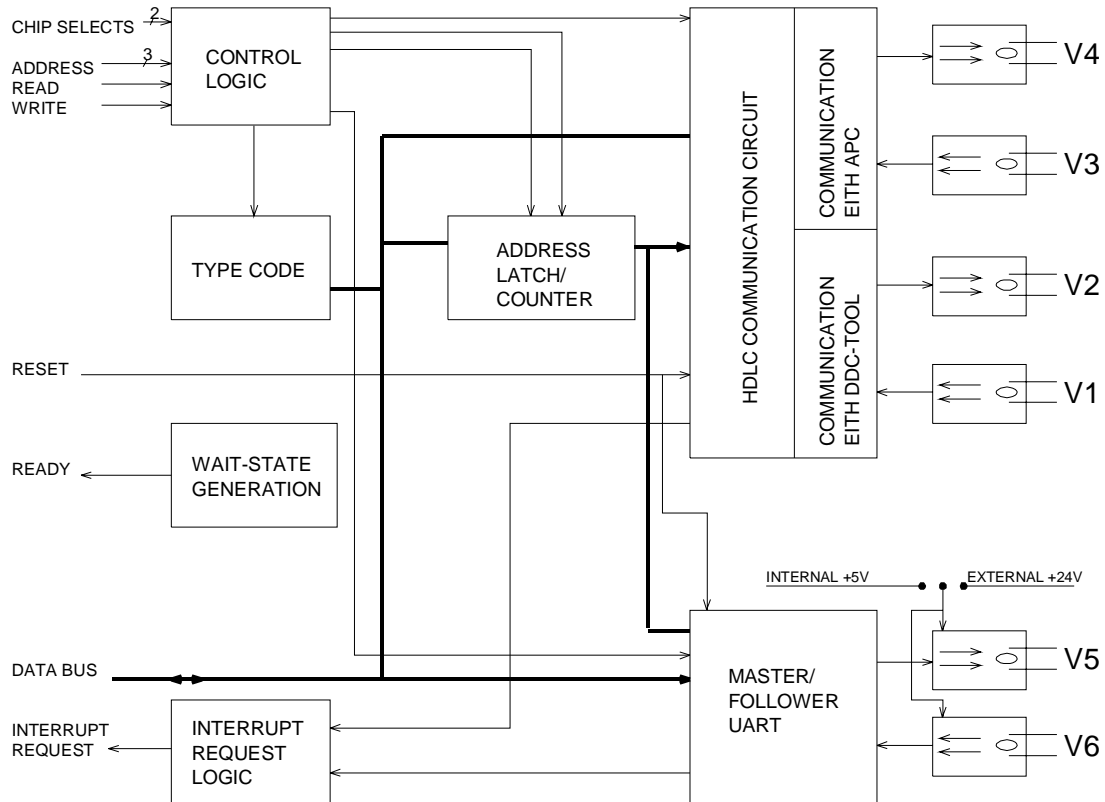


Fig. 43 Block diagram SDCS-COM-1/5

12.2 Connection to the control board

The communication interface is plugged onto connector X11 of the control board SDCS-CON-2.

12.3 Functional description

Communication with CMT software tool (3.x)

Channel A of the HDLC communication device is used for the exchange of data with the CMT software tool, which can be installed on a PC together with the corresponding hardware. The transmission rate via fibre optic cable between PC and SDCS-COM-1/5 is 1.5 MBaud. Communication is synchronous. The matching connection points on the SDCS-COM-1/5 board and the fibre optic cable are marked in the same colour.

12.4 Jumper settings

Jumper S1:

In the factory setting, the short circuit plug is connected to pins 1-1. This position corresponds to the device address (converter number) "1". Only this setting is supported by the voltage regulator software.

REVISION

| Rev. ind. | Page (P) Chapt.(C) | Description | Date Dept./Init. |
|-----------|--------------------|--|------------------|
| A | | - New converter A5 instead of C3 - New converter C2b with 610, 740, 900 A instead of 700 A - Diode failure monitoring UNS 0864b V2 | 03-10-9 / Mo |
| B | 65 | Fig. 39, S21 | 04-03-26 / Mo |
| C | | POW-1 replaced through POW-4 | 06-11-24 / Mo |
| D | | PIN-41 replaced through PIN-48 | 06-12-13 / Mo |



Excitation System

UNITROL[®] F Series

Parameter and Signal List

Version 41.222_2


| | | | | | | | | | |
|---|-----------------------|---------|----------------------------------|-----------------------|-----------------------|-----------|----------|----------|--------------|
| Rev. G | 21-08-02 GM | Rev. D | 7121 99-11-14 Mo | Issued: 98-01-08 GM | Document | Format | Langue | Page | No. of pages |
| Rev. B | 4033 98-09-01 GM | Rev. E | 9595 00-11.02 Mo | Check 1: 98-01-15 DE | ZAB | A4 | E | 1 | 86 |
| Rev. C | 5955 99-06-17 PM | Rev. F | 01-07-02 T.G. | Check 2: | | | | | |
|  | Dept. 1 ICA | Dept. 2 | Der.from/Repla.: Replaced by: | Released: 98-01-15 GM | 3BHS102402 E88 | | | | |

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1 Parameters & Signals

UNITROL-F Standard Excitation System can be adapted to different applications just by setting its parameters to different values. Parameters are used to define:

- analog and digital I/O-connections
- configurations
- limits
- controller gains and time constants
- reference chain setup
- function block application, etc.

UNITROL-F Standard Program (SP) is presented to users with Function Blocks (FB). Each FB contains one basic function of the Standard Program, like AVR SETPOINT, AVR PID, CONTROL LOGIC, etc. FB's are connected to each other to create an excitation application.

The application can include application function blocks (AFB's) as well (see programming manual).

A Function Block has input pins, output pins and block parameters.

Input pins are usually connected to FB output pins. Input pin is presented as a parameter, whose value defines the input connection.

Output pins are presented as signals.

Block parameters are used to define the operation of a FB. They are used to give time constants, gains, limits, etc.

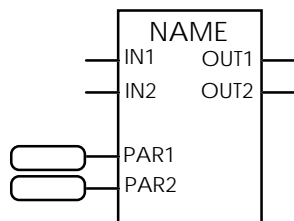


Fig. 1: Structure of a function block.

There are parameters and signals as well which do not belong to any FB.

Parameter values can be modified with the UNS 0874 operator's panel or with a special tool program called CMT (Commissioning and Maintenance Tool), which is running in a PC which is connected to the UNITROL-F via a communication link.

UNITROL-F has a non-volatile memory for parameter backup. At power-on parameters are copied to the working memory. The parameter backup can be updated at any time using a special command (see description of the signal 11201, BACKUP_STORE_MODE). Backup memory can have two different parameter sets. This is a useful feature if the process requires different settings for the parameters.

Signals represent values that are results from measurements or calculations done by the UNITROL-F control program.

The CMT tool or the UNS 0874 operator's panel can access signals in the same way as parameters. Signal values can be seen on actual value display of the operator's panel too.

1.1 Display of Parameters and Signals

The control program in the UNITROL-F uses 16-bit values for calculations and control. To have good accuracy and to be able to use the resolution of analog to digital conversions, certain scaling of values has been used. Scaling has been selected so that resolution of measurements is maintained and there is space for dynamic variation of values.

On the operator's panel values are usually shown either in relative (in per cent) or physical (with units) form. Internal values are not available on the panel.

Selection parameters are shown on the panel as texts so that each parameter value is shown as a short text describing the function if this value is selected.

The CMT can show parameters in different formats. For some parameters three formats are available:

- internal value
- relative value in per cent (p.u.)
- physical value with units

The format is selected by the user.

1.2 Parameter and Signal List of UNITROL-F

Parameters and signals are divided to several different groups. Parameters and signals of a certain group belong to the same functional part of the control program. Maximum number of parameters or signals in one group is 99.

The Group No. is:

- 1...49** for the **parameters**
- 51...99** for the related groups with the **programmable input signals**
(Offset = 50)
- 101...149** for the related groups with the **signals** (Offset = 100)

In the following tables the different columns contain

INDEX of a parameter contains a group number and an element number. Last two digits are the element number and other numbers before them form the group number:

- 101** parameter group 1, element 01.
- 10103** signal group 101 related to parameter group 1, element 03.
- 5308** programmable input signal group 53 related to parameter group 1, element 08.
- 1404** parameter group 14, element 04.
- 11408** signal group 114 related to parameter group 14, element 08.

INDICATION is the name of the parameter or signal given in the same format as it is seen on the panel or CMT. Names with brackets, e.g. **[PULSE BLK]** are programmable

| | |
|-----------------|--|
| FUNCTION | <p>describes (the content of this column is identical to the HELP text found under „More...“ in CMT ParSig menu):</p> <ul style="list-style-type: none">- The function of the parameter or signal.- Short form parameter tuning hints.- DEFAULT using of output signals and programmable inputs including cross references.- Application hints for output signals and programmable inputs. |
| SC | <p>This column defines:</p> <ul style="list-style-type: none">- Scaling factor number for the internal values presented in the columns HL, LL, and DEFAULT to get the values with units (units defined in column U) presented by CMT or PANEL UNS 0874.- AI represents an „analog“ process signal input I2 (16-bit signed integer)- AO represents an „analog“ process signal output I2 (16-bit signed integer)- BI represents a binary input by an Boolean value (0 = FALSE, ≠0 = TRUE)- BO represents a binary output by an Boolean value (0 = FALSE, -1 = TRUE)- ENUM enumeration parameter (signal) 0..(n-1), where n = number of available selections. On panel and CMT only the selection text is presented. |
| HL | <p>Maximum value which can be set, given as internal value. For input pins (signals) HL represents the highest available source signal address.</p> |
| LL | <p>Minimum value which can be set. For input pins (signals) LL represents the lowest available source signal address.</p> |
| DEF | <p>Default values of the firmware. For programmable input pins (signals) DEF connects the inputs to required source signal. The latter must only be altered if the configuration will be changed, or AFB's are implemented to get a new application (see programming manual).</p> |
| U | <p>Unit is given for parameters and signals which have an unit or are relative [per unit p.u.(%)]. Decimal values have the unit d Tsyn means 1/6 of the converter supply voltage cycle period. E.g. $1/(6 \cdot f_n) = 3.333.. \text{ ms}$ at $f_n = 50 \text{ Hz}$ supply frequency.</p> |

CLASS Classification used by CMT to display one ore more sets of data on the screen. This is useful to discriminate data for different tasks.

| | | |
|-------------|-------------------------|---|
| AL | Alarm | Limits which generate Alarms or Faults, „User Event“ inputs, Alarm and Fault signals, Alarm and Fault words |
| AFB | Application FB | SP block inputs which are provided for connecting to application function blocks (AFB) and all application block pins and parameters itself |
| AVR | AVR | Parameters and Signals of AVR (AUTO), MANual control and LIMITER functions |
| CM | Commissioning | Configuration parameters which can be set before first start (e.g. Id Numbers, Test Ref. Select, Phase Sequence, Limits) |
| COM | Communication | Parameters and signals regarding communication via COM-1 board or COM-5 board |
| CON | Converter | Parameters and signals regarding converter functions |
| DIAG | Diagnostics | Function block digital outputs which are relevant for diagnostics, data logger status |
| IMP | Important | Most important parameters at least to be set and most important signals |
| IO | I/O | Parameters and Signals of I/O function blocks (analog and digital) |
| MON | Monitoring (Protection) | Parameter and signals which are used for Monitoring and protective functions |
| HID | Special function | Parameters and Signals of less important and special functions |
| SIP | Superimposed | Parameters and Signals of superimposed controllers to the AVR as P.F.-, Q(VAR)-, Equalizing-CTRL etc. |
| SM | Syn Machine | Parameters and signals regarding synchronous machine and rotating exciter |
| TUN | Tuning | Parameters which are needed to tune the system during commissioning and first start up |
| U | User marked | Selection of user defined parameter and signals |
| VAL | Not valid | Parameter or signals which are not valid (yet), depending on further selections first. On CMT this are grey indicated. |

SP Refers to the Standard Program Block No. in the relevant (GAD) SW drawing.

Revision history

Rev B (4033) 98-09-01:

510: Type C6 and C7 added.

521: Correction and filtering of I_EXC signals in case of ALARM

1215: Also Italian, Spanish and French available.

5909: DEFAULT: I_MACH_RELATIVE instead of I_SIN_RELATIVE.

10337: ALARM's not included anymore. Alarm 109 „Common channel fault“ deleted.

10338: NEW ALARM RESET of 1s added.

10342: Alarm 109 deleted.

10902..04: Alarm 144 „Batt. fail“ improved. Difference to UNS0861 HW added.

2 Parameter

2.1 ANALOG INPUTS Group 01

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|------------------|--|----|-------|--------|--------|---|-------------|----|
| 101 | U ACT HIGH VALUE | With this setting the p.t. signal will be scaled to get U_MACH_RELATIVE (10101)=10000 at machine nominal voltage == Un p.t. Set: U_ACT_HIGH_VALUE = 1629430 / Un p.t.[V] (DEFAULT for 110V) Fine tuning: change U_ACT_HIGH_VALUE until U_MACH_RELATIVE (10101) represents the actual machine % value. | 1 | 65535 | 1 | 14813 | - | CM, IMP, IO | 3 |
| 102 | U MACHN V | Nominal value of the machine voltage in VOLTS Tuning: Set nominal machine Volts which corresponds to U_MACH_RELATIVE (10101)=10000. If the indication U_MACH_V (10102) is not correct, fine tune U_ACT_HIGH_VALUE (101) again | 1 | 32767 | 0 | 0 | V | CM, IMP, IO | 3 |
| 103 | I ACT HIGH VALUE | With this setting the c.t. signal will be scaled to get I_MACH_RELATIVE (10103)=10000 at machine nominal current == In c.t. Set: I_ACT_HIGH_VALUE= 10'000'000 / (In c.t.[A]*RB) for 1A c.t. or 50'000'000 / (In c.t.[A]*RB) for 5A c.t. RB burden resistor on UNS 0862 Interface in Ohm (ref. to HW description). DEFAULT = 300 Ohm Fine tuning: change I_ACT_HIGH_VALUE until I_MACH_RELATIVE (10103) represents the actual machine % value | 1 | 65535 | 0 | 33333 | - | CM, IMP, IO | 3 |
| 104 | I MACHN A | Nominal value of the machine current in AMPS Tuning: Set nominal machine Amps which corresponds to I_MACH_RELATIVE (10103)=10000. If the indication I_MACH_A (10104) is not correct, fine tune I_ACT_HIGH_VALUE (103) again | 1 | 32767 | 0 | 0 | A | CM, IMP, IO | 3 |
| 105 | ISINPHI OFFSET | With this parameter HW offset can be eliminated if necessary (1==0.17%): Tune signal I_SINPHI_REL (10109) to zero, if running machine at least with 50% active load at unity power factor (ref. to instrumentation e.g. VAR meter etc.) | 1 | 100 | 0 | 0 | - | CM, IO, HID | 3 |
| 106 | ICOSPHI OFFSET | With this parameter HW offset can be eliminated if necessary (1==0.17%): Tune signal I_COSPHI_REL (10105) to zero, if running machine at least with 50% reactive load at zero active power (ref. to instrumentation e.g. WATT meter etc.) | 1 | 100 | 0 | 0 | - | CM, IO, HID | 3 |
| 107 | AI2 HIGH VALUE | Value that corresponds to max. A/D conv. input value of +10V. E.g. with AI2_HIGH_VALUE = 10000, the AI2_ACTUAL (10116) becomes 10000 at +10V input. Set: AI2_HIGH_VALUE = [(10V-UE_ZERO) / DELTA_UE] * DELTA_UA UE_ZERO == Burden voltage at AI2_ACTUAL = ZERO DELTA_UE == Burden voltage range, e.g. 4V if 4...20 mA burdened to 1...5V DELTA_UA == Range of internal signal AI2_ACTUAL, e.g. 5000 - (-5000) = 10000 Example: 4...20 mA are burdened to 1...5V and transduced to -5000...+5000: AI2_HIGH_VALUE = [(10V-3V)/4V]*10000= 17500. | 1 | 32766 | -32767 | 10000 | - | CM, IO | 5 |
| 108 | AI2 LOW VALUE | Value that corresponds to min. A/D conv. input value of -10V. E.g. with AI2_LOW_VALUE = -10000, the AI2_ACTUAL (10116) becomes -10000 at -10V input. Set: AI2_LOW_VALUE = [(-10V-UE_ZERO) / DELTA_UE] * DELTA_UA UE_ZERO == Burden voltage at AI2_ACTUAL = ZERO DELTA_UE == Burden voltage range, e.g. 4V if 4...20 mA burdened to 1...5V DELTA_UA == Range of internal signal AI2_ACTUAL, e.g. 5000 - (-5000) = 10000 Example: 4...20 mA are burdened to = 1...5V and transduced to -5000...+5000: AI2_LOW_VALUE = [(-10V-3V)/4V]*10000 = 32500. | 1 | 32766 | -32767 | -10000 | - | CM, IO | 5 |

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|-------------------------|--|------|-------|--------|--------|---|-------------|----|
| 109 | AI2 LIVE ZERO | If AI2_ACTUAL (10116) falls below this value, AI2_FAILURE (10118) will be generated (Alarm 123 „AI failed“). Used to monitor live zero input signals, e.g. 4...20 mA. Example: 4...20 mA are burdened to 1...5V and transduced to -5000...+5000 -> AI2_LIVE_ZERO less than -5000 (calculation see 107). | 1 | 32766 | -32767 | -32767 | - | CM, IO | 5 |
| 110 | AITAC HIGH VALUE | Value that corresponds to max. A/D conv. input value of +10V. E.g. with AITAC_HIGH_VALUE =10000, the AITAC_ACTUAL (10119) becomes 10000 at +10V input. Set: AITAC_HIGH_VALUE = [(10V-UE_ZERO) / DELTA_UE] * DELTA_UA UE_ZERO == Burden voltage at AITAC_ACTUAL = ZERO DELTA_UE == Burden voltage range, e.g. 4V when 4...20 mA burdened to 1...5V DELTA_UA == Range of internal signal AITAC_ACTUAL, e.g. 5000 - (-5000) = 10000 Example: 4...20 mA are burdened to = 1...5V and transduced to -5000...+5000: AITAC_HIGH_VALUE = [(10V-3V)/4V]*10000 = 17500. | 1 | 32766 | -32767 | 10000 | - | CM, IO | 6 |
| 111 | AITAC LOW VALUE | Value that corresponds to min. A/D conv. input value of -10V. E.g. with AITAC_LOW_VALUE =10000, the AITAC_ACTUAL (10119) becomes -10000 at -10V input. Set: AITAC_LOW_VALUE = [(-10V-UE_ZERO) / DELTA_UE] * DELTA_UA UE_ZERO == Burden voltage at AITAC_ACTUAL = ZERO DELTA_UE == Burden voltage range, e.g. 4V when 4...20 mA burdened to 1...5V DELTA_UA == Range of internal signal AITAC_ACTUAL, e.g. 5000 - (-5000) = 10000 Example: 4...20 mA are burdened to = 1...5V and transduced to -5000...+5000: AI2_LOW_VALUE = [(-10V-3V)/4V]*10000 = 32500. | 1 | 32766 | -32767 | -10000 | - | CM, IO | 6 |
| 112 | AITAC LIVE ZERO | If AITAC_ACTUAL (10119) falls below this value, AITAC_FAILURE (10121) will be generated (Alarm 123 „AI failed“). Used to monitor live zero input signals, e.g. 4...20 mA. Example: 4...20 mA are burdened to 1...5V and transduced to -5000...+5000 -> AITAC_LIVE_ZERO less than -5000 (calculation see 110). | 1 | 32766 | -32767 | -32767 | - | CM, IO | 6 |
| 113 | f MACH NOMINAL | Nominal frequency of the machine; 0==50 Hz, 1==60 Hz, 2==16 ² / ₃ Hz (1ph), 3==25Hz (1ph), 4==50Hz (1ph), 5==60Hz (1ph) NOTE: for 16 2/3 Hz variant 2 (V2) of UNS 1860b is required for 25 Hz variant 3 (V3) of UNS 1860b is required (3 ... 5 only Substatus ≥ 3) | ENUM | 2 | 0 | 0 | - | CM, IMP, IO | 7 |
| 114 | AI1E HIGH VALUE | Value that corresponds to max. A/D conv. input value of +10V. E.g. with AI1E_HIGH_VALUE =10000, the AI1E_ACTUAL (10127) becomes 10000 at +10V input. Set: AI1E_HIGH_VALUE = [(10V-UE_ZERO) / DELTA_UE] * DELTA_UA UE_ZERO == Burden voltage at AI1E_ACTUAL = ZERO DELTA_UE == Burden voltage range, e.g. 4V if 4...20 mA burdened to 1...5V DELTA_UA == Range of internal signal AI1E_ACTUAL, e.g. 5000 - (-5000) = 10000 Example: 4...20 mA are burdened to 1...5V and transduced to -5000...+5000: AI1E_HIGH_VALUE = [(10V-3V)/4V]*10000 = 17500. | 1 | 32766 | -32767 | 10000 | - | CM, IO | 83 |
| 115 | AI1E LOW VALUE | Value that corresponds to min. A/D conv. input value of -10V. E.g. with AI1E_LOW_VALUE = -10000, the AI1E_ACTUAL (10127) becomes -10000 at -10V input. Set: AI1E_LOW_VALUE = [(-10V-UE_ZERO) / DELTA_UE] * DELTA_UA UE_ZERO == Burden voltage at AI1E_ACTUAL = ZERO DELTA_UE == Burden voltage range, e.g. 4V if 4...20 mA burdened to 1...5V DELTA_UA == Range of internal signal AI1E_ACTUAL, e.g. 5000 - (-5000) = 10000 Example: 4...20 mA are burdened to = 1...5V and transduced to -5000...+5000: AI1E_LOW_VALUE = [(-10V-3V)/4V]*10000 = 32500. | 1 | 32766 | -32767 | -10000 | - | CM, IO | 83 |

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|------------------------|---|----|-------|--------|--------|---|--------|----|
| 116 | AI1E LIVE ZERO | If AI1E_ACTUAL (10127) falls below this value, AI1E_FAILURE (10129) will be generated (Alarm 123 „AI failed“). Used to monitor live zero input signals, e.g. 4...20 mA. Example: 4...20 mA are burdened to 1...5V and transduced to -5000...+5000 -> AI2_LIVE_ZERO less than -5000 (calculation see 114). | 1 | 32766 | -32767 | -32767 | - | CM, IO | 83 |
| 117 | AI2E HIGH VALUE | Value that corresponds to max. A/D conv. input value of +10V. E.g. with AI2E_HIGH_VALUE =10000, the AI2E_ACTUAL (10130) becomes 10000 at +10V input. Set: AI2E_HIGH_VALUE = [(10V-UE_ZERO) / DELTA_UE] * DELTA_UA UE_ZERO == Burden voltage at AI2_ACTUAL = ZERO DELTA_UE == Burden voltage range, e.g. 4V if 4...20 mA burdened to 1...5V DELTA_UA == Range of internal signal AI2E_ACTUAL, e.g. 5000 - (-5000) = 10000 Example: 4...20 mA are burdened to 1...5V and transduced to -5000...+5000: AI2E_HIGH_VALUE = [(10V-3V)/4V]*10000 = 17500. | 1 | 32766 | -32767 | 10000 | - | CM, IO | 84 |
| 118 | AI2E LOW VALUE | Value that corresponds to min. A/D conv. input value of -10V. E.g. with AI2E_LOW_VALUE = -10000, the AI2E_ACTUAL (10130) becomes -10000 at -10V input. Set: AI2E_LOW_VALUE = [(-10V-UE_ZERO) / DELTA_UE] * DELTA_UA UE_ZERO == Burden voltage at AI2E_ACTUAL = ZERO DELTA_UE == Burden voltage range, e.g. 4V if 4...20 mA burdened to 1...5V DELTA_UA == Range of internal signal AI2E_ACTUAL, e.g. 5000 - (-5000) = 10000 Example: 4...20 mA are burdened to = 1...5V and transduced to -5000...+5000: AI2E_LOW_VALUE = [(-10V-3V)/4V]*10000 = 32500. | 1 | 32766 | -32767 | -10000 | - | CM, IO | 84 |
| 119 | AI2E LIVE ZERO | If AI2E_ACTUAL (10130) falls below this value, AI2E_FAILURE (10132) will be generated (Alarm 123 „AI failed“). Used to monitor live zero input signals, e.g. 4...20 mA. Example: 4...20 mA are burdened to 1...5V and transduced to -5000...+5000 -> AI2E_LIVE_ZERO less than -5000 (calculation see 117). | 1 | 32766 | -32767 | -32767 | - | CM, IO | 84 |

2.2 ANALOG OUTPUTS Group 02

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|-------------------------|--|----|-------|--------|-------|----|---------|----|
| 201 | AO1 NOMINAL V | Output voltage range which corresponds to nominal value range of selected signal: $U_{out} = (AO1.[IN] + AO1_OFFSET_REL) * (AO1_NOMINAL_V / AO1_NOMINAL_VAL)$ E.g. $U_{out} = (10000+0) * (10V/10000) = 10V$; transfers internal RELATIVE value to an +/-10V analog signal. | 1 | 10000 | 0 | 10000 | mV | IO | 1 |
| 202 | AO1 OFFSET REL | Offset which is added to the input e.g.: $U_{out} = (0...10000 + 2500) * (8V/10000) = 2...10V$ transfers internal RELATIVE value 0...10000 to live zero output 2...10V or $U_{out} = (9000...11000 - 8500) * (8V/2000) = 2...10V$ transfers internal RELATIVE value 9000...11000 to live zero output 2...10V (e.g. typical AVR ref. value to analog output). | 1 | 32766 | -32767 | 0 | - | IO, HID | 1 |
| 203 | AO1 NOMINAL VAL | Nominal value range of signal which is connected to the IN-input. E.g. 10000 for internal RELATIVE value, or 2000 for the DEFAULT signal range of the AVR set point. | 1 | 32766 | -32767 | 10000 | mV | IO | 1 |
| 204 | AO2 NOMINAL V | Output voltage range which corresponds to nominal value range of selected signal: $U_{out} = (AO2.[IN] + AO2_OFFSET_REL) * (AO2_NOMINAL_V / AO2_NOMINAL_VAL)$ E.g. $U_{out} = (10000 + 0) * (10V/10000) = 10V$; transfers internal RELATIVE value to an +/-10V analog signal. | 1 | 10000 | 0 | 10000 | mV | IO | 2 |
| 205 | AO2 OFFSET REL | Offset voltage which is added to the input e.g.: $U_{out} = (0...10000 + 2500) * (8V/10000) = 2...10V$ transfers internal RELATIVE value 0...10000 to live zero output 2...10V or $U_{out} = (9000...11000 - 8500) * (8V/2000) = 2...10V$ transfers internal RELATIVE value 9000...11000 to live zero output 2...10V (e.g. typical AVR ref. value to analog output) | 1 | 32766 | -32767 | 0 | - | IO, HID | 2 |
| 206 | AO2 NOMINAL VAL | Nominal value range of signal which is connected to the IN-input. E.g. 10000 for internal RELATIVE value. | 1 | 32766 | -32767 | 10000 | mV | IO | 2 |
| 207 | AO1E NOMINAL V | Output voltage range which corresponds to nominal value range of selected signal: $U_{out} = (AO1E.[IN] + AO1E_OFFSET_REL) * (AO1E_NOMINAL_V / AO1E_NOMINAL_VAL)$ E.g. $U_{out} = (10000 + 0) * (10V/10000) = 10V$; transfers internal RELATIVE value to an +/-10V analog signal. | 1 | 10000 | 0 | 10000 | mV | IO | 85 |
| 208 | AO1E OFFSET REL | Offset which is added to the input e.g.: $U_{out} = (0...10000 + 2500) * (8V/10000) * 10000 + 2V = 2...10V$ transfers internal RELATIVE value 0...10000 to live zero output 2...10V or $U_{out} = (9000...11000 - 8500) * (8V/2000) = 2...10V$ transfers internal RELATIVE value 9000...11000 to live zero output 2...10V (e.g. typical AVR ref. value to analog output) | 1 | 32766 | -32767 | 0 | - | IO, HID | 85 |
| 209 | AO1E NOMINAL VAL | Nominal value range of signal which is connected to the IN-input. E.g. 10000 for internal RELATIVE value, or 2000 for the DEFAULT signal range of the AVR set point. | 1 | 32766 | -32767 | 10000 | mV | IO | 85 |
| 210 | AO2E NOMINAL V | Output voltage range which corresponds to nominal value range of selected signal: $U_{out} = (AO2E.[IN] + AO2E_OFFSET_REL) * (AO2E_NOMINAL_V / AO2E_NOMINAL_VAL)$ E.g. $U_{out} = (10000 + 0) * (10V/10000) * 10000 = 10V$; transfers internal RELATIVE value to an +/-10V analog signal. | 1 | 10000 | 0 | 10000 | mV | IO | 86 |
| 211 | AO2E OFFSET RELV | Offset which is added to the input e.g.: $U_{out} = (0...10000 + 2500) * (8V/10000) * 10000 + 2V = 2...10V$ transfers internal RELATIVE value 0...10000 to live zero output 2...10V or $U_{out} = (9000...11000 - 8500) * (8V/2000) = 2...10V$ transfers internal RELATIVE value 9000...11000 to live zero output 2...10V (e.g. typical AVR ref. value to analog output) | 1 | 32766 | -32767 | 0 | - | IO, HID | 86 |

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|-------------------------|--|----|-------|--------|-------|----|---------|-----|
| 212 | AO2E NOMINAL VAL | Nominal value range of signal which is connected to the IN-input. E.g. 10000 for internal RELATIVE value, or 2000 for the DEFAULT signal range of the AVR set point. | 1 | 32766 | -32767 | 10000 | - | IO | 86 |
| 213 | DATASET2. [IN1] | Fast data output to field bus DEFAULT: Connected to Status word BINARY-INTEGGER converter output (12995) if fieldbus application is loaded. NOTE: This option is only available with external field bus adapter HW and if the relevant field bus application is downloaded. Ref. to relevant fieldbus installation and start-up instructions. | AI | 19999 | 0 | 12501 | - | IO, COM | 126 |
| 214 | DATASET2. [IN2] | Fast data output to field bus DEFAULT: connected to actual reference value REF_ACT (10353) of active controller AUTO (AVR), MANUAL COS PHI (P.F.) or Q (AVR) CTRL, if fieldbus application is loaded. NOTE: This option is only available with external field bus adapter HW and if the relevant field bus application is downloaded. Ref. to relevant fieldbus installation and start-up instructions. | AI | 19999 | 0 | 12501 | - | IO, COM | 126 |
| 215 | DATASET2. [IN3] | Fast data output to field bus. DEFAULT: not used. Spare output for application. NOTE: This option is only available with external field bus adapter HW and if the relevant field bus application is downloaded. Ref. to relevant fieldbus installation and start-up instructions. | AI | 19999 | 0 | 12501 | - | IO, COM | 126 |
| 216 | DATASET4. [IN1] | Fast data output to field bus. DEFAULT: not used. Spare output for application. NOTE: This option is only available with external field bus adapter HW. Ref. to relevant fieldbus installation and start-up instructions. | AI | 19999 | 0 | 12501 | -- | IO, COM | 128 |
| 217 | DATASET4. [IN2] | Fast data output to field bus. DEFAULT: not used. Spare output for application. NOTE: This option is only available with external field bus adapter HW. Ref. to relevant fieldbus installation and start-up instructions. | AI | 19999 | 0 | 12501 | - | IO, COM | 128 |
| 218 | DATASET4. [IN3] | Fast data output to field bus. DEFAULT: not used. Spare output for application. NOTE: This option is only available with external field bus adapter HW. Ref. to relevant fieldbus installation and start-up instructions. | AI | 19999 | 0 | 12501 | - | IO, COM | 128 |

2.3 CONTROL LOGIC Group 03

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|-------------------|--|------|-------|------|------|---|--------------|----|
| 301 | RELEASE FCB OFF | Releases FCB_OFF signal (10309) in parallel with EXC_OFF status (10308): 0==NO, 1==YES | ENUM | 1 | 0 | 0 | - | CM, IMP | 74 |
| 302 | IMPOSED CTRL MODE | Preselects the available imposed control mode(s): 0==NO (Imposed control mode blocked) 1==COSPHI CTRL (only cosphi (P.F.) control possible) 2==Q CTRL (only Q (VAR) control possible) 3==EXTERNAL SEL (releases the inputs SEL_Q_CTRL (5312) and SEL_COSPHI_CTRL (5313)) | ENUM | 1,2,3 | 0 | 0 | - | CM, IMP, SIP | 79 |
| 303 | RECLOSE INH TIME | Defines the minimum time between FCB closing operations. | 0.1 | 600 | 0 | 100 | s | CM, TUN | 74 |
| 304 | FLASH OFF LEVEL | Machine voltage level (higher value of U_MACH_REL or U_SYN_REL for types C1...C4, I_EXC_RELATIVE for type C5 respectively) at which field flashing breaker is switched off (FLASH_ON_FIELD (10330) =0). Effective only if SUPPLY_MODE (901) is set to SHUNT (value = 0). | 0.01 | 5000 | 1500 | 3000 | % | CM, IMP | 75 |
| 305 | FLASH MAX TIME | Maximum allowed field flashing period. If exceeded excitation is shut down by FLASH_FAILURE (10331). | 0.1 | 600 | 10 | 100 | s | CM, TUN | 75 |
| 306 | CMPD ON LEVEL | Machine voltage level (higher value of U_MACH_REL or U_SYN_REL for types C1...C4, I_EXC_RELATIVE for type C5 respectively) below which DC compounding will be switched on with FLASH_ON_FIELD (10330) = TRUE. Effective only if SUPPLY_MODE (901) is set to SHUNT (value = 0). NOTE: compounding and field flashing is switched by the same contactor. Ref. to HW schematic diagram for more information. | 0.01 | 8000 | 0 | 5000 | % | CM, IMP | 75 |
| 307 | CMPD MAX TIME | Maximum allowed DC compounding period. If exceeded excitation is shut down by CMPD_FAILURE (10332). | 0.1 | 600 | 10 | 100 | s | CM, TUN | 75 |
| 308 | CH CONFIG | Configuration parameter to set the channel configurations: 0==SFE Single channel system 1==AFT CH1 Physical channel 1 of an AUTO-AUTO 2 channel system, both channels are identical with AUTO and MANUAL control 2==AFT CH2 Physical channel 2 of an AUTO-AUTO 2 channel system, both channels are identical with AUTO and MANUAL control 3==Not configured ! == DEFAULT setting. CH FAULT 13 "Not configured !" is forced NOTE: While downloading release UN41x22x rom file to target, this channel is set as "not configured" (DEFAULT=3). This leads to CH FAULT 13 "Not configured !", which indicates that this unit must be configured first. Values >0 start channel communication via 2nd serial RS 485 link. During operation of a 2 channel system, the active channel can be put to single operation SFE making the standby channel ready for maintenance works. After that, the channel interconnection cable can be removed. It's not possible to put the non active standby channel to SFE , since this would unconditionally take over the operation. | ENUM | 1,2 | 0 | 0 | - | AVR, CM, IMP | 76 |

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|----------------------|---|------|-------|----|------|---|--------------|----|
| 309 | CB CONFIG | 0==AC SIDE: „Field breaker“ is on the converter input side. Discharge by CROWBAR thyristor. EXC_OFF causes PULSE_BLOCKING, if parameter 301 set to YES. 1==DC W/O DEEXC: Field breaker WITHOUT discharge contact is on converter output. Discharge by CROWBAR thyristor. EXC_OFF causes INV_CTRL prior to PULSE_BLOCKING 2==DC WITH DEEXC: Field breaker WITH discharge contact is on converter output. Discharge by breaker itself. EXC_OFF causes INV_CTRL prior to PULSE_BLOCKING 3==W/O CROWBAR: No crowbar used (indirect excitation system) | ENUM | 0,1,2 | 0 | 3 | - | CM, CON, IMP | 74 |
| 310 | DLY FLDB ACKN | During this time the FLDB_REF_OK signal (10354) will be reset, enabling the fieldbus master's balancing to REF_ACT (10353). Set time bigger than normal fieldbus response time. NOTE: This option is only available with external field bus adapter HW and if the relevant field bus application is downloaded. Ref. to relevant fieldbus installation and start-up instructions. | 0,1 | 100 | 1 | 5 | s | CM, TON | 77 |

2.4 CONVERTER CTRL Group 05

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|------------------------|---|------|-----------|----|------|---|--------------|----|
| 501 | U EXC V NOMINAL | Nominal excitation voltage U _{en} in VOLTS (at converter output). Tuning: Set nominal excitation Volts which corresponds to U_EXC_RELATIVE (10505) =10000. | 1 | 1000 | 0 | 0 | V | CON, SM, IMP | 73 |
| 502 | I EXC A NOMINAL | Nominal excitation current I _{en} in AMPS Tuning: Set nominal excitation Amps . If indication I_EXC_A (10502) doesn't correspond exactly with expected value (shunt sensing etc.) because of burden or gain error, use SET_I_CONV_A (507) for fine tuning. NOTE: The set value can't be bigger than the HW code which is read from interface, even if a bigger value SET_I_CONV_A (507) has been saved to FEPROM. | 0.1 | 5000 0 | 0 | 0 | A | CON, SM, IMP | 73 |
| 503 | PHASE SEQ CW | Phase sequence of converter supply; 1==R-T-S, 2==R-S-T NOTE: Parameter altering becomes effective only after rebooting (power up). Converter will be started with this setting regard-less of real phase sequence applied. If started with wrong sequence the CH FAULT 34 „Converter fault“ appears with rising excitation current. | ENUM | 2 | 1 | 2 | - | CM, CON, HID | 73 |
| 504 | U SYN V NOMINAL | Nominal converter supply voltage U _{SYN} in VOLTS. (no load) Tuning: Set nominal supply voltage in VOLTS . This parameter can be used as well for fine tuning (compensating for voltage divider or gain error) of U_EXC_V (10506) signal (used for panel and CMT). NOTE: Single phase operation of the converter (CONV_SUPPLY (515) set to 1_PH_CONV) causes sensing error of 0 to -15% (depending on firing angle) of U_SYN_V (10504) and U_SYN_RELATIVE (10503) signals. | 1 | 1000 | 0 | 0 | V | CM, CON, IMP | 73 |
| 505 | U SYN MIN | Set point of the undervoltage Monitoring. If supply voltage drops below that, „Conv. undervoltage“ EVENT is written to fault logger. There is no ALARM generated by this event. | 1 | 130 | 0 | 0 | % | AL, CON, MON | 73 |

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|-----------------|--|------|-----------|----|------|----|------------------|----|
| 506 | I EXC MAX LEVEL | Instantaneous excitation overcurrent tripping level in % of conv. rated current I_CONV_A_RATED (10509). If the excitation current exceeds this level for longer than DLY_IE_MAX (513), CH FAULT 2 „Inst. exc. overcurrent“ will be generated. NOTE: The set value is related to nominal converter current instead of nominal excitation current. Set I_EXC_MAX_LEVEL corresponding to approx. 3 times of the value of 502. | 1 | 330 | 20 | 230 | % | AL, CON, MON | 73 |
| 507 | SET I CONV A | Overriding of HW code I_CONV_A by a parameter value > 0 (0 = type code resistors in use) NOTE: this parameter overwrites the nominal output current of the converter defined by type code resistors of the C1, C2, C3, C5 types, if the set parameter value >0. Consider if doing so, that the c.t. burden on the power interface must fit with the changed setting. With all C4 types there is no type code resistor available; therefore this parameter has to be set according to converter data. If this parameter is used for fine tuning (compensating for burden or gain error) of I_EXC_A (10502) signal used for panel and CMT, consider that the ALARM 129 „Type code changed“ will be generated, which will be cleared only after the new parameter set has been saved (BACKUPSTOREMODE). Consider as well that bigger values than the read hardware code are not accepted to be saved (except C4 without HW code). | 0.1 | 6000 0 | 0 | 0 | A | CM, CON, HID | 73 |
| 508 | SET U CONV V | Overriding of HW code U CONV V by parameter value > 0 (0 = type code resistors in use) NOTE: This parameter overwrites the nominal input voltage of the converter defined by type code resistors of the C1, C2, C3, C5 types, if the set parameter value >0. Consider if doing so, that the voltage divider on the power interface must fit with the altered setting. With all C4 types there is no type code resistor available; therefore this parameter must be set according to converter data. Consider that at values >0 the ALARM 129 "Type code changed" will be generated, which will be cleared only after the new parameter set has been saved (BACKUPSTOREMODE). Consider as well that bigger values than the read hardware code are not accepted to be saved (except C4 without HW code). | 1 | 2000 | 0 | 0 | V | CM, CON, HID | 73 |
| 509 | SET MAX BR TEMP | Overriding of HW code MAX BR TEMP DEG by parameter value > 0 (0 = type code resistors in use) NOTE: This parameter overwrites the maximum bridge temperature of the converter defined by type code resistors, if the set parameter value >0. C4 type measures the air inlet temperature instead of heat sink temperature at C1...C3 types. The value must be set to 45 DEG for nominal converter rating (Alarm „Conv.overtemp.alarm“ (code 105) above 35 DEG. Increase this value if converter used with derating at higher ambient temperature. Consider that at values >0 the ALARM 129 "Type code changed" will be generated, which will be cleared only after the new parameter set has been saved (BACKUPSTOREMODE). Consider as well that bigger values than the read hardware code are not accepted to be saved (except C4 without HW code). | 1 | 150 | 0 | 0 | °C | AL, CM, CON, HID | 73 |
| 510 | SET CONV TYPE | Overriding of HW code CONV TYPE by parameter value > 0: 0 = type code resistors used, 1==C1, 2==C2, 3==C3, 4==C4, 5==C5 (Chopper), 6==C6(3 phase AC controller), 7==C7 (fn converter ≠ 50/60 Hz) NOTE: This parameter overwrites the type size of the converter defined by type code resistors, if the set parameter value >0. C6 and C7 uses the same HW code regarding converter voltage and current as type C2. With all C4 types there is no type code resistor available; therefore this parameter must be set according to converter data. Consider that at values >0 the ALARM 129 "Type code changed" will be generated, which will be cleared only after the new parameter set has been saved (BACKUPSTOREMODE). | ENUM | 6 | 1 | 0 | - | CM, CON, HID | 73 |
| 511 | SET QUADR TYPE | Overriding of HW code QUADR TYPE by parameter value > 0: 0 = type code resistors used, 1==TWO QUADRANT, 4==FOUR QUADRANT NOTE: This parameter overwrites the type of the converter defined by type code resistors, if the set parameter value >0. With this SW version the value 4 must not be used! Consider that at values >0 the ALARM 129 "Type code changed" will be generated, which will be cleared only after the new parameter set has been saved (BACKUPSTOREMODE). | ENUM | 1,4 | 0 | 0 | - | CM, CON, HID | 73 |

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|------------------|--|------|-----|-----|------|--------------------|-----------------------|----|
| 512 | RIPPLE TIME | ON delay of the RIPPLE MONITOR. If converter current ripple occur for longer than the set time, depending on parameter RIPPLE_MON_MODE (521), ALARM 124 "Converter failed" or, FAULT 34 „Converter fault“ will be generated. The fault branch no. will be logged in the CYCLE LOG. MEM (see 10515). NOTE: The set value is the number of faults which are counted before responding. With a single branch fault the time is given by set integer value times the cycle time of the converter supply voltage 1/fn. E.g. DEFAULT value = 10 corresponds to a delay of 10 * 20 ms = 200 ms at 50Hz. | 1 | 10 | 1 | 10 | 1/fn | AL, CM, CON, IMP, MON | 73 |
| 513 | DLY IE MAX | ON delay of the instantaneous exc. current relay. If the excitation current exceeds I_EXC_MAX_LEVEL (506) for longer than DLY_IE_MAX (513), CH FAULT 2 „inst. exc. overcurrent“ will be generated. During the delay time + 30*Ts _{syn} the FREEWHL_CROWBAR (10516) output is TRUE for external freewheeling function at 2 channel (TWIN converter) application. NOTE: The resulting time delay is equal to the set integer value multiplied by 1/(6*fn). E.g. DEFAULT value of 4 corresponds to a delay of 4 * 3.3ms = 13.3ms at 50 Hz | 1 | 30 | 1 | 4 | *Ts _{syn} | AL, CM, CON, IMP, MON | 73 |
| 514 | CONV CT LOCATION | Selection of the converter C.T. location: 0==AT CONV INPUT DEFAULT, valid for all C1 and C2 thyristor types and also for C3 in single channel configuration 1==AT COMMON LINE Only for 2 Channel (TWIN) type AFT, if converter C.T.'s put to common line input or if the chopper version UNS 4870 (type C5) is used. In this case current will be measured also in the non duty channel for back up protection. NOTE: In AFT application with mode AT CONV INPUT, the stand-by channel receives the excitation current signal only across the Modbus channel-to-channel communication link. This link is not fast enough to ensure instantaneous overcurrent protection (CH FAULT 2) in the stand-by channel, only delayed overcurrent (CH FAULT 3) protection is available. | ENUM | 1 | 0 | 0 | - | CM, CON, HID | 73 |
| 515 | CONV SUPPLY | Type of converter supply source: 0==3 PH CONV 1==1 PH CONV / CHOPPER (fully controlled / C5= Chopper). NOTE: Parameter altering becomes effective only after rebooting (power up). Single phase operation (1 PH CONV) causes sensing error between 0 and -15% on U_SYN_RELATIVE (10503) and U_SYN_V (10504) depending on firing angle. | ENUM | 1 | 0 | 0 | - | CM, CON, IMP | 47 |
| 516 | ALPHA MIN LIMIT | ALPHA MIN (minimum firing angle). Setting for max. positive output voltage of converter. Value in degree. NOTE: Type C5 (Chopper): The setting is ignored. IGBT duty cycle internally limited to (180 -3 DEG)/180 DEG. Thyristor duty cycle = 100%. Download only permitted with values between LL and HL -> change value temporarily at C5 ! | 1 | 60 | 10 | 15 | °el | CON, HID | 47 |
| 517 | ALPHA MAX LIMIT | ALPHA MAX (maximum firing angle). Setting for max. negative output voltage of converter. Value in degree. Consider required commutation reserve if DXN (519) is not used (set to 0). With correct setting of DXN (519) the value can be increased up to 165 degree. NOTE: Type C5 (Chopper): The setting is ignored. IGBT duty cycle = 0.31 ms * 2 fn. fn = syn. machine nominal frequency Thyristor duty cycle = (180 -170 DEG)/180 DEG. Download only permitted with values between LL and HL -> change value temporarily with C5 ! | 1 | 165 | 130 | 150 | °el | CON, HID | 47 |

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|------------------|---|------|-----|----|------|----|-----------------------|----|
| 518 | USYN COMPENS SEL | <p>0==OFF: The actual value of converter supply is not considered for ALPHA calculation</p> <p>1==ON: The converter output is kept constant at constant UCTRL if converter supply voltage varies in the range of +/-30% U SYN V NOMINAL (504).</p> <p>CAUTION: don't use this option with single phase supply (515=1 PH CONV) because of the error of U_SYN sensing (see signals 10503 and 10504). Don't use it together with series compounding.</p> <p>NOTE: Type C5 (Chopper): The setting is ignored, there is no compensation available</p> | ENUM | 1 | 0 | 0 | - | CON, HID | 47 |
| 519 | DXN | <p>Additional commutation reserve proportional to the excitation current.</p> <p>Set: $DXN = 2 * ek * (I_CONV_A_RATED/I_EXC_A_NOMINAL) [\%]$.</p> <p>ek = short circuit reactance of excitation transformer in %.</p> <p>NOTE: Type C5 (Chopper): The setting is ignored, there is no current depending reserve required.</p> | 0.1 | 300 | 0 | 0 | % | CON, HID | 47 |
| 520 | I EXC FILT TC | <p>Optional excitation current measurement filter time constant.</p> <p>NOTE: Can be used if the load inductance is to small, especially with indirect excitation systems and single phase converter supply. Consider the increased measuring time constant influence to the closed loop controllers MANUAL CTRL and EXC CURRENT limiter etc.</p> | 1 | 100 | 0 | 0 | ms | DIA, HID | |
| 521 | RIPPLE MON. MODE | <p>Modes OFF and ALARM are only applicable from SW release 41.221!</p> <p>Ref. also to RIPPLE_TIME (512) and BRANCH_NO (10515)</p> <p>0==OFF To be used only if surplus monitor action expected.</p> <p>1==ALARM Used for converter redundancy at single channel system SFE In case one branch may fail. ALARM 124 "Coverter failed" is generated in case of branch fault. Note: Not selfresetting, must be reset.</p> <p>2==CH_FAULT Standard. Must be used at 2 channel system AFT. CH FAULT 34 "Converter fault" is generated in case of branch fault.</p> <p>NOTE: Ripple Monitor trigger condition: DCPEAK + SCHWEL > DCEND DCPEAK Peak current of the thyristor branch conducting cycle (at 30 DEG) DCEND Current at the end of previous conducting cycle SCHWEL 6% of converter nominal current (corresponding to 1.5V burden voltage). The branch number failed can be read from signal BRANCH_NO (10516). From release 41.221_1: In case of an ALARM, the burden signal has an error since the converter gets a freewheeling period of 60 deg. This error will be corrected by a factor 1.2 to the I_EXC_RELATIVE(10501) and I_EXC_A (10502) signal. In addition I_EXC_RELATIVE is filtered by 20ms in this case. Consider this increased measuring time constant for manual control and excitation current limiter.</p> | ENUM | 2 | 2 | 2 | - | AL, CM, CON, MON, IMP | 73 |

2.5 DATA LOGGER Group 06

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|-------------------------|---|----------|-------|--------|-------|--------|-----------|-----|
| 601 | DLOG.[IN1] | Input of DATA_LOGGER. Selects the signal which is measured in channel 1. This channel is as well used as trigger channel if DLOG.TRIGG_COND (607) is set to 2, 3 or 4. DEFAULT: connected to U_MACH_RELATIVE (10101). | AI BI | 19999 | 0 | 10101 | - | DIAG, HID | 130 |
| 602 | DLOG.[IN2] | Input of DATA_LOGGER. Selects the signal which is measured in channel 2. DEFAULT: connected to I_EXC_RELATIVE (10501). | AI BI | 19999 | 0 | 10501 | - | DIAG, HID | 130 |
| 603 | DLOG.[IN3] | Input of DATA_LOGGER. Selects the signal which is measured in channel 3. DEFAULT: connected to U_CTRL_OUT_CH (12110). | AI BI | 19999 | 0 | 12110 | - | DIAG, HID | 130 |
| 604 | DLOG.[IN4] | Input of DATA_LOGGER. Selects the signal which is measured in channel 4. DEFAULT: connected to P_MACH_RELATIVE (10106). | AI BI | 19999 | 0 | 10106 | - | DIAG, HID | 130 |
| 605 | DLOG.[IN5] | Input of DATA_LOGGER. Selects the signal which is measured in channel 5. DEFAULT: connected to Q_MACH_RELATIVE (10110). | AI BI | 19999 | 0 | 10110 | - | DIAG, HID | 130 |
| 606 | DLOG.[IN6] | Input of DATA_LOGGER. Selects the signal which is measured in channel 6. DEFAULT: connected to U_EXC_RELATIVE (10505). | AI BI | 19999 | 0 | 10505 | - | DIAG, HID | 130 |
| 607 | DLOG.TRIGG COND | Selects the triggering condition for the data logger: 0 EXTERNAL, i.e. by CMT TRIG button or if input 611 = TRUE. 1 FAULT + EXT. 2 DIFFERENCE: two successive values of data logger CH1 are larger than DLOG.TRIGG_VALUE (608). 3 MAX / 4==MIN value of data logger CH1 exceeds / falls below DLOG.TRIGG_VALUE (608). | ENUM | 0,2,3 | 0 | 1 | - | DIAG, HID | 130 |
| 608 | DLOG.TRIGG VALUE | Reference value that is used for the triggering conditions DIFFERENCE, MAX or MIN set by parameter DLOG.TRIGG_COND (607). | 1 | 32767 | -32768 | 20000 | - | DIAG, HID | 130 |
| 609 | DLOG.TRIGG DELAY | Number of samples collected after triggering instant. Length of data logger is 1000 samples in each channel. | 1 | 1000 | 0 | 200 | - | DIAG, HID | 130 |
| 610 | DLOG.SAMPL INT | Sampling interval defining how often a measurement is made in each channel. | 1 | 1000 | 1 | 3 | m s | DIAG, HID | 130 |
| 611 | [DLOG.TRIG] | The DATA_LOGGER will be triggered if the input is TRUE and the parameter 607 has been set for 0==EXTERNAL or 1==FAULT + EXT. DEFAULT: not used (12501). | BI | 19999 | 0 | 12501 | - | DIAG, HID | 130 |
| 612 | [DLOG.STOP] | After triggering, the DATA_LOGGER will be stopped if the input is TRUE and the logger is not full yet. DEFAULT: not used (12501). | BI | 19999 | 0 | 12501 | - | DIAG, HID | 130 |
| 613 | [DLOG.RESTART] | The DATA_LOGGER will be restart (ready for new trigger command) after it has been stopped (either full or by DLOG.STOP command) DEFAULT: not used (12501). | BI | 19999 | 0 | 12501 | - | DIAG, HID | 130 |

2.6 DIGITAL I/O Group 07

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|------------|---|----|-------|----|-------|---|---------|----|
| 701 | DOX02.[IN] | DEFAULT: EXC_TRIP from CONTROL LOGIC. Pulls TRIP relay on UNS 0863. (Ref. to 10350 for more information). | BI | 19999 | 0 | 10350 | - | AFB, IO | 9 |
| 702 | DOX03.[IN] | DEFAULT: Field breaker closing command (1.5s) FCB_ON_CTRL from CONTROL LOGIC. NOTE: No action in the non active channel. | BI | 19999 | 0 | 10305 | - | AFB, IO | 10 |
| 703 | DOX04.[IN] | DEFAULT: Field breaker trip command (1.5s) FCB_OFF from CONTROL LOGIC. NOTE: No action in the non active channel. | BI | 19999 | 0 | 10309 | - | AFB, IO | 11 |
| 704 | DOX05.[IN] | DEFAULT: Status AUTO_ON from CONTROL LOGIC. AUTO (AVR) control is active. NOTE: No action in the non active channel. | BI | 19999 | 0 | 10310 | - | AFB, IO | 12 |
| 705 | DOX06.[IN] | DEFAULT: Status MAN_ON from CONTROL LOGIC. MANUAL CTRL is active. NOTE: No action in the non active channel. | BI | 19999 | 0 | 10311 | - | AFB, IO | 13 |
| 706 | DOX07.[IN] | DEFAULT: Status ON_SUPERIMPOSED from CONTROL LOGIC. Preselected controller is active. NOTE: No action in the non active channel. | BI | 19999 | 0 | 10314 | - | AFB, IO | 14 |
| 707 | DOX08.[IN] | DEFAULT: Status REF_MAX_ACTIVE from CONTROL LOGIC. Set point (ref.) of selected controller in MAX (HL) position. NOTE: No action in the non active channel. | BI | 19999 | 0 | 10312 | - | AFB, IO | 15 |
| 708 | DOX09.[IN] | DEFAULT: Status REF_MIN_ACTIVE from CONTROL LOGIC. Set point (ref.) of selected controller in MIN (LL) position. NOTE: No action in the non active channel. | BI | 19999 | 0 | 10313 | - | AFB, IO | 16 |
| 709 | DOX10.[IN] | DEFAULT: Status ON_OE_LIMITER from AVR INPUT. One of the Over Excitation Limiters (OEL) is active. NOTE: No action in the non active channel. | BI | 19999 | 0 | 12002 | - | AFB, IO | 17 |
| 710 | DOX11.[IN] | DEFAULT: Status ON_UE_LIMITER from AVR INPUT. One of the Under Excitation Limiters (UEL) is active. NOTE: No action in the non active channel. | BI | 19999 | 0 | 12003 | - | AFB, IO | 18 |
| 711 | DOX12.[IN] | DEFAULT: Status LOCAL from CONTROL LOGIC. System has been put to LOCAL CTRL by panel or CMT. NOTE: No action in the non active channel. | BI | 19999 | 0 | 10339 | - | AFB, IO | 19 |
| 712 | DOX13.[IN] | DEFAULT: Status RDY_XFER_A_M from FOLLOW UP CTRL. Difference between AUTO and MANUAL is below NOT_OK_LEVEL (2120). This signal enables A-M transfer by Panel or CMT in LOCAL mode. NOTE: No action in the non active channel. | BI | 19999 | 0 | 12117 | - | AFB, IO | 20 |
| 713 | DOX14.[IN] | DEFAULT: Status EXC_ON from CONTROL LOGIC. Excitation is switched ON. NOTE: No action in the non active channel. | BI | 19999 | 0 | 10307 | - | AFB, IO | 21 |
| 714 | DOX15.[IN] | DEFAULT: Field flashing contactor ON command FLASH_ON_FIELD from CONTROL LOGIC. The same output will be activated during battery compounding cycle as well (ref. 10331). NOTE: No action in the non active channel. | BI | 19999 | 0 | 10330 | - | AFB, IO | 22 |
| 715 | DOX16.[IN] | DEFAULT: not used. Spare digital output for application. NOTE: No action in the non active channel. | BI | 19999 | 0 | 12501 | - | AFB, IO | 23 |
| 716 | DOX17.[IN] | DEFAULT: not used. Spare digital output for application. NOTE: No action in the non active channel. | BI | 19999 | 0 | 12501 | - | AFB, IO | 24 |
| 717 | DOX18.[IN] | DEFAULT: Status ALARM from CONTROL LOGIC. Any ALARM is active. NOTE: No action in the non active channel. 2 channel system: No action in the standby channel. Any ALARM (including also channel faults) from standby channel operates the ALARM relay via the duty channel using the serial 2 channel communication link. | BI | 19999 | 0 | 10338 | - | AFB, IO | 25 |

2.7 DIGITAL I/O EXTD. Group 08

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|------------|--|----|-------|----|-------|---|----------|-----------------|
| 801 | DO02E.[IN] | DEFAULT: EXC_TRIP from CONTROL LOGIC. Pulls TRIP relay on 2nd UNS 0863. (Ref. to 10350 for more information). NOTE: Only available with optional I/O extension board UNS 0867 and 2nd I/O board UNS 0863. No action in the non active channel. | BI | 19999 | 0 | 10350 | - | AFB, I/O | 104 |
| 802 | DOE03.[IN] | DEFAULT: not used. Spare digital output for application. NOTE: Only available with optional I/O extension board UNS 0867 and 2nd I/O board UNS 0863. No action in the non active channel. | BI | 19999 | 0 | 12501 | - | AFB, I/O | 105 |
| 803 | DOE04.[IN] | DEFAULT: not used. Spare digital output for application. NOTE: Only available with optional I/O extension board UNS 0867 and 2nd I/O board UNS 0863. No action in the non active channel. | BI | 19999 | 0 | 12501 | - | AFB, I/O | |
| 804 | DOE05.[IN] | DEFAULT: not used. Spare digital output for application. NOTE: Only available with optional I/O extension board UNS 0867 and 2nd I/O board UNS 0863. No action in the non active channel. | BI | 19999 | 0 | 12501 | - | AFB, I/O | 106 ,10 7 |
| 805 | DOE06.[IN] | DEFAULT: not used. Spare digital output for application. NOTE: Only available with optional I/O extension board UNS 0867 and 2nd I/O board UNS 0863. No action in the non active channel. | BI | 19999 | 0 | 12501 | - | AFB, I/O | 108 |
| 806 | DOE07.[IN] | DEFAULT: not used. Spare digital output for application. NOTE: Only available with optional I/O extension board UNS 0867 and 2nd I/O board UNS 0863. No action in the non active channel. | BI | 19999 | 0 | 12501 | - | AFB, I/O | 109 |
| 807 | DOE08.[IN] | DEFAULT: not used. Spare digital output for application. NOTE: Only available with optional I/O extension board UNS 0867 and 2nd I/O board UNS 0863. No action in the non active channel. | BI | 19999 | 0 | 12501 | - | AFB, I/O | 110 |
| 808 | DOE09.[IN] | DEFAULT: not used. Spare digital output for application. NOTE: Only available with optional I/O extension board UNS 0867 and 2nd I/O board UNS 0863. No action in the non active channel. | BI | 19999 | 0 | 12501 | - | AFB, I/O | 111 |
| 809 | DOE10.[IN] | DEFAULT: not used. Spare digital output for application. NOTE: Only available with optional I/O extension board UNS 0867 and 2nd I/O board UNS 0863. No action in the non active channel. | BI | 19999 | 0 | 12501 | - | AFB, I/O | 112 |
| 810 | DOE11.[IN] | DEFAULT: not used. Spare digital output for application. NOTE: Only available with optional I/O extension board UNS 0867 and 2nd I/O board UNS 0863. No action in the non active channel. | BI | 19999 | 0 | 12501 | - | AFB, I/O | 113 |
| 811 | DOE12.[IN] | DEFAULT: not used. Spare digital output for application. NOTE: Only available with optional I/O extension board UNS 0867 and 2nd I/O board UNS 0863. No action in the non active channel. | BI | 19999 | 0 | 12501 | - | AFB, I/O | 114 |
| 812 | DOE13.[IN] | DEFAULT: not used. Spare digital output for application. NOTE: Only available with optional I/O extension board UNS 0867 and 2nd I/O board UNS 0863. No action in the non active channel. | BI | 19999 | 0 | 12501 | - | AFB, I/O | 115 |
| 813 | DOE14.[IN] | DEFAULT: not used. Spare digital output for application. NOTE: Only available with optional I/O extension board UNS 0867 and 2nd I/O board UNS 0863. No action in the non active channel. | BI | 19999 | 0 | 12501 | - | AFB, I/O | 116 |

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|------------|---|----|-------|----|-------|---|----------|-----|
| 814 | DOE15.[IN] | DEFAULT: not used. Spare digital output for application. NOTE: Only available with optional I/O extension board UNS 0867 and 2nd I/O board UNS 0863. No action in the non active channel. | BI | 19999 | 0 | 12501 | - | AFB, I/O | 117 |
| 815 | DOE16.[IN] | DEFAULT: not used. Spare digital output for application. NOTE: Only available with optional I/O extension board UNS 0867 and 2nd I/O board UNS 0863. No action in the non active channel. | BI | 19999 | 0 | 12501 | - | AFB, I/O | 118 |
| 816 | DOE17.[IN] | DEFAULT: not used. Spare digital output for application. NOTE: Only available with optional I/O extension board UNS 0867 and 2nd I/O board UNS 0863. No action in the non active channel. | BI | 19999 | 0 | 12501 | - | AFB, I/O | 119 |
| 817 | DOE18.[IN] | DEFAULT: not used. Spare digital output for application. NOTE: Only available with optional I/O extension board UNS 0867 and 2nd I/O board UNS 0863. No action in the non active channel. | BI | 19999 | 0 | 12501 | - | AFB, I/O | 120 |

2.8 MONITORING Group 09

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|-------------------|---|------|-------|-----|------|---|--------------|----|
| 901 | SUPPLY MODE | Normal converter supply mode: 0==SHUNT (from machines terminals) 1==LINE or PE supply (from aux. LINE or Pilot Exciter machine) NOTE: If LINE supply is used temporarily only (e.g. for BRAKING sequence), this parameter must not be altered, but the ALARM 145 "Test supply" can be suppressed via input A145_BLK/C5_TST(5907). | ENUM | 1 | 0 | 0 | - | IMP, MON | 80 |
| 902 | START IE MONITOR | Margin, in % of nominal excitation current, between actual excitation current limiting and Monitoring characteristics. If exc. current exceeds this margin, then exc. overcurrent Monitoring starts. NOTE: Consider the selectivity to other OEL protections and the control error of the limiter. | 0.01 | 2000 | 100 | 500 | % | CM, MON | 80 |
| 903 | DLY IE MONITORING | ON delay of overcurrent Monitoring. After delay OC1_EXC_CURR (10905) will be TRUE, i.e. IE_LIMITER was not successful within set ON delay. NOTE: Consider the selectivity to other OEL protections and the limiter settling time after big transients. | 0.1 | 100 | 5 | 20 | s | CM, MON, TUN | 80 |
| 904 | START UEL MONIT | Margin, in % of nominal reactive current, between set -Q(P) limiting and loss of excitation Monitoring characteristics. If reactive current drops below this margin, then UEL Monitoring starts. NOTE: Consider the selectivity to other UEL protections and the control error of the limiter. | 0.01 | 10000 | 100 | 100 | % | CM, MON | 80 |
| 905 | DLY UEL MONITOR | ON delay of UEL Monitoring. After delay Signal UE1 FAULT (10907) will be TRUE, i.e. Q(P) limiter was not successful within set ON delay. NOTE: Consider the selectivity to other UEL protections and the limiter settling time after big transients. | 0.1 | 100 | 5 | 20 | s | CM, MON, TUN | 80 |
| 906 | DLY DIODE ALARM | Delay of DIODE_ALARM (10718) signal from optional UNS 0864. If TRUE for longer than the set delay, the BR_INTRPT_ROT_REC (10911) will be TRUE and ALARM 115 „Rot. rectifier OC“ will be released, i.e. a branch interrupt in the rotating rectifier was detected. | 0.1 | 500 | 20 | 100 | s | CM, MON, HID | 80 |
| 907 | DEV U MONITORING | Margin, in % of nominal voltage, between U_MACH_REL and U_SYN_REL. If the difference between this two signals exceeds the set margin, either one of following signal will be TRUE after a delay of 100 ms: If U_MACH_REL < (U_SYN_REL - DEV_U_MONITORING) then U_MACH_FAIL (10908) = TRUE If U_SYN_REL < (U_MACH_REL - DEV_U_MONITORING) then U_SYN_FAIL (10909) = TRUE NOTE: This Monitoring function is not available at 1_PH_CONV and/or LINE or PE supply. | 0.01 | 5000 | 500 | 1500 | % | CM, MON | 81 |

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|-------------------|--|------|------|-----|-------|----|--------------|----|
| 908 | SEL B/L MODE | Not applicable for this release 41.22x | ENUM | - | - | 0 | - | CM, HID, MON | |
| 909 | DELTA U MACH | Not applicable for this release 41. 22x | 0.01 | - | - | 200 | % | CM, MON, TUN | |
| 910 | BOOST TRIG | Not applicable for this release 41. 22x | 0.01 | -0 | - | 12000 | % | CM, MON | |
| 911 | DLY B/L MONITOR | Not applicable for this release 41. 22x | 1 | - | - | 250 | ms | CM, MON | |
| 912 | START V/HZ MON | Margin in % between V/Hz limiting characteristic set by parameters 1911 and 1912 and protection characteristic. Monitoring starts if U_MACH_RELATIVE is higher than the set characteristic. | 0.01 | 2000 | 100 | 500 | % | CM, MON | 80 |
| 913 | DLY V/HZ MONITOR | ON delay of the V/Hz Monitoring function. After delay V/HZ_FAULT (10920) will be TRUE, i.e. the limiter was not successful within set ON delay. NOTE: In MANUAL CTRL mode, the V/Hz limiter is a superimposed type, whose response time has to be considered. | 0.1 | 100 | 5 | 20 | s | CM, MON | 80 |
| 914 | SEL PT FAIL DYN | Selects for the dynamic P.T. failure detection mode: 0==OFF Function not used. 1==ON Dynamic P.T. failure detection released. 2==TEST As ON but only U_MACH_FAIL_DYN (10921) is life, the ALARM 120 „Machine P.T. fail“ and the output U_MACH_FAIL (10908) are inhibited. NOTE: To avoid surplus action the parameters 915 and 916 must be carefully set up and tested before final release. Don't use this function at 3 phase shunt supply, because the Monitoring function set by DEV_U_MONITORING (907) is more robust and doesn't need performance tests. | ENUM | 1 | 0 | 0 | - | HID, MON | 81 |
| 915 | DELAY DU/DT | ON delay of the dU/dt_TRIGGER input. ON delay is required to compensate for the measuring time constant of the input 5909 signal. Increase this delay if the blocking effect by input 5909 signal transients occurs to late. Vice versa the delay must be decreased if the blocking action occurs also and to early at a P.T. failure, because of fast syn. machine response. After setting of 916 check for correct delay by load applications which just releases dU/dt_TRIGGER. In this case blocking action must be prior to dU/dt_TRIGGER. | 1 | 100 | 0 | 50 | ms | MON, TUN | 81 |
| 916 | TRIG DI/DT BLK | Trigger point of the input 5909 transients. Transients above this point are instantaneously blocking the dU/dt_TRIGGER input. Set this value as small as possible, but so that no blocking effect occurs at steady state operation. Check the action of the monitor in TEST position by interrupting one phase of the P.T. leads, when ON_LINE and in MAN operation. Output U_MACH_FAIL_DYN (10921) indicates the action also in TEST position. | 0.01 | 2000 | 0 | 250 | % | MON, TUN | |
| 917 | FLDBFAULT MODE | Selects the type of fieldbus communication fault: 0==EVENT Only logging to FAULT LOGGER 1==ALARM Forces output ALARM (10338) 2==CHANNEL FAULT Forces output CH_FAIL LOGGED (10349) 3==EXCITATION TRIP Forces output EXC_TRIP (10350) | ENUM | 3 | 0 | 1 | - | COM | 81 |
| 918 | FLDBFAULT TIMEOUT | Selects the activation delay: Communication FAULT was to be active for longer than the set time until it is accepted. | 20 | 150 | 0 | 20 | ms | COM | 81 |
| 919 | PWR PACK/I-O HW | Selects the type of power supply unit in combination with interface UNS 1860 type 0==0861 power pack 1860a or b measuring interface 1==0868 power pack supply and 1860a measuring interface 2==0868 power pack supply and 1860b measuring interface | ENUM | 2 | 0 | 2 | - | MON | 80 |

2.9 RT MONITORING Group 10

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|-------------------------|---|------|-------|------|-------|----|--------------|-----|
| 1001 | SEL RTM MODE | Preselects the available Rotor Temp. Monitoring mode: 0==OFF RTM inactive (DEFAULT) 1==ON RTM released 2==TEST1 Temp. simulating (R = U_EXC_TEST (1012) / 100% I_EXC) ALARM and FAULT outputs blocked 3==TEST2 Temp. simulating (R = U_EXC_TEST (1012) / 100% I_EXC) ALARM and FAULT outputs released 4==TEST3 RTM released but ALARM and FAULT outputs blocked NOTE: Preadjust the parameters 1002... 1008 and use TEST3 to verify measured temperature before releasing. Refer also to U_EXC_TEST (1012) setting for temperature indication results during test. Consider the 10s measuring time constant as well (it takes about 50s for steady state indication). | ENUM | 4 | 1 | 0 | - | CM, MON | 121 |
| 1002 | U BRUSH RELATIVE | Fixed part of voltage drop across the slip ring brushes. Set U_BRUSH_RELATIVE [%] = 100 * U_BRUSH [V] / U_EXC_V_NOMINAL (501) NOTE: U_BRUSH = Current independent voltage drop across both brushes (+ and -) U_EXC_V_NOMINAL = Required converter output voltage at set rotor temp. RTEMP_DEG_NOM (1008), which includes both voltage drops U_BRUSH_RELATIVE and U_DROP_RELATIVE. Readjust parameter 501 first if required. | 0.01 | 1000 | 0 | 0 | % | CM, MON, TUN | 121 |
| 1003 | U DROP RELATIVE | Current dependent drop between Exciter output and field winding including current dependent brush drop. Set U_DROP_RELATIVE [%] = 100 * RL [Ohm] / RFN [Ohm] NOTE: RL = resistance of connections between converter output and field winding including brush resistance RFN = Field winding resistance at RTEMP_DEG_NOM (1008) | 0.01 | 2000 | 0 | 0 | % | CM, MON, TUN | 121 |
| 1004 | TC OFF LINE | Effective time constant if machine OFF_LINE = no load time constant Td0' of the synchronous machine. | 0.01 | 2000 | 20 | 600 | s | CM, MON | 121 |
| 1005 | TC ON LINE | Effective time constant if machine ON_LINE = transient time constant Td' of the synchronous machine. | 0.01 | 100 | 10 | 100 | s | CM, MON | 121 |
| 1006 | RFN RELATIVE | Relative total resistance seen from converter output at RTEMP_DEG_NOM (1008): Set RFN_RELATIVE = 10'000% / [100% - U_BRUSH_RELATIVE (1002) - U_DROP_RELATIVE (1003)] NOTE: After this setting output RF_RELATIVE (11001) represents relative field winding resistance = 100% at set nominal rotor temp. RTEMP_DEG_NOM (1008). Use RFN_RELATIVE parameter for fine tuning of RTEMP_DEG (11002) output if required. | 0.01 | 15000 | 5000 | 10000 | % | CM, MON, TUN | 121 |
| 1007 | RF0 RELATIVE | Relative field resistance at zero degree centigrade: Set RF0_RELATIVE = (100% * DEG_R0) / (DEG_R0 + RTEMP_DEG_NOM (1008)) NOTE: DEG_R0 is the fictive temperature for zero field resistance (Cu = 235K). RTEMP_DEG_NOM: see 1008. | 0.01 | 15000 | 4000 | 7460 | % | CM, MON, TUN | 121 |
| 1008 | RTEMP DEG NOM | Rotor temperature at RF_RELATIVE (11001) = 100% Reduce this value to the specified rotor temp. at full load point. | 1 | 150 | 30 | 80 | °C | CM, MON | 121 |
| 1009 | RTEMP DEG ALARM | Rotor temperature ALARM level. If temp. increases above this level RTEMP_ALARM (11004) will be TRUE, which generates ALARM 104 „Rotor temp. Alarm“. Set this level to the required ALARM level. | 1 | 150 | 50 | 110 | °C | CM, MON | 121 |
| 1010 | RTEMP DEG FAULT | Rotor temperature FAULT level. If temp. increases above this level RTEMP_FAULT (11005) will be TRUE, which generates FAULT 7 „Rotor overtemp.trip“. Reduce this level to the required FAULT level. NOTE: Be sure that rotor temp. measurement is O.K. before reducing to avoid the risk of unexpected TRIP of the system. | 1 | 200 | 50 | 160 | °C | CM, MON | 121 |

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|----------------|---|------|-------|----|-------|---|--------------|-----|
| 1011 | HOT SPOT CONST | With this constant the hot spot temp. HS_RTEMP_DEG (11003) will be calculated as follows: $HS_RTEMP_DEG = RTEMP_DEG (11002) + ((HOT_SPOT_CONST/100) * IE^2[p.u])$ NOTE: The hot spot is not considered in for ALARM and FAULT evaluations. | 0.01 | 2000 | 0 | 0 | % | CM, MON | 121 |
| 1012 | U EXC TEST | Test parameter simulating excitation voltage if SEL_RTM_MODE = TEST 1 or TEST 2. $RF_RELATIVE [\%] = RE_TOT_RELATIVE [\%] * (U_EXC_TEST / 100\%)$ | 0.01 | 20000 | 0 | 10000 | % | CM, MON, HID | 121 |

2.10 FAULTS, ALARMS Group 11

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|------------------|--|------|-------|----|-------|---|-------|----|
| 1101 | USER EVENT1.[IN] | Activates logging of an external ALARM or FAULT into the FAULT LOGGER. | BI | 19999 | 0 | 12501 | - | AL | 48 |
| 1102 | USER EVENT1.TYPE | Selects the type of external EVENT: 0==EXCITATION TRIP Forces output EXC_TRIP (10350) 1==CHANNEL FAULT Forces output CH_FAIL_LOGGED (10349) 2==AVR FAULT Forces output AVR_FAULT (10910) 3==ALARM Forces output ALARM (10338) 4==EVENT Only logging to FAULT LOGGER | ENUM | 4 | 1 | 4 | - | AL | 48 |
| 1103 | USER EVENT1.TEXT | Defines the text which can be read from the FAULT LOGGER. NOTE: With this SW version TEXT cannot be changed. Default text read: „User Event 1“ | - | - | - | - | - | HID | 48 |
| 1104 | USER EVENT1.DLY | Selects the activation delay: External EVENT has to be active for longer than the set time delay until it is accepted. | 0.01 | 32767 | 0 | 0 | s | HID | 48 |
| 1105 | USER EVENT2.[IN] | Activates logging of an external ALARM or FAULT into the FAULT LOGGER. | BI | 19999 | 0 | 12501 | - | AL | 49 |
| 1106 | USER EVENT2.TYPE | Selects the type of external EVENT: (See USER EVENT1.TYPE for available values). | ENUM | 4 | 1 | 4 | - | AL | 49 |
| 1107 | USER EVENT2.TEXT | Defines the text which can be read from the FAULT LOGGER. NOTE: With this SW version TEXT cannot be changed. Default text read: „User Event 2“ | - | - | - | - | - | HID | 49 |
| 1108 | USER EVENT2.DLY | Selects the activation delay: External EVENT has to be active for longer than the set time delay until it is accepted. | 0.01 | 32767 | 0 | 0 | s | HID | 49 |
| 1109 | USER EVENT3.[IN] | Activates logging of an external ALARM or FAULT into the FAULT LOGGER. | BI | 19999 | 0 | 12501 | - | AL | 50 |
| 1110 | USER EVENT3.TYPE | Selects the type of external EVENT: (See USER EVENT1.TYPE for available values). | ENUM | 4 | 1 | 4 | - | AL | 50 |
| 1111 | USER EVENT3.TEXT | Defines the text which can be read from the FAULT LOGGER. NOTE: With this SW version TEXT cannot be changed. Default text read: „User Event 3“ | - | - | - | - | - | HID | 50 |
| 1112 | USER EVENT3.DLY | Selects the activation delay: External EVENT has to be active for longer than the set time delay until it is accepted. | BI | 32767 | 0 | 0 | s | HID | 50 |
| 1113 | USER EVENT4.[IN] | Activates logging of an external ALARM or FAULT into the FAULT LOGGER. | 0,01 | 19999 | 0 | 12501 | - | AL | 51 |
| 1114 | USER EVENT4.TYPE | Selects the type of external EVENT: (See USER EVENT1.TYPE for available values). | ENUM | 4 | 1 | 4 | - | AL | 51 |
| 1115 | USER EVENT4.TEXT | Defines the text which can be read from the FAULT LOGGER. NOTE: With this SW version TEXT cannot be changed. Default text read: „User Event 4“ | - | - | - | - | - | HID | 51 |
| 1116 | USER EVENT4.DLY | Selects the activation delay: External EVENT has to be active for longer than the set time delay until it is accepted. | 0.01 | 32767 | 0 | 0 | s | HID | 51 |
| 1117 | USER EVENT5.[IN] | Activates logging of an external ALARM or FAULT into the FAULT LOGGER. | BI | 19999 | 0 | 12501 | - | AL | 52 |
| 1118 | USER EVENT5.TYPE | Selects the type of external EVENT: (See USER EVENT1.TYPE for available values). | ENUM | 4 | 1 | 4 | - | AL | 52 |

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|------------------|--|------|-------|----|-------|---|-------|----|
| 1119 | USER EVENT5.TEXT | Defines the text which can be read from the FAULT LOGGER. NOTE: With this SW version TEXT cannot be changed. Default text read: „User Event 5“ | - | - | - | - | - | HID | 52 |
| 1120 | USER EVENT5.DLY | Selects the activation delay: External EVENT has to be active for longer than the set time delay until it is accepted. | 0.01 | 32767 | 0 | 0 | s | HID | 52 |
| 1121 | USER EVENT6.[IN] | Activates logging of an external ALARM or FAULT into the FAULT LOGGER. | BI | 19999 | 0 | 12501 | - | AL | 53 |
| 1122 | USER EVENT6.TYPE | Selects the type of external EVENT: (See USER EVENT1.TYPE for available values). | ENUM | 4 | 1 | 4 | - | AL | 53 |
| 1123 | USER EVENT6.TEXT | Defines the text which can be read from the FAULT LOGGER. NOTE: With this SW version TEXT cannot be changed. Default text read: „User Event 6“ | - | - | - | - | - | HID | 53 |
| 1124 | USER EVENT6.DLY | Selects the activation delay: External EVENT has to be active for longer than the set time delay until it is accepted. | 0.01 | 32767 | 0 | 0 | s | HID | 53 |

2.11 MAINTENANCE Group 12

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|--------------------------|---|------|-------|------------|------|---|---------|----|
| 1201 | TEST MODE | This parameter is used to start special functions for testing and maintenance. After the function has been completed TEST MODE changes to value 0. If an error occurs during „special function“, TEST MODE is set to value 12. Following functions are available: 0==NOT_ACTIVATED No function is active 1==CLEAR_FAULT_LOGG. Clears the content of the Fault Logger 2==CALC_PROGRAM_LOAD Calculates the load of UN-F control program. The result can be read from PROGRAM_LOAD (11209). The calculation will take about 20 s. | ENUM | 1,2 | 0 | 0 | - | CM, HID | |
| 1202 | CMT UNF ADDR | The node address of the device in the communication link for CMT/UNF PC tool. Not used with CMT for DCS500 (only „single drive“ application available). | 1 | 250 | 1 | 250 | - | CM, HID | |
| 1203 | DEVICE ID | The node address number at the Modbus panel link. The UNS 0874 panel is always Master and has the ID = 0. DEFAULT: ID of the channel 1 (or single channel). NOTE: Set the ID No. to 2 in the 2nd channel. The address will only be accepted from master (UNS 0874) after disconnection of the panel UNS 0874 (reboot). | 1 | 31 | 0 | 0 | - | CM, HID | |
| 1204 | POT1 VALUE | Constant test reference 1 for commissioning. (Upper) value of the SQUARE_WAVE (11203) signal. Normally used for manual tuning PI(D) controllers. | 1 | 32767 | - 32768 | 800 | - | TUN | |
| 1205 | POT2 VALUE | Constant test reference 2 for commissioning. (Lower) value of the SQUARE_WAVE (11203) signal. Normally used for manual tuning PI(D) controllers. | 1 | 32767 | - 32768 | 50 | - | TUN | |
| 1206 | PERIOD BTW POT1/2 | The cycle period of the square wave generator for commissioning. During this period the SQUARE_WAVE (11203) signal becomes the POT1_VALUE (1204) and the POT2_VALUE (1205) with a duty cycle of 50% each. Normally used for manual tuning PI(D) controllers. | 0.01 | 30000 | 1 | 100 | s | TUN | |
| 1207 | DEBUG ADDR 1 | Debugging address which gives access to any known address in the firmware. Mainly used for debugging of not documented addresses within the function blocks (SP) by ABB software experts. | 1 | 65535 | 0 | 0 | - | DIAG | |
| 1208 | DEBUG ADDR 2 | Debugging address which gives access to any known address in the firmware. Mainly used for debugging of not documented addresses within the function blocks (SP) by ABB software experts. | 1 | 65535 | 0 | 0 | - | DIAG | |
| 1209 | DEBUG ADDR 3 | Debugging address which gives access to any known address in the firmware. Mainly used for debugging of not documented addresses within the function blocks (SP) by ABB software experts. | 1 | 65535 | 0 | 0 | - | DIAG | |
| 1210 | DEBUG ADDR 4 | Debugging address which gives access to any known address in the firmware. Mainly used for debugging of not documented addresses within the function blocks (SP) by ABB software experts. | 1 | 65535 | 0 | 0 | - | DIAG | |
| 1211 | DEBUG ADDR 5 | Debugging address which gives access to any known address in the firmware. Mainly used for debugging of not documented addresses within the function blocks (SP) by ABB software experts. | 1 | 65535 | 0 | 0 | - | DIAG | |
| 1212 | DEBUG ADDR 6 | Debugging address which gives access to any known address in the firmware. Mainly used for debugging of not documented addresses within the function blocks (SP) by ABB software experts. | 1 | 65535 | 0 | 0 | - | DIAG | |
| 1213 | WRITE ENABLE KEY | KEY number: To enable parameter change, KEY has to be equal to PIN. | 1 | 1000 | 1 | 358 | - | HID | |

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|--------------------|---|------|-------|----|-------|---|---------|----|
| 1214 | WRITE ENABLE PIN | PIN number to protect the parameter settings. Indication is „0“ if the KEY number (1213) is not correct. In this case the parameters are write protected. Important: if PIN number is other than DEFAULT, before saving parameters to FEPROM you should write the PIN number down to the system documentation and save enabled state (KEY==PIN) to disk, if CMT available. Don't use "0" as PIN number since KEY number has to be >0! NOTE: if PIN number gets lost, download saved parameter set (with KEY==PIN) or set parameters to DEFAULT values and change parameters according to application by hand. | 1 | 1000 | 0 | 358 | - | HID | |
| 1215 | LANGUAGE | Selects the language used for texts in the panel and in the CMT. 0==ENGLISH 1==GERMAN 2==ITALIAN 3==SPANISH 4==FRENCH NOTE: ITALIAN, SPANISH, FRENCH are only available from release 41.221_1 (Substatus 1). | ENUM | 4 | 0 | 0 | - | CM, IMP | - |
| 1216 | ACTUAL VALUE 1 | Address of the actual value signal displayed on the panel row 2. DEFAULT: MODE_INDICATION (10301) | BI | 19999 | 0 | 10301 | - | CM, HID | |
| 1217 | ACTUAL VALUE 1 | Address of the actual value signal displayed on the panel row 3. DEFAULT: U_MACH_V (10102) | BI | 19999 | 0 | 10301 | - | CM, HID | |
| 1218 | ACTUAL VALUE 1 | Address of the actual value signal displayed on the panel row 4. DEFAULT: I_EXC_A (10502) | BI | 19999 | 0 | 10301 | - | CM, HID | |
| 1219 | FIELD BUS NODE ADD | Node Address of the DDCS link. NOTE: DDCS link is only used as point to point connection to the fieldbus adapter module, therefore the address is always 1. | 1 | 255 | 0 | 1 | - | CM, HID | |
| 1220 | MACRO SELECT | Not applicable for this firmware release 41.22x: 0==NONE 1==MACRO 1 2==MACRO 2 3==MACRO 3 | ENUM | 3 | 0 | 0 | - | CM, HID | |

2.12 IE LIMITER Group 13

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|------------------|---|------|-------|-----------|-------|---|-----------------|----|
| 1301 | REF1 IETH | (Upper) thermal limiting setpoint (1) of excitation current. Parameter is active as long as the input SEL_REF2_IETH (6303) is not active. Set continuous allowed excitation current (100...110% I_EXC_RELATIVE). If the REF2_IETH (1302) is used too, set REF1_IETH equal to or higher than REF2_IETH (1302). | 0.01 | 20000 | 1000 | 10500 | % | AVR, TUN | 55 |
| 1302 | REF2 IETH | (Lower) thermal limiting setpoint (2) of excitation current. Parameter is active as long as the input SEL_REF2_IETH (6303) is active. Set REF2_IETH equal to or lower than REF1_IETH (1301). | 0.01 | 20000 | 1000 | 10500 | % | HID, AVR | 55 |
| 1303 | REF1 IEMAX | (Upper) ceiling limiting setpoint (1) of excitation current. Parameter is active as long as the input SEL_MAX2_IEMAX (6304) is not active. Set ceiling excitation current which is allowed during TIME_IEMAX_SEL (1305). If the REF2_IEMAX (1304) is used too, set REF1_IEMAX equal to or higher than REF2_IEMAX (1304). | 0.01 | 32767 | 1000 | 16000 | % | AVR, TUN | 55 |
| 1304 | REF2 IEMAX | (Lower) ceiling limiting setpoint (2) of excitation current. Parameter is active as long as the input SEL_MAX2_IEMAX (6304) is active. Set REF2_IEMAX equal to or lower than REF1_IEMAX (1303). | 0.01 | 32767 | 1000 | 16000 | % | HID, AVR | 55 |
| 1305 | TIME IEMAX SEL | Ceiling cycle at excitation current equal to selected ceiling setpoint REF1_IEMAX (1303) or REF2_IEMAX (1304). Overcurrent cycle for any current IE between IETH and IEMAX: $t = [(REF_IEMAX[p.u.] - 0.9REFx_IETH)^2 / (IE[p.u.] - 0.9REFx_IETH)^2] * TIME_IEMAX_SEL$. | 0.1 | 1000 | 10 | 100 | s | AVR, TUN | 55 |
| 1306 | TC IERED MAX-TH | With this time constant the reference value REF_IE_LIM_ACT will be reduced to selected IETH after an overcurrent cycle. | 0.01 | 1000 | 10 | 100 | s | HID, AVR | 55 |
| 1307 | TIME IE BACK INT | Time which is needed to fully reset overcurrent integrator after I_EXC_RELATIVE (10501) has been fallen below selected REF1, 2_IETH value. | 0.1 | 32767 | 100 | 1000 | s | AVR, TUN | 55 |
| 1308 | not used | | 0.01 | 32767 | 1000 0 | 16000 | % | CM, HID, AVR | 55 |
| 1309 | KOEL IE | Limiting gain in % of actual AVR gain. Lead/lag time constants TA, TB see AVR CTRL group 19. | 1 | 200 | 0 | 50 | % | AVR, TUN | 55 |

2.13 I LIMITER Group 14

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|-------------------|---|------|-------|------|-------|---|----------|----|
| 1401 | REF1 I MACH TH | (Upper) thermal limiting setpoint (1) of stator current. Parameter is active as long as the input SEL_REF2_ITH2 (6402) is not active . Set continuous allowed stator current (100...110% I_MACH_RELATIVE). If the REF2_I_MACH_TH (1402) is used too, set REF1_I_MACH_TH equal or higher than REF2_I_MACH_TH (1402). | 0.01 | 20000 | 1000 | 10500 | % | AVR, TUN | 56 |
| 1402 | REF2 I MACH TH | (Lower) thermal limiting setpoint (2) of stator current. Parameter is active as long as the input SEL_REF2_ITH2 (6402) is active . Set REF2_I_MACH_TH equal or lower than REF1_I_MACH_TH (1401). | 0.01 | 20000 | 1000 | 10500 | % | HID, AVR | 56 |
| 1403 | I MACH EQUIVALENT | At this current level the overcurrent cycle time is equal to set time TIME_I_EQUIVALENT (1404). NOTE: There is no instantaneous stator current limitation at this current level. | 0.01 | 32767 | 1000 | 16000 | % | AVR, TUN | 56 |
| 1404 | TIME I EQUIVALENT | Time delay at stator current level equal to I MACH EQUIVALENT. Overcurrent cycle for any stator overcurrent I: $t = [(I_MACH_EQUIVALENT[p.u.] - 0.9REFx_I_MACH_TH)^2 / (I[p.u.] - 0.9REFx_I_MACH_TH)^2] * TIME_I_EQUIVALENT$ NOTE: There is no instantaneous stator current limitation at I_MACH_EQUIVALENT. | 0.1 | 1000 | 10 | 100 | s | AVR, TUN | 56 |
| 1405 | TC I MACH RED | With this time constant the reference value REF_I_LIM_ACT will be reduced from 332% to selected REF_I_MACH_TH after an overcurrent cycle. | 0.01 | 1000 | 10 | 100 | s | HID, AVR | 56 |
| 1406 | TIME I BACK INT | Time which is needed to fully reset overcurrent integrator after I_MACH_RELATIVE (10103) has been fallen below selected REF1, 2_I_MACH_TH value. | 0.1 | 32767 | 10 | 1000 | s | AVR, TUN | 56 |
| 1407 | KOEL I MACH | OE (lag) limiter gain in % of actual AVR gain. Lead/lag time constants TA, TB see AVR CTRL group 19. NOTE: With parameter value = 0, the whole limiter block is skipped. Consider processor load increase of approx. 1% when using this limiter function (Check CPU load by parameter 1201). Ref. also to parameter 7005 for activation of limiter. | 1 | 200 | 0 | 50 | % | AVR, TUN | 56 |
| 1408 | KUEL I MACH | UE (lead) limiter gain in % of actual AVR gain. Lead/lag time constants TA, TB see AVR CTRL group 19. NOTE: if the value is set very low (<10%) to get stable operation, then PSS option UN 0869 may be required. Ref. to 7008 regarding limiter using. With parameter value = 0, the whole limiter block is skipped. Consider processor load increase of approx. 1% when using this limiter function (Check CPU load by parameter 1201). Ref. also to param. 7008 for activation of limiter. | 1 | 200 | 0 | 50 | % | AVR, TUN | 56 |

2.14 PQ IEMIN LIM Group 15

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|-------------------|--|------|------|--------|--------|---|----------|----|
| 1501 | REF0 Q(P) LIM | Characteristic -Q = f(P) at P = 0%. Consider that the characteristic in the power chart will be moved by the square of U_MACH [p.u.]. E.g. If U_MACH_RELATIVE = 0.9, then -Qlim = 0.81*-Qlim set. | 0.01 | 0 | -15000 | -15000 | % | AVR, TUN | 61 |
| 1502 | REF25 Q(P) LIM | Characteristic -Q = f(P) at P = 25%. Consider that the characteristic in the power chart will be moved by square of U_MACH [p.u.]. E.g. If U_MACH_RELATIVE = 0.9, then -Qlim = 0.81*-Qlim set. | 0.01 | 0 | -15000 | -15000 | % | AVR, TUN | 61 |
| 1503 | REF50 Q(P) LIM | Characteristic -Q = f(P) at P = 50%. Consider that the characteristic in the power chart will be moved by square of U_MACH [p.u.]. E.g. If U_MACH_RELATIVE = 0.9, then -Qlim = 0.81*-Qlim set. | 0.01 | 2000 | -15000 | -15000 | % | AVR, TUN | 61 |
| 1504 | REF75 Q(P) LIM | Characteristic -Q = f(P) at P = 75%. Consider that the characteristic in the power chart will be moved by square of U_MACH [p.u.]. E.g. If U_MACH_RELATIVE = 0.9, then -Qlim = 0.81*-Qlim set. | 0.01 | 2000 | -15000 | -15000 | % | AVR, TUN | 61 |
| 1505 | Q(P) LIM | Characteristic -Q = f(P) at P = 100%. Consider that the characteristic in the power chart will be moved by square of U_MACH [p.u.]. E.g. If U_MACH_RELATIVE = 0.9, then -Qlim = 0.81*-Qlim set. | 0.01 | 2000 | -15000 | -15000 | % | AVR, TUN | 61 |
| 1506 | KUEL Q(P) LIM | P Q limiter gain in % of ACTUAL AVR gain. Lead/lag time constants TA, TB see AVR CTRL group 19. NOTE: if the value is set very low (<10%) to get stable operation, than PSS option UN 0869 is may be required. Ref. to 7007 regarding limiter using too. | 1 | 200 | 0 | 50 | % | AVR, TUN | 61 |
| 1507 | REF IEMIN LIM AVR | Minimum excitation current limit. NOTE: It is not required using this limiter to hold a minimum converter (thyristor hold) current, because the gate pulse stream always ensures converter starting. Ref. to 7009 for limiter using. | 0.01 | 5000 | 0 | 0 | % | AVR, TUN | 62 |
| 1508 | KUEL IEMIN LIM A | IE MIN limiter gain in % of actual AVR gain. Lead/lag time constants TA, TB see AVR PID group 19. Ref. to 7009 for limiter using. | 1 | 200 | 0 | 50 | % | AVR, TUN | 62 |

2.15 COSPHI CTRL Group 17

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|-------------------|---|------|------|-------|-------|---|--------------|----|
| 1701 | RELEASE FOLLOW C | COSPHI setpoint follows the actual operating condition; 0==OFF, 1==ON. NOTE: Use this option if no setpoint feedback via analog output is made to control desk. It ensures that COSPHI_CTRL starts from actual operating point if switched ON. | ENUM | 1 | 0 | 0 | - | CM, IMP, SIP | 58 |
| 1702 | RAMPTIME REF COS | Setpoint ramp time , valid for remote RAISE, LOWER commands (traveling time between HL and LL at permanent command). | 0.1 | 1000 | 0 | 600 | s | CM, HID, SIP | 58 |
| 1703 | HL REF COSPHI | COSPHI setpoint maximum limit. NOTE: Value to be set = $10000 - [(COSPHI_{min} \text{ overexcited}) * 10000]$. E.g. for COSPHI _{min} overexcited = 0.6 , set $10000 - [(0.6) * 10000] = 4000$. Where COSPHI _{min} = lowest overexcited P.F. Don't set this parameter below LL_REF_COSPHI (1704). Consider that the set value is valid as well for the IN_REF_EXT_COS (6705) signal, thus use the same range at analog input channel (ref. to 107..112), otherwise the remote ref. signal range doesn't correspond to the set limits. | 1 | 7000 | 0 | 5000 | - | CM, HID, SIP | 58 |
| 1704 | LL REF COSPHI | COSPHI setpoint minimum limit. Value to be set = $[(COSPHI_{min} \text{ underexcited}) * 10000] - 10000$, e.g. for COSPHI _{min} underexcited = 0.8 , set $[(0.8) * 10000] - 10000 = -2000$. Where COSPHI _{min} = lowest underexcited P.F. NOTE: Don't set this parameter above HL_REF_COSPHI (1703). Consider that the set value is valid as well for the IN_REF_EXT_COS (6705) signal, thus use the same range at analog input channel (ref. to 107..112 and 115...120), otherwise the remote ref. signal range doesn't correspond to the set limits. | 1 | 0 | -7000 | -5000 | - | CM, HID, SIP | 58 |
| 1705 | PRESET REF COSPHI | COSPHI setpoint preset value. Preset value which becomes active if TRIG_PRST_COS (6704) is TRUE. Set it between HL and LL_REF_COSPHI. Consider the setpoint characteristic: VALUE = $10000 - [(PRESET_REF_COSPHI \text{ overexcited}) * 10000]$ e.g. = $10000 - [0.8 * 10000] = 2000$ VALUE = $[(PRESET_REF_COSPHI \text{ underexcited}) * 10000] - 10000$ e.g. = $[0.9 * 10000] - 10000 = -1000$ DEFAULT: This value will dynamically be set by ON_PRESET_CMD (10304) at start excitation and if machine goes OFF_LINE. | 1 | 7000 | -7000 | 0 | - | CM, HID, SIP | 58 |
| 1706 | DEADBAND IMP CTRL | Error dead band of the selected imposed controller. Within the set dead band there is no imposed controller action. If the error signal leaves the dead band, first DELAY_IMP_CTRL (1707) must elapse before action. NOTE: If set value is too small, the timer may not be reset because of fluctuations and the timer function may be lost i.e. instantaneous action at external transients. On the other hand if set value is too big, then accuracy of control decreases. | 0.01 | 1000 | 0 | 50 | % | SIP, TUN | 58 |
| 1707 | DELAY IMP CTRL | Delay which starts if imposed controller error signal exceeds dead band. Ref. to 1706. | 0.1 | 1000 | 0 | 50 | s | SIP, TUN | 58 |

2.16 Q CTRL Group 18

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|-------------------|--|------|-------|--------|--------|---|--------------|----|
| 1801 | RELEASE FOLLOW Q | Q_CTRL setpoint follows the actual operating condition; 0==OFF, 1==ON. NOTE: Use this option if no setpoint feedback via analog output is made to control desk. It ensures that Q_CTRL starts from actual operating point if switched on. | ENUM | 1 | 0 | 0 | - | CM, IMP, SIP | 57 |
| 1802 | RAMPTIME REF Q | Setpoint ramp time , valid for remote RAISE, LOWER commands (traveling time between HL and LL at permanent command). | 0.1 | 1000 | 0 | 600 | s | CM, HID, SIP | 57 |
| 1803 | HL REF Q CTRL | Q_CTRL setpoint maximum limit. 100% == 1p.u. overexcited . -100% == 1p.u. underexcited . | 0.01 | 10000 | -10000 | 10000 | % | CM, HID, SIP | 57 |
| 1804 | LL REF Q CTRL | Q_CTRL setpoint minimum limit. 100% == 1p.u. overexcited . -100% == 1p.u. underexcited . | 0.01 | 10000 | -10000 | -10000 | % | CM, HID, SIP | 57 |
| 1805 | PRESET REF Q CTRL | Q_CTRL setpoint preset value. Preset value which becomes active if TRIG_PRST_Q (6804) is TRUE. Set it between HL and LL_REF_Q_CTRL. | 0.01 | 10000 | -10000 | 0 | % | CM, HID, SIP | 57 |

2.17 AVR CTRL Group 19

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|-------------------|---|------|-------|-----------|-------|---|-------------------|----|
| 1901 | HL REF AVR | AVR (AUTO) setpoint max. limit. NOTE: The following signals: Q, P_DROOP/COMPENS (1909, 10), ADD_IN_REF1_A (6908), ADD_INPUT_AVR (7002) influence the operation range of the AVR too. E.g. Q_DROOP (1909) = -5% reduces the max. setpoint by 5% at 100% reactive load generation. Consider the settings of the V/Hz limiter in group 21 too. Don't set this parameter below LL_REF_AVR (1902). | 0.01 | 15000 | 0 | 11000 | % | CM, HID, AVR | 43 |
| 1902 | LL REF AVR | AVR (AUTO) setpoint min. limit. NOTE: The following signals: Q, P_DROOP/COMPENS (1909, 10), ADD_IN_REF1_A (6908), ADD_INPUT_AVR (7002) influence the operation range of the AVR too. E.g. Q_COMPENSATION (1909) = +5% increases the min. setpoint by 5% at 100% reactive load generation. Don't set this parameter above HL_REF_AVR (1901). | 0.01 | 15000 | 0 | 9000 | % | CM, HID, AVR | 43 |
| 1903 | PRESET1 REF AVR | AVR setpoint PRESET1 value. 1st preset value which becomes active if SEL_PRESET2_AVR (6906) is FALSE and TRIG_PRST_AVR (6907) is TRUE. Set it between HL and LL_REF_AVR. DEFAULT: This value will dynamically be set by ON_PRESET_CMD (10304) at start excitation and if machine goes OFF_LINE. | 0.01 | 15000 | 0 | 10000 | % | CM, HID, AVR | 43 |
| 1904 | PRESET2 REF AVR | AVR setpoint PRESET2 value. 2nd preset value which becomes active if SEL_PRESET2_AVR (6906) and TRIG_PRST_AVR (6907) is TRUE. Set it between HL and LL_REF_AVR. DEFAULT: not used (12501). | 0.01 | 15000 | 0 | 10000 | % | CM, HID, AVR | 43 |
| 1905 | RAMP TIME1 REF A | AVR setpoint ramp time 1, valid for remote RAISE, LOWER commands (traveling time between HL and LL at permanent COMMAND). Becomes active if SEL_RAMPTIME2_A is FALSE = DEFAULT. | 0.1 | 6000 | 10 | 600 | s | CM, HID, AVR | 43 |
| 1906 | RAMP_TIME2 REF A | AVR setpoint ramp time 2, valid for remote RAISE, LOWER commands (traveling time between HL and LL at permanent COMMAND). Becomes active if SEL_RAMPTIME2_A is TRUE. DEFAULT: not used (12501). | 0.1 | 6000 | 10 | 600 | s | CM, HID, AVR | 43 |
| 1907 | TC FOLLOW UP AVR | Time constant of the auto follower. Because of superimposed action to the AVR setpoint, the TC should be at least 10 times bigger than selected TA (1920...1922) during MANUAL operation. | 0.1 | 10000 | 10 | 100 | s | AVR, TUN | 43 |
| 1908 | TC IMPOSED CTRL A | Time constant of the imposed follower. Because of superimposed action to the AVR setpoint, the TC should be 50..100 times bigger than selected TA (1920...1922) during imposed ctrl operation. NOTE: The reason for the big TC is because the reactive power change rate resulting from an AVR setpoint change depends on the resulting Q-droop of the system by: $\Delta Q = \Delta \text{REF_AVR} / Q_DROOP$ e.g. 40% $\Delta Q = 2\% \Delta \text{REF_AVR} / 5\% Q_DROOP$. | 0.1 | 10000 | 10 | 1000 | s | SIP, TUN | 43 |
| 1909 | Q DROOP/COMPENS | Determines characteristic $U_MACH_RELATIVE = f(Q_MACH_RELATIVE)$: DROOP = negative values (-3..-8%) are required for parallel operation with rigid grid or to get reactive load sharing with other machines which are connected to the same bus bar without unit transformers. COMPENSATION = positive values to compensate a part of the unit transformers reactance to get the same resulting droop of -3..-8% instead of transformer reactance. DEFAULT: -5% DROOP. | 0.01 | 2000 | -200 0 | -500 | % | CM, IMP, AVR, TUN | 44 |

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|--------------------------|---|------|-------|---------------|-------|----------|---------------|----|
| 1910 | P DROOP/COMPENS | Determines characteristic $U_MACH_RELATIVE = f(P_MACH_RELATIVE)$: Normally used to compensate (positive values) for line droop, or to get overexcited with increasing active power after synchronization, e.g. P.F. = 0.8. DEFAULT: not used (12501). | 0.01 | 2000 | - 200 0 | 0 | % | CM, HID, AVR | 44 |
| 1911 | REF V/Hz LIM AVR | V/Hz gradient in % voltage / 100% speed (frequency): DEFAULT = 115% V/Hz means that the AVR setpoint drops with a gradient of 1.15 p.u. voltage/speed from the point REF_UMAX_fNOM_AVR (1912) NOTE: The V/Hz characteristic is effective also at nominal frequency (point REF_UMAX_fNOM_AVR (1912)) an up to the point where it hits the frequency independent limit REF_UMAX_AVR (1913). The cut off frequency in % at nominal voltage is therefore given by: $f[\%] = 100\% - [(100\% / REF_V/Hz_LIM_AVR) * (REF_UMAX_fNOM_AVR - 100\%)]$. With DEFAULT settings: $100\% - [(100/115) * (115 - 100)] = 86.96\%$ fn or 43.47 Hz if fn = 50 Hz. And at zero voltage is: $f0[\%] = 100\% - [(100\% / REF_V/Hz_LIM_AVR) * (REF_UMAX_fNOM_AVR)]$. With DEFAULT settings $100\% - [(100/115) * 115] = 0\%$. Ref. to SW description for more details. | 0.01 | 20000 | 0 | 11500 | % | CM, HID, AVR | 44 |
| 1912 | REF UMAX fNOM AVR | V/Hz limit in % voltage at 100% frequency = fn. This means that V/Hz characteristic crosses always this point with the gradient set at REF_V/Hz_LIM_AVR (1911). Cut off frequency see REF_V/Hz_LIM_AVR (1911). | 0.01 | 20000 | 100 00 | 11500 | % | CM, HID, AVR | 44 |
| 1913 | REF UMAX AVR | Absolute voltage limit in % independent of overspeed. DEFAULT = 115%. | 0.01 | 20000 | 100 00 | 11500 | % | CM, HID, AVR | 44 |
| 1914 | DELAY V/Hz LIM A | Independent ON delay of the V/Hz limiter. DEFAULT: not used (12501). | 0.1 | 600 | 0 | 0 | s | CM, HID, AVR | 44 |
| 1915 | SOFTSTART RAMP | SOFTSTART ramp time for 100% voltage. NOTE: The actual voltage is taken over as start point of the integrator at field flashing OFF instant. Therefore the effective ramp time from this point to 100% is given by: $t = SOFTSTART_RAMP * [(100\% - Uflash\ off[\%])/100]$ | 0.1 | 600 | 10 | 50 | s | CM, HID, AVR | 44 |
| 1916 | CEILING FACTOR A | Represents the external part of the loop gain caused by the converter itself: Converter gain = non load ceiling exc. voltage divided by required no load exc. voltage (air gap value). If data not known set CEILING FACTOR A as follows: 3 phase supply type C1...C4: $[UT2n * 1.35] / [(no\ load\ exc.\ voltage) * 0.88]$ Single phase supply type C1: $[UT2n * 0.9] / [(no\ load\ exc.\ voltage) * 0.88]$ Chopper version type C5: $[UC+/-] / [(no\ load\ exc.\ voltage) * 0.88]$ UT2n nominal excitation transformer secondary voltage UC+/- intermediate circuit voltage at no load excitation 0.88 estimated saturation factor | 1 | 2000 | 100 | 500 | % | CM, IMP, AVR | 42 |
| 1917 | DC GAIN AVR | AVR overall DC loop gain. This setting includes CEILING_FACTOR_A (1916). Internal DC gain $OUT_PID_AVR / IN_AVR_ERR = DC_GAIN_AVR * 100 / CEILING_FACTOR_A$. For setting consult commissioning instructions. | 1 | 1000 | 10 | 500 | p. u. | AVR, TUN | 42 |
| 1918 | P GAIN AVR | AVR overall Proportional loop gain. This setting includes CEILING_FACTOR_A (1916). Internal P gain $OUT_PID_AVR / IN_AVR_ERR = P_GAIN_AVR * 100 / CEILING_FACTOR_A$ For setting consult commissioning instructions. | 1 | 300 | 1 | 50 | p. u. | IMP, AVR, TUN | 42 |
| 1919 | HF GAIN AVR | AVR overall High Frequency loop gain. This setting includes CEILING_FACTOR_A (1916). Internal HF gain $OUT_PID_AVR / IN_AVR_ERR = HF_GAIN_AVR * 100 / CEILING_FACTOR_A$ For setting consult commissioning instructions. | 1 | 1000 | 1 | 250 | p. u. | AVR, TUN | 42 |

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|------------|---|------|------|----|------|---|---------------|----|
| 1920 | TA1 | AVR integration time constant 1. Active with normal AVR operation. For setting consult commissioning instructions. | 0.01 | 1000 | 1 | 100 | s | IMP, AVR, TUN | 42 |

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|------------|--|------|------|----|------|--------|---------------|----|
| 1921 | TA2 | AVR integration time constant 2. DEFAULT: active if IE_LIMITER or IEMIN_LIMITER is active. For setting consult commissioning instructions. | 0.01 | 1000 | 1 | 10 | s | AVR, TUN | |
| 1922 | TA3 | AVR integration time constant 3. DEFAULT: active if Q(P)_LIMITER or I_LIMITER is active. For setting consult commissioning instructions. | 0.01 | 1000 | 1 | 100 | s | AVR, TUN | |
| 1923 | TB1 | AVR differentiation time constant 1. Active with normal AVR operation. NOTE: settings below 25 ms switch off the differentiation effect. For setting consult commissioning instructions. | 1 | 2000 | 1 | 100 | m s | IMP, AVR, TUN | |
| 1924 | TB2 | AVR differentiation time constant 2. DEFAULT: active if IE_LIMITER or IEMIN_LIMITER is active. NOTE: settings below 25 ms switch off the differentiation effect. For setting consult commissioning instructions. | 1 | 2000 | 1 | 0 | m s | AVR, TUN | |
| 1925 | TB3 | AVR differentiation time constant 3. DEFAULT: active if Q(P)_LIMITER or I_LIMITER is active. NOTE: settings below 25 ms switch off the differentiation effect. For setting consult commissioning instructions. | 1 | 2000 | 1 | 100 | m s | AVR, TUN | |

2.18 AVR IN, PSS Group 20

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|------------------|--|------|-----|----|------|------|-------------------|-----|
| 2001 | SEL LIM PRIORITY | Selection of dominating limiter group: The group without priority can not respond as long as the group with priority is active. 0==OEL group (IELIM, IOEL, USER_OEL). 1==UEL group (Q(P)_LIM, IUE, IEMINLIM). | - | 1 | 0 | 0 | - | CM, HID, AVR | 41 |
| 2002 | SEL PSS MODE | Enables PSS control: 0==OFF PSS inactive (DEFAULT) 1==ON PSS active 2==ON (external P) PSS active, power signal input connected to AI1. NOTE: PSS function is available only with hardware option UNS 0869 installed (sub module to the signal processing device UNS 1860b)! For PSS mode ==2, an external power transducer must be connected to the analog input AI1 on the UNS 0863 and signal 10115 must be connected to IN_P_PSS (7012). In addition, the low pass filter in the frequency measuring is disabled. | - | 1 | 0 | 0 | - | CM, HID, AVR | 122 |
| 2003 | PSS KS1 | Parameter of Power System Stabilizer according to IEEE Std 421.5 Type PSS2B. Setting according PSS calculation study by ABB or Utility. | 0.1 | 500 | 1 | 50 | p.u. | CM, HID, AVR, TUN | 122 |
| 2004 | PSS KS2 | Parameter of Power System Stabilizer according to IEEE Std 421.5 Type PSS2B. Setting according PSS calculation study by ABB or Utility. | 0.01 | 500 | 1 | 20 | p.u. | CM, HID, AVR, TUN | 122 |
| 2005 | PSS KS3 | Parameter of Power System Stabilizer according to IEEE Std 421.5 Type PSS2B. Setting according PSS calculation study by ABB or Utility. | 0.01 | 500 | 1 | 100 | p.u. | CM, HID, AVR, TUN | 122 |
| 2006 | PSS T1 | Parameter of Power System Stabilizer according to IEEE Std 421.5 Type PSS2B. Setting according PSS calculation study by ABB or Utility. | 0.01 | 250 | 1 | 20 | s | CM, HID, AVR, TUN | 122 |

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|--------------|--------------------|---|------|------|-----|------|---|-------------------|-----|
| 2007 | PSS T2 | Parameter of Power System Stabilizer according to IEEE Std 421.5 Type PSS2B. Setting according PSS calculation study by ABB or Utility. | 0.01 | 250 | 1 | 4 | s | CM, HID, AVR, TUN | 122 |
| 2008 | PSS T3 | Parameter of Power System Stabilizer according to IEEE Std 421.5 Type PSS2B. Setting according PSS calculation study by ABB or Utility. | 0.01 | 250 | 1 | 36 | s | CM, HID, AVR, TUN | 122 |
| 2009 | PSS T4 | Parameter of Power System Stabilizer according to IEEE Std 421.5 Type PSS2B. Setting according PSS calculation study by ABB or Utility. | 0.01 | 250 | 1 | 12 | s | CM, HID, AVR, TUN | 122 |
| 2010 | PSS T7 | Parameter of Power System Stabilizer according to IEEE Std 421.5 Type PSS2B. Setting according PSS calculation study by ABB or Utility. | 0.01 | 3000 | 0.2 | 200 | s | CM, HID, AVR, TUN | 122 |
| 2011 | PSS T8 | Parameter of Power System Stabilizer according to IEEE Std 421.5 Type PSS2B. Setting according PSS calculation study by ABB or Utility. NOTE: If both T8 and T9 are set to 0 the output of the ramp-tracking filter is equal to the input (no filtering). | 0.01 | 250 | 0 | 0 | s | CM, HID, AVR, TUN | 122 |
| 2012 | PSS T9 | Parameter of Power System Stabilizer according to IEEE Std 421.5 Type PSS2B. Setting according PSS calculation study by ABB or Utility. NOTE: If both T8 and T9 are set to 0 the output of the ramp-tracking filter is equal to the input (no filtering). | 0.01 | 250 | 0 | 10 | s | CM, HID, AVR, TUN | 122 |
| 2013 | PSS TW1 | Parameter of Power System Stabilizer according to IEEE Std 421.5 Type PSS2B. Setting according PSS calculation study by ABB or Utility. NOTE: With the time constant set to 0 the output of the ramp-tracking filter is equal to the input (no filtering). | 0.1 | 300 | 0 | 20 | s | CM, HID, AVR, TUN | 122 |
| 2014 | PSS TW2 | Parameter of Power System Stabilizer according to IEEE Std 421.5 Type PSS2B. Setting according PSS calculation study by ABB or Utility. NOTE: With the time constant set to 0 the output of the ramp-tracking filter is equal to the input (no filtering). | 0.1 | 300 | 0 | 20 | s | CM, HID, AVR, TUN | 122 |
| 2015 | PSS TW3 | Parameter of Power System Stabilizer according to IEEE Std 421.5 Type PSS2B. Setting according PSS calculation study by ABB or Utility. NOTE: With the time constant set to 0 the output of the ramp-tracking filter is equal to the input (no filtering). | 0.1 | 300 | 0 | 20 | s | CM, HID, AVR, TUN | 122 |
| 2016 | PSS TW4 | Parameter of Power System Stabilizer according to IEEE Std 421.5 Type PSS2B. Setting according PSS calculation study by ABB or Utility. NOTE: With the time constant set to 0 the output of the ramp-tracking filter is equal to the input (no filtering). | 0.1 | 300 | 0 | 0 | s | CM, HID, AVR, TUN | 122 |
| 2017 | PSS N | Parameter of Power System Stabilizer according to IEEE Std 421.5 Type PSS2B. Setting according PSS calculation study by ABB or Utility. NOTE: For N = 0 the output of the ramp-tracking filter is permanently forced to 0. | 1 | 4 | 0 | 1 | - | | 122 |
| 2018 | PSS M | Parameter of Power System Stabilizer according to IEEE Std 421.5 Type PSS2B. Setting according PSS calculation study by ABB or Utility. | 1 | 5 | 2 | 5 | - | | 122 |
| 2019 | PSS VST LIM | Limitation of the PSS influence. NOTE: If MODE 1 is selected, the DEFAULT value can normally be used to achieve acceptable under- or over voltage if PSS remains at one of its limits (20% means +/- 20% of nominal machine voltage). | 0.01 | 2000 | 0 | 1000 | % | CM, HID, AVR | 122 |
| 2020 | P MACH MIN | Below this level PSS is automatically blocked. NOTE: If PSS is required for a reactive power compensatory machine, this parameter should probably be reduced to zero. In this case PSS has to be blocked via BLK_PSS (7014) if OFF-LINE. | 0.01 | 5000 | 0 | 500 | % | CM, HID, AVR | 122 |
| 2021 | PSS T10 | Parameter of Power System Stabilizer according to IEEE Std 421.5 Type PSS2B. Setting according PSS calculation study by ABB or Utility. NOTE: If parameter is set to zero 3 rd LEAD LAG is skipped (as for PSS2A). | 0.01 | 250 | 0 | 0 | s | CM, HID, AVR, TUN | 122 |
| 2022 | PSS T11 | Parameter of Power System Stabilizer according to IEEE Std 421.5 Type PSS2B. Setting according PSS calculation study by ABB or Utility. NOTE: If parameter is set to zero 3 rd LEAD LAG is skipped (as for PSS2A). | 0.01 | 250 | 0 | 0 | s | CM, HID, AVR, TUN | 122 |
| 2023 to 2027 | | Not available with this SW release | | | | | | | 122 |

2.19 MANUAL CTRL Group 21

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|--------------------------|---|------|-------|----|-------|---|---------------|----|
| 2101 | TC IMPOSED CTRL M | Time constant of the imposed controller. DEFAULT: V/Hz manual restrict. Because of superimposed action to the MANUAL_CTRL setpoint, the TC should be at least 10 times bigger than TA_MANUAL (2114). | 0.1 | 10000 | 0 | 100 | s | AVR, TUN | 45 |
| 2102 | TC FOLLOW UP MAN | Time constant of the auto follower. Because of superimposed action to the MAN setpoint, the TC should be at least 10 times bigger than TA_MANUAL (2114). | 0.1 | 10000 | 0 | 100 | s | AVR, TUN | 45 |
| 2103 | RAMP TIME1 REF M | MANUAL_CTRL setpoint ramp time 1, valid for remote RAISE, LOWER commands (traveling time between HL and LL at permanent COMMAND). Becomes active if SEL_RAMPTIME2_M is FALSE = DEFAULT. | 0.1 | 10000 | 0 | 600 | s | CM, HID | 45 |
| 2104 | RAMP TIME2 REF M | MANUAL_CTRL setpoint ramp time 2, valid for remote RAISE, LOWER commands (traveling time between HL and LL at permanent COMMAND). Becomes active if SEL_RAMPTIME2_M is TRUE. DEFAULT: not used (12501). | 0.1 | 10000 | 0 | 600 | s | AVR, CM, HID | 45 |
| 2105 | LL REF MANUAL | MANUAL_CTRL setpoint min. limit. DEFAULT: 0 to have the full operating range at line or separate (TEST) supply, i.e. for SHUNT supply application. The starting ref. at SHUNT supply is given by PRESET1_REF_MAN (2107). | 0.01 | 15000 | 0 | 0 | % | AVR, CM, HID | 45 |
| 2106 | HL REF MANUAL | MANUAL_CTRL setpoint max. limit. DEFAULT: 110% of nominal excitation current I_EXC_NOMINAL (502) | 0.01 | 15000 | 0 | 11000 | % | AVR, CM, HID | 45 |
| 2107 | PRESET1 REF MAN | MANUAL_CTRL setpoint PRESET1 value. 1st preset value which becomes active if SEL_PRESET2_MAN (7106) is FALSE and TRIG_PRST_MAN (7107) is TRUE. Normally set to 90...100% no load excitation current, to get approx. nominal voltage if starting or going OFF_LINE at MANUAL_CTRL. DEFAULT: This value will dynamically be set at start excitation and if machine goes off line by ON_PRESET_CMD (10304). | 0.01 | 15000 | 0 | 2500 | % | AVR, CM, HID | 45 |
| 2108 | PRESET2 REF MAN | MANUAL_CTRL setpoint preset 2 value. 2nd preset value which becomes active if SEL_PRESET2_MAN (7106) is TRUE and TRIG_PRST_MAN (7107) is TRUE. Normally set to 0 excitation current, for starting manually from zero at „Test supply“. | 0.01 | 15000 | 0 | 0 | % | AVR, CM, HID | 45 |
| 2109 | REF0 IE(P) LIM | UE manual restrict characteristic I_EXC_RELATIVE=f(P) at P=0%. Set the characteristic if ON_LINE at MANUAL_CTRL and zero active power by increasing the parameter value to the max. permitted reactive power value. Leave the value at zero if manual restrict is not required. | 0.01 | 10000 | 0 | 0 | % | AVR, HID, TUN | 45 |
| 2110 | REF25 IE(P) LIM | UE manual restrict characteristic I_EXC_RELATIVE=f(P) at P=25%. Set the characteristic if ON_LINE at MANUAL_CTRL and 25% active power by increasing the parameter value to the max. permitted reactive power value. Leave the value at zero if manual restrict is not required. | 0.01 | 10000 | 0 | 0 | % | AVR, HID, TUN | 45 |
| 2111 | REF50 IE(P) LIM | UE manual restrict characteristic I_EXC_RELATIVE=f(P) at P=50%. Set the characteristic if ON_LINE at MANUAL_CTRL and 50% active power by increasing the parameter value to the max. permitted reactive power value. Leave the value at zero if manual restrict is not required. | 0.01 | 10000 | 0 | 0 | % | AVR, HID, TUN | 45 |
| 2112 | REF75 IE(P) LIM | UE manual restrict characteristic I_EXC_RELATIVE=f(P) at P=75%. Set the characteristic if ON_LINE at MANUAL_CTRL and 75% active power by increasing the parameter value to the max. permitted reactive power value. Leave the value at zero if manual restrict is not required. | 0.01 | 10000 | 0 | 0 | % | AVR, HID, TUN | 45 |
| 2113 | REF100 IE(P) LIM | UE manual restrict characteristic I_EXC_RELATIVE=f(P) at P=100%. This setting must normally be extrapolated from previous settings because of the turbine power limits. Set the parameter value to the max. permitted reactive power value. Leave the value at zero if manual restrict is not required. | 0.01 | 10000 | 0 | 0 | % | AVR, HID, TUN | 45 |
| 2114 | TA MANUAL | Integration time constant of manual PI controller. For setting consult commissioning instructions. | 0.01 | 500 | 1 | 10 | s | AVR, IMP, TUN | 59 |
| 2115 | P GAIN MANUAL | Proportional gain of manual PI controller (external part of the loop gain caused by the converter is not considered). For setting consult commissioning instructions. | 0.1 | 200 | 1 | 10 | - | AVR, IMP, TUN | 59 |

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|----------------|--|------|-------|----|------|---|----------|----|
| 2116 | DC GAIN MANUAL | DC gain of manual PI controller (external part of the loop gain caused by the converter is not considered). For setting consult commissioning instructions. | 1 | 300 | 0 | 100 | - | AVR, TUN | 59 |
| 2117 | FB GAIN | Feedback rate of the inactive controller AVR (AUTO) or MAN. E.g. 10% means that only 10% of the A_M_DFF (12118) or CH_STB_DIFF (12119) difference is fed back to the inactive controller input. NOTE: If value is too big then accuracy of auto follower is restricted and the A_M_DIFF or CH_STB_DIFF signal becomes smaller for the same error. On the other hand if value is too small, auto follower tends for hunting and then the A_M_DIFF or CH_STB_DIFF indication could be too big for the same error. | 1 | 50 | 0 | 10 | % | AVR, HID | 46 |
| 2118 | REL LEVEL | Above this level the auto follower becomes active. With increasing A_M_DIFF or CH_STB_DIFF there is an ON delay set by BLK_TIME (2119) to avoid follower action during short time transients. NOTE: This setting determines auto follower accuracy. | 0.01 | 20000 | 0 | 20 | % | AVR, HID | 46 |
| 2119 | BLK TIME | ON delay of follower action after error signal A_M_DIFF or CH_STB_DIFF have exceeded REL_LEVEL (2118). This delay blocks follower action during short time transients. | 0.1 | 200 | 0 | 100 | s | AVR, HID | 46 |
| 2120 | NOT OK LEVEL | If error signal A_M_DIFF is below this level, RDY_XFER_A_M (12117) signal becomes TRUE for back indication „ready for transfer“ to control room. If FALSE, transfer is not possible by local control panel. NOTE: This setting is used only for indication and has no influence for follower accuracy. | 0.01 | 20000 | 0 | 500 | % | AVR, TUN | 46 |

2.20 CH COMMUNICATION Group 24

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|------------|----------|----|----|----|------|---|-------|----|
| - | - | - | | | | | | | |

2.21 FB EXECUTION Group 25

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|-------------------|---|-------|-------|----|------|---|-------|----|
| 2501 | TASK 1 EXEC ORDER | Execution order of function blocks of task 1, which is executed at 5 ms interval. Ref. to FB programming instructions. | ARRAY | 10000 | 0 | 0 | - | AFB | |
| 2502 | TASK 2 EXEC ORDER | Execution order of function blocks of task 2, which is executed at 20 ms interval. Ref. to FB programming instructions. | ARRAY | 10000 | 0 | 0 | - | AFB | |
| 2503 | TASK 3 EXEC ORDER | Execution order of function blocks of task 3, which is executed at 200 ms interval. Ref. to FB programming instructions. | ARRAY | 10000 | 0 | 0 | - | AFB | |
| 2504 | FB APPL ENABLE | Selection parameter for execution of function block application: 0 == DISABLED (FB's are not executed), 1 == ENABLED (FB's are executed). NOTE: It should be carefully considered, what stopping of the application means for the hole application. Save this parameter always by BACKUPSTOREMODE (by Panel or by CMT on line communication). The download program sets this parameter automatically to 0. | ENUM | 1 | 0 | 0 | - | AFB | |
| 2505 | FB TASK LOCK | Interlocking flag of the function blocks application: 0 == DISABLED (locking flag is not set), 1 == ENABLED (locking flag is set). | ENUM | 1 | 0 | 0 | - | AFB | |

2.22 Function Blocks 1 Group 26

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-----------|------------|---|----|----|----|------|---|-------|----|
| 2601-2699 | | Parameters for application function blocks See application function block data sheets. | - | - | - | - | - | AFB | |

2.23 Function Blocks 2 Group 27

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-----------|------------|---|----|----|----|------|---|-------|----|
| 2701-2799 | | Parameters for application function blocks See application function block data sheets. | - | - | - | - | - | AFB | |

2.24 Function Blocks 3 Group 28

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-----------|------------|---|----|----|----|------|---|-------|----|
| 2801-2899 | | Parameters for application function blocks See application function block data sheets. | - | - | - | - | - | AFB | |

2.25 Function Blocks 4 Group 29

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-----------|------------|---|----|----|----|------|---|-------|----|
| 2901-2999 | | Parameters for application function blocks See application function block data sheets. | - | - | - | - | - | AFB | |

2.26 Function Blocks 5 Group 30

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-----------|------------|---|----|----|----|------|---|-------|----|
| 3001-3099 | | Parameters for application function blocks See application function block data sheets. | - | - | - | - | - | AFB | |

2.27 Function Blocks 6 Group 31

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-----------|------------|---|----|----|----|------|---|-------|----|
| 3101-3199 | | Parameters for application function blocks See application function block data sheets. | - | - | - | - | - | AFB | |

2.28 Function Blocks 7 Group 32

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-----------|------------|---|----|----|----|------|---|-------|----|
| 3201-3299 | | Parameters for application function blocks See application function block data sheets. | - | - | - | - | - | AFB | |

2.29 Function Blocks 8 Group 33

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-----------|------------|---|----|----|----|------|---|-------|---------|
| 3301-3399 | | Parameters for application function blocks See application function block data sheets. | - | - | - | - | - | AFB | 442,445 |

2.30 Function Blocks 9 Group 34

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-----------|------------|---|----|----|----|------|---|-------|----|
| 3401-3499 | | Parameters for application function blocks See application function block data sheets. | - | - | - | - | - | AFB | |

2.31 Fieldbus Group 40

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|-----------------|--|------|-----|----|------|---|-------|-----|
| 4001 | Fieldbus Par. 1 | <p>Selects the fieldbus adapter type:</p> <p>0==DISABLED 1==PROFIBUS 2==CS31 3==MODBUS 4==DEVICENET 5==ADVANT / DDCS 6==NOT USED 7==MODBUS PLUS 8==NOT ACTIVATED</p> <p>NOTE: The required fieldbus adapter HW must be installed and connected to DDCS link. The changes of parameter do not take effect immediately. To change the module settings, the power must be disconnected from fieldbus adapter module. Refer also to fieldbus type specific „Installation and Start-up Instructions“</p> | ENUM | 8 | 0 | 0 | - | AFB | 129 |
| 4002 | Fieldbus Par. 2 | <p>MODBUS MODE: Shows the logical protocol on the HW communication option module. Specifies the binary, or Remote Terminal Unit (RTU) mode:</p> <p>0==RTU wdg:flt On a watch dog error, the module will indicate a watch-dog error. 1==RTU wdg:rst On a watch-dog error, the module will reset itself.</p> <p>PROFIBUS MODE:</p> <p>0==FMS FMS protocol is used 1==DP-PPO1 DP protocol used with PPO1 message type 1 2==DP-PPO2 DP protocol used with PPO1 message type 2 3==DP-PPO3 DP protocol used with PPO1 message type 3 4==DP-PPO4 DP protocol used with PPO1 message type 4 5==DP-PPO5 DP protocol used with PPO1 message type 5</p> <p>NOTE: The changes of parameter do not take effect immediately. To change the module settings, the power must be disconnected from fieldbus adapter module. Refer also to fieldbus type specific „Installation and Start-up Instructions“</p> | 1 | 255 | 0 | 0 | - | AFBN | 129 |
| 4003 | Fieldbus Par. 3 | <p>STATION NUMBER:</p> <p>Sets the node number for the module on the network.</p> <p>Modbus: 1 ... 247 Profibus: 3 ... 126</p> <p>NOTE: Use different node numbers for each channel in a 2-channel system. The changes of parameter do not take effect immediately. To change the module settings, the power must be disconnected from fieldbus adapter module. Refer also to fieldbus type specific „Installation and Start-up Instructions“</p> | 1 | 255 | 0 | 0 | - | AFBN | 129 |

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP | | | | | | | | | | | | | | | | | | |
|-----------|-----------------|---|--------|----------|----------|----------|-----------|-------|---------|------|---------|-------|---------|-------|----------|-----|-----|------|-----|------|---|-----|---|---|---|------|-----|
| 4004 | Fieldbus Par. 4 | Defines the communication speed BAUD RATE: <table style="margin-left: 20px; border: none;"> <tr> <td style="padding-right: 20px;">Modbus</td> <td>Profibus</td> </tr> <tr> <td style="padding-right: 20px;">[kbit/s]</td> <td>[kbit/s]</td> </tr> <tr> <td>0== 1.200</td> <td>9.6</td> </tr> <tr> <td>1== 2.4</td> <td>19.2</td> </tr> <tr> <td>2== 4.8</td> <td>93.75</td> </tr> <tr> <td>3== 9.6</td> <td>187.5</td> </tr> <tr> <td>4== 19.2</td> <td>500</td> </tr> <tr> <td>5==</td> <td>1500</td> </tr> <tr> <td>6==</td> <td>AUTO</td> </tr> </table> NOTE: The changes of parameter do not take effect immediately. To change the module settings, the power must be disconnected from fieldbus adapter module. Refer also to fieldbus type specific „Installation and Start-up Instructions“ | Modbus | Profibus | [kbit/s] | [kbit/s] | 0== 1.200 | 9.6 | 1== 2.4 | 19.2 | 2== 4.8 | 93.75 | 3== 9.6 | 187.5 | 4== 19.2 | 500 | 5== | 1500 | 6== | AUTO | 1 | 255 | 0 | 0 | - | AFBN | 129 |
| Modbus | Profibus | | | | | | | | | | | | | | | | | | | | | | | | | | |
| [kbit/s] | [kbit/s] | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0== 1.200 | 9.6 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1== 2.4 | 19.2 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2== 4.8 | 93.75 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3== 9.6 | 187.5 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4== 19.2 | 500 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5== | 1500 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6== | AUTO | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4005 | Fieldbus Par. 5 | Modbus: PARITY: Defines the parity to be used with the Modbus communication. This parameter also defines the number of stop bits in use. With Modbus communication the number of stop bits must be 2 with NONE parity bit, and 1 with EVEN or ODD parity 0==EVEN 1==ODD 2==NONE Profibus: 3==WRITE PPO DATA SET SEL (fixed) NOTE: The changes of parameter do not take effect immediately. To change the module settings, the power must be disconnected from fieldbus adapter module. Refer also to fieldbus type specific „Installation and Start-up Instructions“ | 1 | 255 | 0 | 0 | - | AFBN | 129 | | | | | | | | | | | | | | | | | | |
| 4006 | Fieldbus Par. 6 | Modbus: GOOD MESSAGES: This diagnostic counter increases by one every time a valid Modbus message has been received by the adapter module. This counter roll over from 32767 to 0. During normal operation, this counter is increasing constantly. Profibus: 4==READ PPO DATA SET SEL (fixed) NOTE: The changes of parameter do not take effect immediately. To change the module settings, the power must be disconnected from fieldbus adapter module. Refer also to fieldbus type specific „Installation and Start-up Instructions“ | 1 | 255 | 0 | 0 | - | AFBN | 129 | | | | | | | | | | | | | | | | | | |

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|-------------------------|---|----|-----|----|------|---|-------|-----|
| 4007 | Fieldbus Par. 7 | Modbus: BAD MESSAGES: This diagnostic counter increases by one every time the Modbus adapter module finds any kind of communication error. This counter roll over from 32767 back to 0. During normal operation, this counter hardly ever increases. Profibus: not used NOTE: The changes of parameter do not take effect immediately. To change the module settings, the power must be disconnected from fieldbus adapter module. Refer also to fieldbus type specific „Installation and Start-up Instructions“ | 1 | 255 | 0 | 0 | - | AFBN | 129 |
| 4008 | Fieldbus Par. 8 | Not used. | 1 | 255 | 0 | 0 | - | AFBN | 129 |
| 4009 | Fieldbus Par. 9 | Not used. | 1 | 255 | 0 | 0 | - | AFBN | 129 |
| 4010 | Fieldbus Par. 10 | Not used. | 1 | 255 | 0 | 0 | - | AFBN | 129 |
| 4011 | Fieldbus Par. 11 | Not used. | 1 | 255 | 0 | 0 | - | AFBN | 129 |
| 4012 | Fieldbus Par. 12 | Not used. | 1 | 255 | 0 | 0 | - | AFBN | 129 |
| 4013 | Fieldbus Par. 13 | Not used. | 1 | 255 | 0 | 0 | - | AFBN | 129 |
| 4014 | Fieldbus Par. 14 | Not used. | 1 | 255 | 0 | 0 | - | AFBN | 129 |
| 4015 | Fieldbus Par. 15 | Not used. | 1 | 255 | 0 | 0 | - | AFBN | 129 |

3 Programming

3.1 ANALOG INPUTS Group 51

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|------------|--|----|-------|----|-------|---|----------|----|
| 5101 | [POLARITY] | Input which inverts all outputs 10105 10112. Used if the phase sequence of the p.t. is changed e.g. using syn. machine for 2 operation modes, either as generator or as motor. DEFAULT: not used (12501) | BI | 19999 | 0 | 12501 | - | AFB, HID | 3 |

3.2 ANALOG OUTPUTS Group 52

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|------------|---|----|-------|----|-------|---|---------|----|
| 5201 | AO1.[IN] | Input IN of AO1 SP. DEFAULT: spare == 0 (12501). Connect to signal needed in AO1. | AI | 19999 | 0 | 12501 | - | AFB, IO | 1 |
| 5202 | AO2.[IN] | Input IN of AO2 SP. DEFAULT: spare == 0 (12501). Connect to signal needed in AO2. | AI | 19999 | 0 | 12501 | - | AFB, IO | 85 |
| 5203 | AO1E.[IN] | Input IN of AO1E SP. DEFAULT: spare == 0 (12501). Connect to signal needed in AO1E. NOTE: Only available if optional hardware UNS 0867 on CON-2 and second UNS 0863 are installed. | AI | 19999 | 0 | 12501 | - | AFB, IO | 2 |
| 5204 | AO2E.[IN] | Input IN of AO2E SP. DEFAULT: spare == 0 (12501). Connect to signal needed in AO2E. NOTE: Only available if optional hardware UNS 0867 on CON-2 and second UNS 0863 are installed. | AI | 19999 | 0 | 12501 | - | AFB, IO | 86 |

3.3 CONTROL LOGIC Group 53

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|--------------------|---|----|-------|----|-------|---|----------|----|
| 5301 | [BLOCK START UP] | Input for blocking of excitation startup. DEFAULT: INH_OF_START (10351). NOTE: With DEFAULT connection, start up is blocked by all ALARMS are except, following: - ALARM 111 „Common STBY fault“ - ALARM 113 „2 channel comerror“ - ALARM 122 „fieldbus timeout“ - ALARM 137 „Standby trip“ - ALARM 145 „Test supply“ If input not connected, then start up is independent from any alarm. | BI | 19999 | 0 | 10351 | - | AFB, IMP | 74 |
| 5302 | [START EXCITATION] | Excitation start command: closes FCB if not yet closed and releases thyristor firing, field flashing with shunt excitation and then the SOFTSTART_RAMP (1915). DEFAULT: DIX01 (10701). NOTE: Start up is completed only by the active channel of a 2 channel configuration (AFT). | BI | 19999 | 0 | 10701 | - | AFB, IMP | 74 |

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|-------------------|--|----|-------|----|-------|---|----------|----|
| 5303 | [EXC OFF CMD] | Input for Excitation OFF (STOP) command. Stops excitation by inverter mode and opens the field breaker as well, if RELEASE_FCB_OFF (301) is set to YES. After 60 s inverter mode, the firing pulses are blocked too. Instead of inverter mode, the pulses are blocked immediately, if the converter input side (field) C.B. opens (parameters RELEASE_FCB_OFF (301) = YES and CB_CONFIG (309) = AC SIDE). DEFAULT: Connected to DIX02 (10702). NOTE: At the configuration with field C.B. on converter input (parameter CB_CONFIG (309) = 0==AC SIDE) and parameter RELEASE_FCB_OFF (301) set to 0==NO, this input must only be used for remote OFF cmd. In that case, the external F.C.B. TRIP command must be connected to input OFF_BLK_CMD (5335). | | 19999 | 0 | 10702 | - | AFB, IMP | 74 |
| 5304 | [RAISE CMD] | RAISE command to active controller AUTO (AVR), MANUAL CTRL, COSPHI (P.F.) or Q (VAR) DEFAULT: connected to DIX03 (10703) | | 19999 | 0 | 10703 | - | AFB, IMP | 77 |
| 5305 | [LOWER CMD] | LOWER command to active controller AUTO (AVR), MANUAL CTRL, COSPHI (P.F.) or Q (VAR). DEFAULT: connected to DIX04 (10704) | | 19999 | 0 | 10704 | - | AFB, IMP | 77 |
| 5306 | [ON AUTO CMD] | Input which transfers to AUTO (AVR) operation mode. NOTE: To be used only for interlocking between DIX05 and this input. DEFAULT: connected to DIX05 (10705). | BI | 19999 | 0 | 10705 | - | AFB, HID | 76 |
| 5307 | [ON MAN CMD] | Input which transfers to MANUAL operation mode. NOTE: To be used only for interlocking between DIX06 and this input. DEFAULT: connected to DIX06 (10706). | BI | 19999 | 0 | 10706 | - | AFB, HID | 76 |
| 5308 | [ON CH1 CMD] | Input for external channel 1 ON command e.g. for remote ctrl. Connect to corresponding digital input, if remote ctrl is required. NOTE: Remote channel transfer is normally not useful, because with an AFT system both channels are identically and from MTBF figures, the 2nd channel converter should always serve as cold standby. Use the same digital input for both channels (same parameter set). | BI | 19999 | 0 | 12501 | - | AFB, HID | 76 |
| 5309 | [ON CH2 CMD] | Input for external channel 2 ON command e.g. for remote ctrl. Connect to corresponding digital input, if remote ctrl is required. NOTE: Remote channel transfer is normally not useful, because with an AFT system both channels are identically and from MTBF figures, the 2nd channel converter should always serve as cold standby. Use the same digital input for both channels (same parameter set). | BI | 19999 | 0 | 12501 | - | AFB, HID | 76 |
| 5310 | [ON IMP CMD] | Input which activates preselected IMPOSED CTRL mode, if in AUTO mode and ON_LINE. NOTE: To be used only for interlocking between DIX07 and this input. DEFAULT: connected to DIX07 (10707). | B1 | 19999 | 0 | 10707 | - | AFB, HID | 79 |
| 5311 | [OFF IMP CMD] | Input which deactivates preselected IMPOSED CTRL mode, if in AUTO mode and ON_LINE. NOTE: To be used only for interlocking between DIX08 and this input. DEFAULT: connected to DIX08 (10708). | B1 | 19999 | 0 | 10708 | - | AFB, HID | 79 |
| 5312 | [SEL Q CTRL] | Input which preselects Q CTRL function if at remote ctrl and the parameter IMPOSED_CTRL_MODE (302) is set to EXTERNAL SEL (value = 3). DEFAULT: not used == 0 (12501). | BI | 19999 | 0 | 12501 | - | AFB, SIP | 79 |
| 5313 | [SEL COSPHI CTRL] | Input which preselects COS PHI CTRL function if at remote ctrl and the parameter IMPOSED_CTRL_MODE (302) is set to EXTERNAL SEL (value = 3). DEFAULT: not used == 0 (12501). | BI | 19999 | 0 | 12501 | - | AFB, SIP | 79 |

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|-------------------|---|----|-------|----|-------|---|----------|-----|
| 5314 | [ON LINE] | Input which indicates that machine is connected to grid (normally machine main breaker closed). Internally used for different processes. NOTE: as long as this input is FALSE, following signals are forced to zero: I_MACH_A (10104), P_MACH_KW (10107), P_MACH_MW (10108), Q_MACH_KVAR (10111), Q_MACH_MVAR (10112), S_MACH_KVA (10113), S_MACH_MVA (10114), COSPHI_AO (10126). COSPFI (10124) is forced to 1. At motor application (motor breaker is closed before excitation start), this input must not be TRUE until excitation is started. Put an AND gate to release this input only if EXC_ON (10307) is TRUE. DEFAULT: connected to DIX15 (10715). | BI | 19999 | 0 | 10715 | - | AFB, IMP | 74 |
| 5315 | [RDY XFER A M] | Input which enables LOCAL A-M transfer commands from Panel or CMT. DEFAULT: connected to RDY_XFER_A_M (12117). | BI | 19999 | 0 | 12308 | - | AFB, HID | 76 |
| 5316 | [READY XFER TWIN] | Input which enables LOCAL channel transfer commands from Panel or CMT. DEFAULT: connected to RDY_XFER_TWIN (12120). | BI | 19999 | 0 | 12311 | - | AFB, HID | 76 |
| 5317 | [AUTO FAIL] | Input which transfers from AUTO (AVR) to MANUAL control. NOTE: If CH_CONFIG (308) = 1 (AFT CH1) or 2 (AFT CH2), this input causes channel transfer prior to A-M transfer. For combination of faults ref. to SW diagram and description. DEFAULT: connected to AVR_FAULT (10910). | BI | 19999 | 0 | 12410 | - | AFB, IMP | 76 |
| 5318 | [MAN FAIL] | Not applicable for this SW release 41.220 | BI | 19999 | 0 | 12501 | - | AFB, HID | 76 |
| 5319 | [IN CH FAULT] | Input which unconditionally forces output CH_FAIL (10342). With a 2 channel system (CH_CONFIG >0) it forces channel transfer via serial link and via hard wire connection (DOX01 relay drops). DEFAULT: connected to fault logger output CH_FAIL_LOGGED (10349). | BI | 19999 | 0 | 10350 | - | AFB, HID | 76 |
| 5320 | [IN CH1 FAULT] | Input for external channel 1 failure signal, e.g. converter C.B. open or converter fuses blown. To use identical parameter sets in both channels (except CH_CONFIG (308)), this signal is evaluated for CH_FAULT 47 „Ext. CH fault“ in the physical channel 1 of an AFT system or in a single channel system (CH_CONFIG (308) = 1 (AFT CH1) or 0 (SFE)). DEFAULT: DIX09 (10709) Connect to corresponding spare digital input if separate converter C.B. or converter fuses with indicators are provided. | BI | 19999 | 0 | 10709 | - | AFB, HID | 76 |
| 5321 | [IN CH2 FAULT] | Input for external channel 2 failure signal, e.g. converter C.B. open or converter fuses blown. To use identical parameter sets in both channels (except CH_CONFIG (308)), this signal is evaluated for CH_FAULT 47 „Ext. CH fault“ in the physical channel 2 of an AFT system (CH_CONFIG (308) = 2 (AFT CH2)). DEFAULT: DIX10 (10710) Connect to corresponding spare digital input if separate converter C.B. or converter fuses with indicators are provided. | BI | 19999 | 0 | 10710 | - | AFB, HID | 76 |
| 5322 | [TRIP CMD] | Input which immediately and unconditionally shuts down excitation. DEFAULT: EXC_TRIP (10350). | BI | 19999 | 0 | 10350 | - | AFB, IMP | 74 |
| 5323 | [PULSE BLK] | Input which blocks firing pulses by application program. DEFAULT: not used (12501). | BI | 19999 | 0 | 12501 | - | AFB, CON | 74 |
| 5324 | [RESET] | Reset command. This command will reset those fault memories which corresponding fault is not active any more. NOTE: This input RESET the fault logger of both channels. DEFAULT: not used, because all faults (and some alarms) can be reset via panel or CMT. | BI | 19999 | 0 | 12501 | - | AFB, IMP | 123 |
| 5325 | [DISABLE LOCAL] | This command will disable local control of the excitation system, both from panel and CMT. | BI | 19999 | 0 | 12501 | - | AFB, HID | 74 |
| 5326 | [PARAMETER SET2] | The unit has 2 parameter sets. This input activates the second parameter set: 0 = Parameter set no. 1, <>0 = Parameter set no. 2. NOTE: the 2nd parameter set can only be activated at open field breaker. | BI | 19999 | 0 | 12501 | - | AFB, HID | 74 |

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|-------------------|--|----|-------|----|-------|---|----------|----|
| 5327 | [IN FLDB REQ] | Input from fieldbus. Enables inputs 5328...5334 to be controlled via fieldbus. Connection by application program required (Ref. to 3BHS100500) and fieldbus type specific „Installation and Start-up Instructions“. DEFAULT: Connected to Control word INTEGER- BINARY converter output (12972) if fieldbus application is loaded. | B1 | 19999 | 0 | 12501 | - | AFB, HID | 77 |
| 5328 | [FLDB ON/OFF] | Input from fieldbus. Controls field breaker via fieldbus. Connection by application program required (Ref. to 3BHS100500) and fieldbus type specific „Installation and Start-up Instructions“. DEFAULT: Connected to Control word INTEGER- BINARY converter output (12962) if fieldbus application is loaded. | B1 | 19999 | 0 | 12501 | - | AFB, HID | 77 |
| 5329 | [FLDB START STOP] | Input from fieldbus. Controls EXCITATION START / STOP via fieldbus. Connection by application program required (Ref. to 3BHS100500) and fieldbus type specific „Installation and Start-up Instructions“. DEFAULT: Connected to Control word INTEGER- BINARY converter output (12963) if fieldbus application is loaded. | B1 | 19999 | 0 | 12501 | - | AFB, HID | 74 |
| 5330 | [FLDB A/M] | Input from fieldbus. Controls AUTO-MANUAL CHANGEOVER via fieldbus. Connection by application program required (Ref. to 3BHS100500) and fieldbus type specific „Installation and Start-up Instructions“. DEFAULT: Connected to Control word INTEGER- BINARY converter output (12973) if fieldbus application is loaded. | B1 | 19999 | 0 | 12501 | - | AFB, HID | 74 |
| 5331 | [FLDB CMD IMP] | Input from fieldbus. Controls preselected IMPOSED CONTROL ON-OFF via fieldbus. Connection by application program required (Ref. to 3BHS100500) and fieldbus type specific „Installation and Start-up Instructions“. DEFAULT: Connected to Control word INTEGER- BINARY converter output (12974) if fieldbus application is loaded. | B1 | 19999 | 0 | 12501 | - | AFB, HID | 74 |
| 5332 | [FLDB SEL IMP] | Input from fieldbus. Preselects IMPOSED COTROLLER TYPE (VAR or P.F.) via fieldbus. Connection by application program required (Ref. to 3BHS100500) and fieldbus type specific „Installation and Start-up Instructions“. DEFAULT: Connected to Control word INTEGER- BINARY converter output (12975) if fieldbus application is loaded. | B1 | 19999 | 0 | 12501 | - | AFB, HID | 76 |
| 5333 | [FLDB REQ REF] | Input from fieldbus. Enables REFERENCE VALUE of active controller to be received via fieldbus. Connection by application program required (Ref. to 3BHS100500) and fieldbus type specific „Installation and Start-up Instructions“. DEFAULT: Connected to Control word INTEGER- BINARY converter output (12965) if fieldbus application is loaded. | B1 | 19999 | 0 | 12501 | - | AFB, HID | 79 |
| 5334 | [IN FLDB REF] | Input from fieldbus. REFERENCE VALUE to active controller via fieldbus. Connection by application program required (Ref. to 3BHS100500) and fieldbus type specific „Installation and Start-up Instructions“. DEFAULT: Connected to Control word DATASET 1 OUT2 (10134) if fieldbus application is loaded. | B1 | 19999 | 0 | 12501 | - | AFB, HID | 79 |

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|---------------|--|----|-------|----|-------|---|----------|----|
| 5335 | [OFF BLK CMD] | <p>Input for Excitation OFF (STOP) command. Stops excitation by inverter mode or by pulse blocking together with opening of the converter input (field) breaker, if RELEASE_FOB_OFF (301) is set to YES.</p> <p>DEFAULT: not used (12501).</p> <p>NOTE: At the configuration with field C.B. on converter input (parameter CB_CONFIG (309) = 0==AC SIDE) and parameter RELEASE_FCB_OFF (301) set to 0==NO, this input must only be used in parallel to the external F.C.B. TRIP command. In that case the normal EXCITATION_OFF COMMAND must be connected to input EXC_OFF_CMD (5303).</p> | BI | 19999 | 0 | 12501 | - | AFB, IMP | 74 |

3.4 CONVERTER CTRL Group 55

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|-------------------|--|----|-------|----|-------|---|---------------|----|
| 5501 | [SEL SEQUENCE] | Input which selects for reversed converter input phase sequence. Same functionality as parameter 503. Used for MOTOR-GENERATOR applications when sequence has to be selected by control logic. Back indication by REVERSE_SEQ (10518). DEFAULT: not used (12501). NOTE: Input command is only accepted when excitation off. | BI | 19999 | 0 | 12501 | - | AFB, HID | 73 |
| 5502 | [UCTRL] | Gate control input signal: -10000==ALPHA 180 DEG (C5: MIN thyristor duty cycle in Q4); +10000==ALPHA 0 DEG (C5: MAX. IGBT duty cycle in Q1). DEFAULT: connected to U_CTRL_OUT_CH (12110). | BI | 19999 | 0 | 12301 | - | AFB, CON, IMP | 47 |
| 5503 | [INV CTRL] | Inverter operation mode control input. Forces firing angle ALPHA to ALPHA_MAX_LIMIT (517). DEFAULT: not used (12501). | BI | 19999 | 0 | 12501 | - | AFB, CON, IMP | 47 |
| 5504 | [IN FREEWHEELING] | Freewheeling mode control input. Forces permanent firing to + and - thyristors of phase 1 (L1 input), if pulses released (No pulse blocking active) while all other pulses are blocked. Duration is internally limited to 10s and repetition is only available again after 20s without freewheeling. DEFAULT: not used (12501) NOTE: Connect this input to N.C. aux. contact of HV side breaker, if it can be opened during normal operation. | BI | 19999 | 0 | 12501 | - | AFB, HID | 47 |

3.5 DATA LOGGER Group 56

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|------------|----------|----|----|----|------|---|-------|----|
| - | - | - | | | | | | | |

3.6 DIGITAL I/O Group 57

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|------------|----------|----|----|----|------|---|-------|----|
| - | - | - | | | | | | | |

3.7 MONITORING Group 59

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|-------------------|---|----|-------|----|-------|---|--------------|----|
| 5901 | [OVP CURRENT] | Input for external crowbar current Monitoring detector. If TRUE, EXCITATION_ON and no FREEWHL_CROWBAR (10516) present, the Fault 35 „Field overvoltage“ is generated. DEFAULT: not used (12501). Connect to corresponding spare digital input DIX... if crowbar provided (always needed for static excitation). NOTE: This signal is monitored during normal field discharge by crowbar (CB_CONFIG (309) = 0 or 1). If no signal detected during discharge, ALARM 135 „Crowbar failed“ will be generated. | BI | 19999 | 0 | 12501 | - | AFB, AL, IMP | 80 |
| 5902 | [OVT1 TRAF0] | Input for external excitation transformer temperature detector. If TRUE the Alarm 103 „Trafo temp. Alarm“ is generated. DEFAULT: not used (12501). Connect to corresponding spare digital input DIX... if signal provided (normally for static excitation). | BI | 19999 | 0 | 12501 | - | AFB, AL, IMP | 80 |
| 5903 | [OVT2 TRAF0] | Input for excitation transformer temperature detector. If TRUE the Fault 06 „Trafo overtemp.trip“ is generated. DEFAULT: not used (12501). Connect to corresponding spare digital input DIX... if signal provided (normally for static excitation). | BI | 19999 | 0 | 12501 | - | AFB, AL, IMP | 80 |
| 5904 | [NO EXT ALARM] | Input for general alarm of secondary external auxiliaries like M.C.B's of aux. supply heater, etc. DEFAULT: DIX14 (10714). NOTE: This is an inverting input. With default setting of BLOCK_START_UP (5301), starting excitation is NOT POSSIBLE as long as external alarm loop isn't closed. | BI | 19999 | 0 | 10714 | - | AFB, AL, IMP | 80 |
| 5905 | [IN B/L MONITOR] | Not applicable for this SW release 41.22x | AI | 19999 | 0 | 10101 | | CM, HID, MON | |
| 5906 | [BLK B/L MONITOR] | Not applicable for this SW release 41.22x | AI | 19999 | 0 | 12501 | | CM, HID, MON | |
| 5907 | [A145 BLK/C5 TST] | Input which blocks the ALARM 145 „Test supply“, or forces it in case of chopper (type C5). Used in case when supply can be switched over from shunt to separate supply, e.g. for braking operation, or in case C5 at normal TEST SUPPLY condition. DEFAULT: not used (12501). | BI | 19999 | 0 | 12502 | | AFB, HID | 80 |
| 5908 | [IN PT FAIL] | Input for external or AFB made P.T. FAIL relay. If input TRUE, U_MACH_FAIL (10908) and AVR_FAULT (10910) become TRUE and Alarm 120 „Machine P.T. fail“ is generated. DEFAULT: not used (12501). | BI | 19999 | 0 | 12501 | | AFB, HID | 81 |
| 5909 | [IN PT FAIL DYN] | Input for reactive or armature current. If this signals changes dynamically before the P.T. signals drops (dU/dt_TRIGGER (10125) = TRUE), then the Monitoring will be blocked. DEFAULT: I_SINPHI_RELATIVE (10109). From Rel. 41.221_1: I_MACH_RELATIVE (10103) NOTE: I_MACH_RELATIVE should be used instead of I_SINPHI_RELATIVE since in case P.T. phase 2 or 3 fails, I_SINPHI_RELATIVE fails too. | BI | 19999 | 0 | 12405 | - | AFB, HID | 81 |

3.8 RT MONITORING Group 60

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|------------|--|----|-------|----|-------|---|--------------|-----|
| 6001 | [IN U RTM] | Input voltage for calculation of RF RELATIVE. DEFAULT: U_EXC_RELATIVE (10505). | AI | 19999 | 0 | 10505 | | AFB, CM, MON | 121 |
| 6002 | [IN I RTM] | Current input for calculation of RF RELATIVE. DEFAULT: I_EXC_RELATIVE (10501). | AI | 19999 | 0 | 10501 | | AFB, CM, MON | 121 |

3.9 FAULTS, ALARMS Group 61

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|------------|----------|----|----|----|------|---|-------|----|
| - | - | - | | | | | | | |

3.10 MAINTENANCE Group 62

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|------------|----------|----|----|----|------|---|-------|----|
| - | - | - | | | | | | | |

3.11 IE LIMITER Group 63

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|------------------|---|----|-------|----|-------|---|---------------|----|
| 6301 | [ADD REF IETH] | Spare input added to selected REF1, 2_IETH for correction by e.g. cooling medium temp. DEFAULT: not used (12501). | AI | 19999 | 0 | 12501 | - | AFB, HID, AVR | 55 |
| 6302 | [ADD REF IEMAX] | Spare input added to selected REF1, 2_IEMAX for correction by e.g. cooling medium temperature. DEFAULT: not used (12501). | AI | 19999 | 0 | 12501 | - | AFB, HID, AVR | 55 |
| 6303 | [SEL REF2 IETH] | Control input for REF2_IETH selection. DEFAULT: not used (12501). | BI | 19999 | 0 | 12501 | - | AFB, HID, AVR | 55 |
| 6304 | [SEL MAX2 IEMAX] | Control input for REF2_IEMAX2 selection. DEFAULT: not used (12501). | BI | 19999 | 0 | 12501 | - | AFB, HID, AVR | 55 |
| 6305 | [IEL MAX RETRIG] | Control input to release selected ceiling setpoint REF1, 2_IEMAX if machine voltage drops, e.g. caused by line faults. DEFAULT: dU/dt_TRIGGER (10125). | BI | 19999 | 0 | 10125 | - | HID, AVR | 55 |
| 6306 | [IN I IELIM] | Actual value input to IE limiter. Connect it to spare analog input if e.g. EXCITER output current must be limited instead of EXCITER field current. DEFAULT: connected to I_EXC_RELATIVE (10501) | A1 | 19999 | 0 | 10501 | - | AFB, HID AVR | 55 |

3.12 I LIMITER Group 64

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|-------------------|--|----|-------|----|-------|---|--------------|----|
| 6401 | [ADD REF I MACH] | Spare input added to selected REF_I_MACH TH for correction by e.g. cooling medium temp. DEFAULT: not used (12501). | AI | 19999 | 0 | 12501 | - | AFB, CM, AVR | 56 |
| 6402 | [SEL REF2 ITH2] | Control input for REF2_I_MACH_TH selection. DEFAULT: not used (12501). | BI | 19999 | 0 | 12501 | - | AFB, CM, AVR | 56 |
| 6403 | [I UNLTD TRIGGER] | Control input to release non limiting condition if machine voltage drops, e.g. caused by line faults. DEFAULT: dU/dt_TRIGGER (10125). | BI | 19999 | 0 | 10125 | - | AFB, CM, AVR | 56 |

3.13 PQ IEMIN LIM Group 65

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|------------|----------|----|----|----|------|---|-------|----|
| - | - | - | | | | | | | |

3.14 COSPHI CTRL Group 67

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|-------------------|--|----|-------|----|-------|---|---------------|----|
| 6701 | [RAISE COSPHI] | Remote cosphi (P.F.) RAISE command input. DEFAULT: connected to RAISE_COSPHI_CMD (10323). | BI | 19999 | 0 | 10324 | - | AFB, SIP | 58 |
| 6702 | [LOWER COSPHI] | Remote cosphi (P.F.) LOWER command input. DEFAULT: connected to LOWER_COSPHI_CMD (10324). | BI | 19999 | 0 | 10325 | - | AFB, SIP | 58 |
| 6703 | [SEL REF EXT COS] | Control input which activates user defined setpoint input connected to IN REF EXT COS (6705). DEFAULT: not used (12501). | BI | 19999 | 0 | 12501 | - | AFB, HID, SIP | 58 |
| 6704 | [TRIG PRESET COS] | Input which unconditionally forces the REF_COSPHI_ACT (11704) to the set PRESET_REF_COSPHI (1705) value. Use a „MONO“ AFB (TP = 1s) between ON_COSPHI_CTRL (10315) and this input if COSPHI controller should start always at PRESET point instead of actual operation point after switched on. If permanent PRESET is required to operate the machine with constant P.F., then connect this input to 12502 = TRUE. DEFAULT: connected to ON_PRESET_CMD (10304). | BI | 19999 | 0 | 10304 | - | AFB, HID, SIP | 58 |
| 6705 | [IN REF EXT COS] | User defined COSPHI setpoint input. E.g. an analog input can be connected to this input, if remote analog setpoint (e.g. 4...20 mA) is provided instead of RAISE/LOWER commands, or a User Parameter can be used if a 2nd constant setpoint is required beside PRESET_REF_COSPHI. DEFAULT: not used (12501). Consider the setpoint characteristic: VALUE = 10000 - [(PRESET_REF_COSPHI overexcited)*10000] e.g. = 10000 - [0.8 * 10000] = 2000 VALUE = [(PRESET_REF_COSPHI underexcited)*10000] -10000 e.g. = [0.9 * 10000] -10000 = -1000 NOTE: The value will be limited by the HL_REF_COSPHI (1703) and LL_REF_COSPHI (1704) if the external signal exceeds the HL, LL values set. Therefore it is recommended to scale analog input to HL, LL set. | AI | 19999 | 0 | 12501 | - | AFB, HID, SIP | 58 |
| 6706 | [IN ERR EXT COS] | User defined ERR_SUPERIMPOSED signal. This input is used if superimposed control is defined by user with AFB's instead of firmware COSPHI_CTRL. E.g. reactive power equalizing between several machines. DEFAULT: not used (12501). | AI | 19999 | 0 | 12501 | - | AFB, HID, SIP | 58 |
| 6707 | [SEL ERR EXT COS] | This input activates IN_ERR_EXT_COS (6706) input. If in use, the ON_COSPHI_CTRL is required as well to get superimposed ctrl active. DEFAULT: not used (12501). | BI | 19999 | 0 | 12501 | - | AFB, HID, SIP | 58 |
| 6708 | [ICOSPHI IN] | Input for active current of the machine. If tie connection P.F. is controlled instead of machine P.F., then external active power transducer is put to this input via a spare analog input. DEFAULT: connected to I_COSPHI_REL (10105). | AI | 19999 | 0 | 10105 | - | AFB, SIP | 58 |
| 6709 | [ISINPHI IN] | Input for reactive current of the machine. If tie connection P.F. is controlled instead of machine P.F., then external reactive power transducer is put to this input via a spare analog input. DEFAULT: connected to I_SINPHI_REL (10109). | AI | 19999 | 0 | 10109 | - | AFB, SIP | 58 |

3.15 Q CTRL Group 68

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|-----------------|--|----|-------|----|-------|---|---------------|----|
| 6801 | [RAISE Q CTRL] | Remote Q (VAR) RAISE command input. DEFAULT: connected to RAISE_Q_CTRL_CMD (10325). | BI | 19999 | 0 | 10325 | - | AFB, SIP | 57 |
| 6802 | [LOWER Q CTRL] | Remote Q (VAR) LOWER command input. DEFAULT: connected to LOWER_Q_CTRL_CMD (10326). | BI | 19999 | 0 | 10326 | - | AFB, SIP | 57 |
| 6803 | [SEL REF EXT Q] | Control input which activates user defined ref. signal connected to IN REF EXT Q (6805). DEFAULT: not used (12501). | BI | 19999 | 0 | 12501 | - | AFB, HID, SIP | 57 |
| 6804 | [TRIG PRESET Q] | Control input which unconditionally forces the REF_Q_ACTUAL (11805) to the set PRESET_REF_Q_CTRL (1805) value. Use a „MONO“ AFB (TP = 1s) between ON_Q_CTRL (10316) and this input if Q controller should start always at PRESET point instead of actual operation point after switched on. If permanent PRESET is required to operate the machine with constant reactive power., then connect this input to 12502 = TRUE. DEFAULT: connected to ON_PRESET_CMD (10304). | BI | 19999 | 0 | 10304 | - | AFB, HID, SIP | 57 |
| 6805 | [IN REF EXT Q] | User defined Q_CTRL setpoint input. E.g. an analog input can be connected to this input, if remote analog setpoint (e.g. 4...20 mA) is provided instead of RAISE/LOWER commands, or an User Parameter can be used if beside PRESET_REF_Q_CTRL a 2nd constant setpoint is required. DEFAULT: not used (12501) NOTE: The value will be limited by the HL_REF_Q_CTRL (1803) and LL_REF_Q_CTRL (1804) if the external signal exceeds the HL, LL values set. Therefore it is recommended to scale analog input to HL, LL set. | AI | 19999 | 0 | 12501 | - | AFB, HID, SIP | 57 |
| 6806 | [IN ERR EXT Q] | User defined ERR_SUPERIMPOSED signal. This input is used if superimposed control is defined by user with AFB's instead of firmware Q_CTRL. E.g. reactive power equalizing between several machines. DEFAULT: not used (12501). | AI | 19999 | 0 | 12501 | - | AFB, HID, SIP | 57 |
| 6807 | [IN UNLOAD Q] | As long as this input is TRUE, the Q controller unloads the machine aperiodically at the time constant set by TC_IMPOSED_CTRL_A (1908) to zero reactive power, independent whether Q_CTRL is activated by the CONTROL_LOGIC. | BI | 19999 | 0 | 12501 | - | AFB, HID, SIP | 57 |
| 6808 | [SEL ERR EXT Q] | This input activates IN_ERR_EXT_Q (6806) input. If using, the ON_Q_CTRL from CONTROL_LOGIC is required as well to get superimposed ctrl active. DEFAULT: not used (12501) | BI | 19999 | 0 | 12501 | - | AFB, HID, SIP | 57 |
| 6809 | [Q IN] | Input for reactive power of the machine. The controller can be used alternatively by the user, if putting here instead of absolute reactive power e.g. reactive power difference, getting from optional equalizing bus. DEFAULT: connected to Q_MACH_RELATIVE (10110). | AI | 19999 | 0 | 10110 | - | AFB, HID, SIP | 57 |

3.16 AVR CTRL Group 69

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|--------------------|---|----|-------|----|-------|---|---------------|----|
| 6901 | [RAISE AVR] | Remote AVR setpoint RAISE command input. DEFAULT: RAISE_AUTO_CMD (10319). | BI | 19999 | 0 | 10319 | - | AFB, AVR | 43 |
| 6902 | [LOWER AVR] | Remote AVR setpoint LOWER command input. DEFAULT: LOWER_AUTO_CMD (10320). | BI | 19999 | 0 | 10320 | - | AFB, AVR | 43 |
| 6903 | [SEL IMPOSED AVR] | Activates the ERR_IMPOSED_AVR (6904) input. DEFAULT: ON_SUPERIMPOSED (10314). | BI | 19999 | 0 | 10314 | - | AFB, SIP | 43 |
| 6904 | [ERR IMPOSED AVR] | Input for the error signal from superimposed controller output. DEFAULT: ERR_SUPERIMPOSED (11708). | AI | 19999 | 0 | 13808 | - | AFB, SIP | 43 |
| 6905 | [SEL RAMP TIME2 A] | Control input for RAMP_TIME2_REF_A (1906) selection. DEFAULT: not used (12501). | BI | 19999 | 0 | 12501 | - | AFB, HID, AVR | 43 |
| 6906 | [SEL PRESET2 AVR] | Control input for PRESET2_REF_AVR (1904) selection. DEFAULT: not used (12501). | BI | 19999 | 0 | 12501 | - | AFB, HID, AVR | 43 |
| 6907 | [TRIG PRST AVR] | Control input which unconditionally forces the REF1_AVR_REL (11901) to the selected PRESET1_REF_AVR or PRESET2_REF_AVR value. DEFAULT: ON_PRESET_CMD (10304). | BI | 19999 | 0 | 10304 | - | AFB, HID, AVR | 43 |
| 6908 | [ADD IN REF1 A] | Extra summing input to REF1_AVR_REL. DEFAULT: not used (12501). | AI | 19999 | 0 | 12501 | - | AFB, HID, AVR | 44 |
| 6909 | [PID SET2 SEL1] | Input 1 which selects TA2 and TB2. DEFAULT: connected to ON_IE_LIMITER (12004). If DEFAULT source is disconnected because of other requirements, PID_SET1 becomes active for IE_LIMITER. | BI | 19999 | 0 | 12004 | - | CM, HID, AVR | 42 |
| 6910 | [PID SET2 SEL2] | Input 2 which selects TA2 and TB2. DEFAULT: connected to ON_IEMIN_LIMITER (12009). If DEFAULT source is disconnected because of other requirements, PID_SET1 becomes active for IEMIN_LIMITER. | BI | 19999 | 0 | 12009 | - | CM, HID, AVR | 42 |
| 6911 | [PID SET2 SEL3] | Input 3 which selects TA2 and TB2. DEFAULT: not used (12501). | BI | 19999 | 0 | 12501 | - | CM, HID, AVR | 42 |
| 6912 | [PID SET2 SEL4] | Input 4 which selects TA2 and TB2. DEFAULT: not used (12501). | BI | 19999 | 0 | 12501 | - | CM, HID, AVR | 42 |
| 6913 | [PID SET3 SEL1] | Input 1 which selects TA3 and TB3. DEFAULT: connected to ON_IOE_LIMITER (12005). If DEFAULT source is disconnected because of other requirements, PID_SET1 becomes active for IOE_LIMITER. | BI | 19999 | 0 | 12005 | - | CM, HID, AVR | 42 |
| 6914 | [PID SET3 SEL2] | Input 2 which selects TA3 and TB3. DEFAULT: connected to ON_IUE_LIMITER (12008). If DEFAULT source is disconnected because of other requirements, PID_SET1 becomes active for IUE_LIMITER. | BI | 19999 | 0 | 12008 | - | CM, HID, AVR | 42 |
| 6915 | [PID SET3 SEL3] | Input 3 which selects TA3 and TB3. DEFAULT: connected to ON_Q(P)_LIMITER (12007). If DEFAULT source is disconnected because of other requirements, PID_SET1 becomes active for Q(P)_LIMITER. | BI | 19999 | 0 | 12007 | - | CM, HID, AVR | 42 |
| 6916 | [PID SET3 SEL4] | Input 4 which selects TA3 and TB3. DEFAULT: not used (12501). | BI | 19999 | 0 | 12501 | - | CM, HID, AVR | 42 |
| 6917 | [IN AVR ERR] | AVR PID controller input error signal. DEFAULT: connected to ERR1_AVR (12001). | AI | 19999 | 0 | 12001 | - | AFB, HID, AVR | 42 |
| 6918 | [ADD IN1 AVR] | Additional AVR PID controller input 1. DEFAULT: connected to OUT_PSS (12010). | AI | 19999 | 0 | 12010 | - | AFB, HID, AVR | 42 |
| 6919 | [ADD IN2 AVR] | Additional AVR PID controller input 2. DEFAULT: not used (12501). | AI | 19999 | 0 | 12501 | - | AFB, HID, AVR | 42 |
| 6920 | [ADD AVR OUT] | Adder input at AVR PID output. DEFAULT: not used (12501). | AI | 19999 | 0 | 12011 | - | AFB, HID, AVR | 42 |

3.17 AVR IN, PSS Group 70

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|-------------------|---|----|-------|----|-------|---|---------------|-----|
| 7001 | [REF INPUT AVR] | Input for the finally processed AVR (AUTO) setpoint (ref.) signal. DEFAULT: REF4_AVR_REL (11906). | AI | 19999 | 0 | 12101 | - | AFB, HID, AVR | 41 |
| 7002 | [ADD INPUT AVR] | Spare input to AVR summing point. DEFAULT: not used (12501). | AI | 19999 | 0 | 12501 | - | AFB, HID, AVR | 41 |
| 7003 | [FB IN FOLLOW A] | Feedback input from FOLLOW_UP_CTRL (group 21). This feedback closes the control loop of the inactive AVR (AUTO) channel to get stable auto follower loop. DEFAULT: FBA_FOLLOW_AUTO (12113). | AI | 19999 | 0 | 12304 | - | AFB, HID, AVR | 41 |
| 7004 | [IN IELIM ERR A] | Input for the IE_LIMITER error signal. If lower than the AVR error signal it takes over loop control instead of the AVR. This action is indicated by the output ON_IE_LIMITER (12004) and ON_OE_LIMITER (12002) at AUTO mode. DEFAULT: OUT_IE_LIMITER (11301). NOTE: The limiter is made inactive by setting the input to CONST_20000 (12509). | AI | 19999 | 0 | 11301 | - | CM, HID, AVR | 41 |
| 7005 | [IN IOEL ERR AVR] | Input for the I_LIMITER OE error signal. If lower than the AVR error signal it takes over loop control instead of the AVR. This action is indicated by the output ON_IOE_LIMITER (12005) and ON_OE_LIMITER (12002) at AUTO mode. DEFAULT: not used == CONST_20000 (12509). NOTE: Connect to OUT_I_OE_LIMITER (11401) if I_OE limiter required. The parameter 1407 must be set prior to >0, otherwise the AVR input high limit will be set to zero by this action. Ref. also to parameter 1407. | AI | 19999 | 0 | 12509 | - | CM, HID, AVR | 41 |
| 7006 | [IN USER OEL ERR] | Spare input for the user defined OE_LIMITER error signal. If lower than the AVR error signal it takes over loop control instead of the AVR. This action is indicated by the output ON_IE_USER_LIM (12006) and ON_OE_LIMITER (12002) at AUTO mode. DEFAULT: not used == CONST_20000 (12509). | AI | 19999 | 0 | 12509 | - | AFB, HID, AVR | 41 |
| 7007 | [IN Q(P) LIM ERR] | Input for the Q(P)_LIM error signal. If higher than the AVR error signal it takes over loop control instead of the AVR. This action is indicated by the output ON_Q(P)_LIMITER (12007) and ON_UE_LIMITER (12003) at AUTO mode. DEFAULT: OUT_Q(P)_LIMITER (11501). NOTE: The limiter is made inactive permanently by setting the input to CONST_N20000 (12510). | AI | 19999 | 0 | 11501 | - | CM, HID, AVR | 41 |
| 7008 | [IN IUEL ERR AVR] | Input for the I_LIMITER UE error signal. If higher than the AVR error signal it takes over loop control instead of the AVR. This action is indicated by the output ON_IUE_LIMITER (12008) and ON_UE_LIMITER (12003) at AUTO mode. DEFAULT: not used == CONST_N20000 (12510). NOTE: Use this limiter very restrictively for TURBO machine, since the Q(P) limiter covers normally all requirements. Connect to OUT_I_UE_LIMITER (11402) if I_UE limiter required. The parameter 1408 must be set prior to >0, otherwise the AVR input low limit will be set to zero by this action. Ref. also to parameter 1408. | AI | 19999 | 0 | 12510 | - | CM, HID, AVR | 41 |
| 7009 | [IN IEMINLIM ERR] | Input for the IEMIN_LIMITER error signal. If higher than the AVR error signal it takes over loop control instead of the AVR. This action is indicated by the output ON_IEMIN_LIMITER (12009) and ON_UE_LIMITER (12003) at AUTO mode. DEFAULT: not used == CONST_N20000 (12510). | AI | 19999 | 0 | 12510 | - | CM, HID, AVR | 41 |
| 7010 | [BLK LIMITER] | General blocking input. If TRUE all AVR limiter actions are suppressed. DEFAULT: LIM_BLK (10345) which is TRUE if MAN or STBY_ON. The MANUAL Limiters (restrictions) are released separately. | BI | 19999 | 0 | 10345 | - | AFB, HID, AVR | 41 |
| 7011 | [LIM INDIC ON] | Release input for the indication signals 12002...12009 . DEFAULT: LOGIC_1 (12502) == permanently released. NOTE: The indications ON_OE_LIMITER (12002) and ON_UE_LIMITER (12003) include the indication from the MANUAL Limiters too. | BI | 19999 | 0 | 12502 | - | AFB, HID, AVR | 41 |
| 7012 | [IN P PSS] | Power signal Input to PSS. DEFAULT: connected to P_MACH_RELATIVE (10106) | AI | 19999 | 0 | 10106 | - | AFB, HID | 122 |
| 7013 | [IN f PSS] | Frequency signal input to PSS. DEFAULT: connected to f_MACH_RELATIVE (10122) | AI | 19999 | 0 | 10122 | - | AFB, HID | 122 |
| 7014 | [BLK PSS] | PSS blocking input. DEFAULT: not used (12501). Used e.g. for blocking when OFF_LINE if P_MACH_MIN is set to zero. (see PSS P_MACH_MIN (2020)). The output 12010 becomes zero, but PSS is still processed. | BI | 19999 | 0 | 12501 | - | AFB, HID | 122 |

3.18 MANUAL CTRL Group 71

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|--------------------|---|----|-------|----|-------|---|---------------|----|
| 7101 | [SEL IMPOSED MAN] | Activates the ERR_IMPOSED_MAN (7102) input. DEFAULT: V_HZ_MANUAL_ON (12108) which becomes TRUE if OFF_LINE the V/Hz manual restrict interferes (ref. 7102, 12107, 12108). NOTE: The limiter can be switched OFF temporarily by deleting the connection to V_HZ_MANUAL_ON (12108), but consider that the indication ON_OE_LIMITER is not influenced by this action. | BI | 19999 | 0 | 14008 | - | AFB, AVR, HID | 45 |
| 7102 | [ERR IMPOSED MAN] | Input for the error signal from superimposed controller output. DEFAULT: V_HZ_ERR (12107) which is switched ON at negative values if OFF_LINE and MANUAL_CTRL is ON. Then the V/Hz manual restrict interferes by reducing the MANUAL_CTRL setpoint. For V/Hz characteristic ref. to 1911...13. | BI | 19999 | 0 | 14007 | - | AFB, AVR, HID | 45 |
| 7103 | [RAISE MANUAL] | Remote MANUAL_CTRL setpoint RAISE command input. DEFAULT: RAISE_MANUAL_CMD (10321). | BI | 19999 | 0 | 10321 | - | AFB, AVR | 45 |
| 7104 | [LOWER MANUAL] | Remote MANUAL_CTRL setpoint LOWER command input. DEFAULT: LOWER_MANUAL_CMD (10322). | BI | 19999 | 0 | 10322 | - | AFB, AVR | 45 |
| 7105 | [SEL RAMP TIME2 M] | Control input for RAMP_TIME2_REF_M (2104) selection. DEFAULT: not used (12501). | BI | 19999 | 0 | 12501 | - | AFB, AVR, HID | 45 |
| 7106 | [SEL PRESET2 MAN] | Control input for PRESET2_REF_MAN (2108) selection. DEFAULT: connected to TEST_SUPPLY (10901). Since PRESET2_REF_MAN default value is 0, the MANUAL excitation starts automatically at zero if „Test supply“ is recognized at SUPPLY_MODE (901) = SHUNT. | BI | 19999 | 0 | 12401 | - | AFB, AVR, HID | 45 |
| 7107 | [TRIG PRST MAN] | Control input which unconditionally forces the REF_MAN_ACTUAL (12105) to the selected PRESET1_REF_MAN or PRESET2_REF_MAN value. DEFAULT: ON_PRESET_CMD (10304). | BI | 19999 | 0 | 10304 | - | AFB, AVR, HID | 45 |
| 7108 | [IN ACT MANUAL] | MANUAL controller actual value input. DEFAULT: connected to I_EXC_RELATIVE (10501). | AI | 19999 | 0 | 10501 | - | AFB, AVR, HID | 59 |
| 7109 | [IN REF MANUAL] | MANUAL controller reference input. DEFAULT: connected to REF_MAN_ACTUAL (12105) | AI | 19999 | 0 | 14005 | - | AFB, AVR, HID | 59 |
| 7110 | [ADD IN MANUAL] | Extra summing input to MANUAL controller. DEFAULT: not used (12501). | AI | 19999 | 0 | 12501 | - | AFB, AVR, HID | 59 |
| 7111 | [FB IN FOLLOW M] | Feedback input from FOLLOW_UP_CTRL. This feedback closes the control loop of the inactive MANUAL_CTRL channel to get stable auto follower loop. DEFAULT: FBM_FOLLOW_MAN (12114). | AI | 19999 | 0 | 12305 | - | AFB, AVR, HID | 59 |
| 7112 | [FOLLOW RELEASE] | Auto follower action is released by the control logic via this input. DEFAULT: ON_FOLLOW_UP (10303). | BI | 19999 | 0 | 10303 | - | AFB, HID, AVR | 46 |

3.19 CH COMMUNICATION Group 74

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|------------|---|----|-------|----|-------|---|----------|----|
| 7401 | [USER DO] | Input for user digital (Boolean) signal, which has to be transmitted to second (STBY) channel USER_DI (12407) pin. DEFAULT: not used (12501). Connect to required digital output with BO scaling. | BI | 19999 | 0 | 12501 | - | AFB, HID | 82 |
| 7402 | [USER AO] | Input for user „analog“ (INTEGER2) signal, which has to be transmitted to second (STBY) channel USER_AI (12409) pin. DEFAULT: not used (12501). Connect to required output signal. NOTE: Since only 14 Bits are transmitted, the 2 LSB's are set to 0. | AI | 19999 | 0 | 12501 | - | AFB, HID | 82 |

4 Signals

4.1 ANALOG INPUTS Group 101

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|-----------------|---|------|----|----|------|---|------------------|----|
| 10101 | U MACH RELATIVE | Actual machine voltage RELATIVE. DEFAULT: used for AVR, Limiters and Monitoring. | 0.01 | - | - | - | % | IMP, IO, SM, AVR | 3 |

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|------------------------|--|------|----|----|------|----------|-------------|----|
| 10102 | U MACH V | Actual relative machine voltage in VOLTS. NOTE: refresh cycle of 1s. DEFAULT: used for Panel/CMT only. | 1 | - | - | - | V | SM, HID | 3 |
| 10103 | I MACH RELATIVE | Actual machine current RELATIVE. DEFAULT: used for AVR, Limiters and Monitoring. | 0.01 | - | - | - | % | IO, SM, HID | 3 |
| 10104 | I MACH A | Actual machine current in AMPS. NOTE: refresh cycle is 1s. Signal is forced to zero if machine is OFF_LINE. DEFAULT: used for Panel/CMT only. | 0.1 | - | - | - | A | SM, HID | 3 |
| 10105 | I COSPHI REL | Actual machine active current RELATIVE (+ sign means power generation). DEFAULT: used for AVR, Limiters and Monitoring. | 0.01 | - | - | - | % | IMP, IO, SM | 3 |
| 10106 | P MACH RELATIVE | Actual relative machine active power RELATIVE (+ sign means power generation). DEFAULT: used for AVR, Limiters and Monitoring | 0.01 | - | - | - | % | SM, IMP | 3 |
| 10107 | P MACH KW | Machine active power in kW (+ sign means power generation). Use P_MACH_MW (10108) for values bigger than 32767 kW. NOTE: refresh cycle is 1s. Signal is forced to zero if machine is OFF_LINE. CMT and Panel indication toggle between 0 and 11111 if value is bigger than 32767. DEFAULT: used for Panel/CMT only. | 1 | - | - | - | KW | SM, HID | 3 |
| 10108 | P MACH MW | Machine active power in MW (+ sign means power generation). Use P_MACH_KW (10107) if resolution is not sufficient. NOTE: refresh cycle is 1s. Signal is forced to zero if machine is OFF_LINE. DEFAULT: used for Panel/CMT only. | 0.1 | - | - | - | M W | SM, HID | 3 |
| 10109 | I SINPHI REL | Actual machine reactive current RELATIVE (+ sign means reactive power generation == overexcited). DEFAULT: used for AVR, Limiters and Monitoring. | 0.01 | - | - | - | % | IMP, IO, SM | 3 |
| 10110 | Q MACH RELATIVE | Actual relative machine reactive power RELATIVE (+ sign means reactive power generation == overexcited). DEFAULT: used for AVR, Limiters and Monitoring. | 0.01 | - | - | - | % | IMP, IO, SM | 3 |
| 10111 | Q MACH KVAR | Machine reactive power in kVAr(+ sign means reactive power generation == overexcited). Use Q_MACH_MVAR (10112) for values bigger than 32767 kVAR. NOTE: refresh cycle is 1s. Signal is forced to zero if machine is OFF_LINE. CMT and Panel indication toggle between 0 and 11111 if value is bigger than 32767. DEFAULT: used for Panel/CMT only. | 1 | - | - | - | KVAR | SM, HID | 3 |
| 10112 | Q MACH MVAR | Machine reactive power in MVAr (+ sign means reactive power generation == overexcited). Use P_MACH_KVAR (10111) if resolution is not sufficient. NOTE: refresh cycle is 1s. Signal is forced to zero if machine is OFF_LINE. DEFAULT: used for Panel/CMT only. | 0.1 | - | - | - | MVA R | SM, HID | 3 |
| 10113 | S MACH KVA | Machine armature power in kVA. Use S_MACH_MVA (10114) for values bigger than 32767 kVA. CMT and Panel indication toggle between 0 and 11111 if value is bigger than 32767. NOTE: refresh cycle is 1s. Signal is forced to zero if machine is OFF_LINE. DEFAULT: used for Panel/CMT only | 1 | - | - | - | KVA | SM, HID | 3 |
| 10114 | S MACH MVA | Machine armature power in MVA. Use S_MACH_KVA (10113) if resolution is not sufficient. NOTE: refresh cycle is 1s. Signal is forced to zero if machine is OFF_LINE. DEFAULT: used for Panel/CMT only. | 0.1 | - | - | - | MVA | SM, HID | 3 |
| 10115 | AI1 ACTUAL | Actual machine active power from PSS option UNS 0869 V2 or spare analog input from X3:8 terminal if S100 on UNS 1860b in Pos. 2. NOTE: Signal must be scaled by application function block (MULDIV) if required. DEFAULT: not used. | 0.01 | - | - | - | % | SM, IO, HID | 4 |

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|-------------------------|--|------|----|----|------|----|--------------|----|
| 10116 | AI2 ACTUAL | Spare analog input scaled by AI2_HIGH_VALUE (107) and AI2_LOW_VALUE (108) parameters. DEFAULT: not used. | 1 | - | - | - | - | IO | 5 |
| 10117 | AI2 NEG ACTUAL | Negated value of AI2_ACTUAL (10116). DEFAULT: not used. | 1 | - | - | - | - | IO, HID | 5 |
| 10118 | AI2 FAILURE | Signal AI2_ACTUAL (10116) is below AI2_LIVE_ZERO (109) setting. Generates ALARM 123 „AI failed“. DEFAULT: not used. | BO | - | - | - | - | AL, IO, HID | 5 |
| 10119 | AITAC ACTUAL | Spare analog input scaled by AITAC_HIGH_VALUE (110) and AITAC_LOW_VALUE (111) parameters. DEFAULT: not used. | 1 | - | - | - | - | IO | 6 |
| 10120 | AITAC NEG ACTUAL | Negated output of AITAC_ACTUAL (10119). DEFAULT: not used. | 1 | - | - | - | - | IO, HID | 6 |
| 10121 | AITAC FAILURE | Signal AITAC_ACTUAL (10119) is below AITAC_LIVE_ZERO (112) setting. Generates ALARM 123 „AI failed“. DEFAULT: not used. | BO | - | - | - | - | AL, IO, HID | 6 |
| 10122 | f MACH RELATIVE | Actual machine terminal frequency RELATIVE. DEFAULT: used for AVR, Limiters and Monitoring. NOTE: If f-sensing failed (10717 = TRUE): Signal is switched to 100% if EXC_ON or ON_LINE, or switched to zero, if EXC_OFF, OFF_LINE and no PULSE_BLOCKING (10328). If PSS is selected and ON_LINE, the output ramp filter is switched off. | 0.01 | - | - | - | % | IO, SM | 7 |
| 10123 | f MACH HERTZ | Actual machine terminal frequency in Hz. DEFAULT: used for Panel/CMT only. | 0.01 | - | - | - | Hz | IO, SM, HID | 7 |
| 10124 | COS PHI | Machine power factor signal used for PANEL/CMT indication. NOTE: refresh cycle is 1s. Signal is forced to zero if machine is OFF_LINE. + sign means P and Q have the same signs (e.g. power and reactive power generation). - sign means P and Q have different signs (e.g. power generation and reactive power consumption). | 0.01 | - | - | - | - | SM, HID | 3 |
| 10125 | dU/dt TRIGGER | Negative machine voltage gradient > 5 p.u./s. This signal is used to release ceiling ref. of the overexcitation Limiters. DEFAULT: connected to IEL_MAX_RETRIG (6305) and I_UNLTD_TRIGGER (6403). | BO | -1 | 0 | - | - | SM, HID, AVR | 3 |
| 10126 | COSPHI AO | Power factor signal used for analog output which normally feeds an external instrument: -10000...0... +10000 means P.F. = 0 (lead)...1...0 (lag) normally scaled to -10...0...+10V output signal. | 1 | - | - | - | - | IO, SM | 3 |
| 10127 | AI1E ACTUAL | Spare analog input scaled by AI1E_HIGH_VALUE (114) and AI1E_LOW_VALUE (115) parameters. NOTE: Only available if optional hardware UNS 0867 on CON-2 and second UNS 0863 are installed. | 1 | - | - | - | - | IO | 83 |
| 10128 | AI1E NEG ACTUAL | Negated value of AI1E_ACTUAL (10127). NOTE: Only available if optional hardware UNS 0867 on CON-2 and second UNS 0863 are installed. | 1 | - | - | - | - | IO, HID | 83 |
| 10129 | AI1E FAILURE | Signal AI1E_ACTUAL (10127) is below AI1E_LIVE_ZERO (116) setting. Generates ALARM 123 „AI failed“. NOTE: Only available if optional hardware UNS 0867 on CON-2 and second UNS 0863 are installed. | BO | - | - | - | - | AL, IO, HID | 83 |
| 10130 | AI2E ACTUAL | Spare analog input scaled by AI2E_HIGH_VALUE (117) and AI2E_LOW_VALUE (118) parameters. NOTE: Only available if optional hardware UNS 0867 on CON-2 and second UNS 0863 are installed. | 1 | - | - | - | - | IO | 84 |
| 10131 | AI2E NEG ACTUAL | Negated value of AI2E_ACTUAL (10130). NOTE: Only available if optional hardware UNS 0867 on CON-2 and second UNS 0863 are installed. | 1 | - | - | - | - | IO, HID | 84 |
| 10132 | AI2E FAILURE | Signal AI2E_ACTUAL (10130) is below AI2E_LIVE_ZERO (119) setting. Generates ALARM 123 „AI failed“. NOTE: Only available if optional hardware UNS 0867 on CON-2 and second UNS 0863 are installed. | BO | - | - | - | - | AL, IO, HID | 84 |

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|------------------------|--|----|-------|----------------|------|---|---------|-----|
| 10133 | DATASET 1 OUT 1 | Fast data input from field bus. DEFAULT: Control word connected to INTEGER-BINARY converter input (3312) if fieldbus application is loaded. NOTE: This option is only available with external field bus adapter HW and if the relevant field bus application is downloaded. Ref. to relevant fieldbus installation and start-up instructions. | AO | 32767 | - 3276 8 | - | - | COM, IO | 125 |
| 10134 | DATASET 1 OUT 2 | Fast data input from field bus. DEFAULT: Reference signal IN_FLDB_REF (5334) to the active controller AUTO (AVR), MANUAL COS PHI (P.F.) or Q (AVR) CTRL, if fieldbus application is loaded. NOTE: This option is only available with external field bus adapter HW and if the relevant field bus application is downloaded. Ref. to relevant fieldbus installation and start-up instructions. | AO | 32767 | - 3276 8 | - | - | COM, IO | 125 |
| 10135 | DATASET 1 OUT 3 | Fast data input from field bus. DEFAULT: not used. Spare input for application. NOTE: This option is only available with external field bus adapter HW. Ref. to relevant fieldbus installation and start-up instructions. | AO | 32767 | - 3276 8 | - | - | COM, IO | 125 |
| 10136 | DATASET 3 OUT 1 | Fast data input from field bus. DEFAULT: not used. Spare input for application. NOTE: This option is only available with external field bus adapter HW. Ref. to relevant fieldbus installation and start-up instructions. | AO | 32767 | - 3276 8 | - | - | COM, IO | 125 |
| 10137 | DATASET 3 OUT 2 | Fast data input from field bus. DEFAULT: not used. Spare input for application. NOTE: This option is only available with external field bus adapter HW. Ref. to relevant fieldbus installation and start-up instructions. | AO | 32767 | - 3276 8 | - | - | COM, IO | 125 |
| 10138 | DATASET 3 OUT 3 | Fast data input from field bus. DEFAULT: not used. Spare input for application. NOTE: This option is only available with external field bus adapter HW. Ref. to relevant fieldbus installation and start-up instructions. | AO | 32767 | - 3276 8 | - | - | COM, IO | 127 |

4.2 ANALOG OUTPUTS Group 102

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|------------|----------|----|----|----|------|---|-------|----|
| - | | - | | | | | | | |

4.3 CONTROL LOGIC Group 103

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|------------------------|---|------|----|----|------|---|-----------|----|
| 10301 | MODE INDICATION | Actual status of operation mode for panel & CMT indication with different priorities. If more than one status is given, the status with the highest priority (lowest priority No.) is indicated. The first digit indicates the active physical channel (1= Channel 1 or Single Channel, 2= Channel 2 of an AFT system). 1/2 OEL priority 1 indicates any O ver Excitation Limiter is active 1/2 UEL priority 1 indicates any U nder Excitation Limiter is active 1/2 REF MIN priority 2 R Eference (set point) of active ctrl is in M inimal position 1/2 REF MAX priority 2 R Eference (set point) of active ctrl is in M aximal position 1/2 XFER BLKD priority 3 A UTO<-> M AN transfer blocked for panel in L OCAL 1/2 MAN priority 4 M ANual control is active 1/2 COSPHI priority 5 Superimposed C OS P HI (P.F.) control to AVR setpoint 1/2 Q priority 5 Superimposed Q (VAR) control to AVR setpoint 1/2 AUTO priority 6 A UTO (AVR) control is active without superimposed ctrl | ENUM | - | - | - | - | DIAG | - |
| 10302 | MODE SELECTION | Operation mode signal which can be forced by panel or CMT (In LOCAL CTRL mode only): MAN ON selects M ANual control mode if RDY_XFER_A_M (12117) = TRUE (selects MAN in both channels of an AFT system). COSPHI ON selects Superimposed C OS P HI (P.F.) ctrl, if all preconditions O.K. (in both channels of an AFT system). Q ON selects Superimposed Q (VAR) control, if all preconditions O.K. (in both channels of an AFT system). AUTO ON selects A UTO (AVR) mode, if no AUTO_FAIL (5317) is present and RDY_XFER_A_M (12117) = TRUE (selects AUTO in both channels of an AFT system). CHANGEOVER Toggles between the channels. Delayed data transfer if Panel/CMT is connected to the CH2 (slave) instead of CH1 (master). Take notice of NOTE below. NOTE: Activating the channel which is not communicating with the Panel/CMT means, that all signals, parameters, Alarms and Faults presented on Panel/CMT are now from the inactive (nonduty) channel . Only the control functions LOCAL-REMOTE, ON - OFF, START - STOP and Ref. setting are valid for both channels. If the transfer is NOT only for TEST measure, then the communication should be transferred as well by selecting Panel communication (and/or connecting CMT) to the newly activated channel (Ref. to Panel UNS 0874 instructions). | ENUM | - | - | - | - | CM, IMP | - |
| 10303 | ON FOLLOW UP | Releases the auto follower after SOFTSTART period. DEFAULT: connected to FOLLOW_RELEASE (7112). | BO | - | - | - | - | DIAG, HID | 75 |
| 10304 | ON PRESET CMD | Preset pulse generated at START_EXCITATION and if machine goes OFF_LINE. DEFAULT: connected to TRIG_PRST_AVR (6907), TRIG_PRST_MAN (7107), TRIG_PRST_COS (6704) and TRIG_PRST_Q (6804). | BO | - | - | - | - | DIAG, HID | 74 |
| 10305 | FCB ON CTRL | Closing command 1.5s to field circuit breaker (FCB). DEFAULT: connected to DOX03.[IN] (702). NOTE: This is completed only by the active channel of a 2 channel configuration AFT. | BO | - | - | - | - | DIAG, HID | 74 |

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|-------------------------|--|----|----|----|------|---|----------------|----|
| 10306 | FCB FAILURE | FCB_ON_CTRL (10305) or FCB_OFF (10309) were not successful within 1s. Releases ALARM 127 „FCB failed“. NOTE: Signal is transient in case of ON_CTRL. It disappears with end of Signal FCB ON CTRL. | BO | - | - | - | - | AL, DIAG | 74 |
| 10307 | EXC ON | Status: Excitation is ON. DEFAULT: connected to DOX14.[IN] (713). | BO | - | - | - | - | DIAG | 74 |
| 10308 | EXC OFF INV CTRL | Status: Excitation is OFF. DEFAULT: internal use only. C1...C4: Exc. shut down by INVERTER_CTRL (firing angle = max.: see 10520) After another 60s PULSE_BLOCKING (10328) gets TRUE as well. NOTE: If the machine is stopped without LOCAL or REMOTE OFF command, excitation is automatically switched off at low frequency. This feature is only active 60s after start up (EXC_ON = TRUE). At CB_CONFIG (309) = AC SIDE an RELEASE_FCB_OFF = YES: instantaneous PULSE_BLOCKING. C5 Exc. shut down by PULSE_BLOCKING (10328) which means max. operation at quadrant 4. | BO | - | - | - | - | DIAG, HID | 74 |
| 10309 | FCB OFF | 1.5s pulse trip command to field breaker. DEFAULT: connected to DOX04.[IN] (703). NOTE: This is completed only by the active channel of a 2 channel configuration (AFT). | BO | - | - | - | - | DIAG, HID | 74 |
| 10310 | AUTO ON | Status: AUTO (AVR) CTRL mode is active. DEFAULT: connected to DOX05.[IN] (704). For panel/CMT indication ref. to 10301. | BO | - | - | - | - | DIAG, AVR | 76 |
| 10311 | MAN ON | Status: MANUAL CTRL mode is active. DEFAULT: connected to DOX06.[IN] (705). For panel/CMT indication ref. to 10301. | BO | - | - | - | - | DIAG, AVR | 76 |
| 10312 | REF MAX ACTIVE | Status: Ref. (set point) maximum of active controller is reached. DEFAULT: connected to DOX08.[IN] (707). For panel/CMT indication ref. to 10301. NOTE: While superimposed control is ON, it may happen that max. setpoint of the led AVR is reached and indicated before that one of the imposed controller. Coordinate the two setpoint ranges. This is completed only by the active channel of a 2 channel configuration (AFT). | BO | - | - | - | - | DIAG, HID | 78 |
| 10313 | REF MIN ACTIVE | Status: Ref.(set point) minimum of active controller is reached. DEFAULT: connected to DOX09.[IN] (708). For panel/CMT indication ref. to 10301. NOTE: While superimposed control is ON, it may happen that max. setpoint of the led AVR is reached and indicated before that one of the imposed controller. Coordinate the two setpoint ranges. This is completed only by the active channel of a 2 channel configuration (AFT). | BO | - | - | - | - | DIAG, HID | 78 |
| 10314 | ON SUPERIMPOSED | Status: preselected superimposed control is active. DEFAULT: connected to DOX07.[IN] (706). | BO | - | - | - | - | DIAG, SIP | 79 |
| 10315 | ON COSPHI CTRL | Status: preselected superimposed COSPHI (P.F.) CONTROL is active. DEFAULT: no programmable connection. For panel/CMT indication ref. to 10301. | BO | - | - | - | - | DIAG, HID, SIP | 79 |
| 10316 | ON Q CTRL | Status: preselected superimposed Q (VAR) CONTROL is active. DEFAULT: no programmable connection. For panel/CMT indication ref. to 10301. | BO | - | - | - | - | DIAG, HID, SIP | 79 |
| 10317 | PRESEL COSPHI | Status: superimposed COSPHI (P.F.) CONTROL is preselected. DEFAULT: no programmable connection. | BO | - | - | - | - | DIAG, HID, SIP | 79 |
| 10318 | PRESEL Q CTRL | Status: superimposed Q (VAR) CONTROL is pre selected. DEFAULT: no programmable connection. | BO | - | - | - | - | DIAG, HID, SIP | 79 |
| 10319 | RAISE AUTO CMD | RAISE CMD which increases AUTO (AVR) set point. DEFAULT: connected to RAISE_AVR (6901). NOTE: Effective in both channels of a 2 channel configuration (AFT). | BO | - | - | - | - | DIAG, HID, AVR | 77 |
| 10320 | LOWER AUTO CMD | LOWER CMD which decreases AUTO (AVR) set point. DEFAULT: connected to LOWER_AVR (6902). NOTE: Effective in both channels of a 2 channel configuration (AFT). | BO | - | - | - | - | DIAG, HID, AVR | 77 |
| 10321 | RAISE MANUAL CMD | RAISE CMD which increases MANUAL set point. DEFAULT: connected to RAISE_MANUAL (7103). NOTE: Effective in both channels of a 2 channel configuration (AFT). | BO | - | - | - | - | DIAG, HID, AVR | 77 |
| 10322 | LOWER MANUAL CMD | LOWER CMD which decreases MANUAL set point. DEFAULT: connected to LOWER_MANUAL (7104). NOTE: Effective in both channels of a 2 channel configuration (AFT). | BO | - | - | - | - | DIAG, HID, AVR | 77 |
| 10323 | RAISE COSPHI CMD | RAISE CMD which increases COSPHI set point. DEFAULT: connected to RAISE_COSPHI (6701). RAISE means reactive power moves in direction for generation (overexcitation). NOTE: Effective in both channels of a 2 channel configuration (AFT). | BO | - | - | - | - | DIAG, HID, SIP | 77 |

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|-------------------------|--|------|-------|----------------|------|---|----------------|-----|
| 10324 | LOWER COSPHI CMD | LOWER CMD which decreases COSPHI set point. DEFAULT: connected to LOWER_COSPHI (6702). LOWER means reactive power moves in direction for absorption (underexcitation). NOTE: Effective in both channels of a 2 channel configuration (AFT). | BO | - | - | - | - | DIAG, HID, SIP | 77 |
| 10325 | RAISE Q CTRL CMD | RAISE CMD which increases Q (VAR) set point. DEFAULT: connected to RAISE_Q_CTRL (6801). NOTE: Effective in both channels of a 2 channel configuration (AFT). | BO | - | - | - | - | DIAG, HID, SIP | 77 |
| 10326 | LOWER Q CTRL CMD | LOWER CMD which decreases Q (VAR) set point. DEFAULT: connected to LOWER_Q_CTRL (6802). NOTE: Effective in both channels of a 2 channel configuration (AFT). | BO | - | - | - | - | DIAG, HID, SIP | 77 |
| 10327 | FCB ACTION COUNT | Counter status of F.C.B. closing actions. NOTE: counter is cleared if electronic power is OFF more than min. 8 hours (typically more than several days). DEFAULT: not used. | NUM | 30000 | 0 | 0 | - | DIAG | 74 |
| 10328 | PULSE BLOCKING | Status: The thyristor firing pulses are blocked. NOTE: Don't connect to input PULSE_BLK (5323), this causes a loop back. | BO | - | - | - | - | DIAG | 74 |
| 10329 | USYN OK | Not applicable with this SW version 41.220. | BO | - | - | - | - | HID | 75 |
| 10330 | FLASH ON FIELD | SHUNT mode: Controls field flashing contactor if OFF LINE and machine voltage below FLASH_OFF_LEVEL (304). NOTE: by the same output and external contactor, the battery compounding is controlled too while ON LINE and if machine voltage drops below CMP_ON_LEVEL (306) (if set >0). The field flashing action is generated only once per excitation start up sequence. DEFAULT: connected to DOX15[IN] (714). | BO | - | - | - | - | DIAG | 75 |
| 10331 | FLASH FAILURE | Fault: Field flashing was not successful within time set by FLASH_MAX_TIME (305). DEFAULT: FAULT 28 „Field flash fault“ which trips the system. | BO | - | - | - | - | AL, DIAG | 75 |
| 10332 | CMPD FAILURE | Fault: If machine voltage doesn't return within time set by CMPD_MAX_TIME (307). DEFAULT: FAULT 27 „Compounding trip“ which trips the system. | BO | - | - | - | - | AL, DIAG | 75 |
| 10333 | LOCAL PAN REF | Reference value from local operation panel UNS 0874 or CMT. Active on selected controller if in LOCAL mode. NOTE: Refresh cycle is 1s. | 0.01 | 15000 | - 1000 0 | - | % | DIAG | 77 |
| 10334 | PAN REF | Reference value (set point) from local operation panel UNS 0874 or CMT which is fed to the active controller AVR, MAN, P.F or Q CTRL. Effective there at LOCAL CTRL and if channel is active only. NOTE: Refresh cycle is 1s. | 0.01 | 15000 | - 1000 0 | - | % | DIAG | - |
| 10335 | RDY ON | Status: neither TRIP_CMD (5322) connected to EXC_TRIP (10350) nor BLOCK_START_UP cmd (5301) connected to INH_OF_START (10351) is active; ready to close field breaker. If EXC_ON, this status is TRUE independent from any alarm. CMT status. | BO | - | - | - | - | DIAG | 74 |
| 10336 | FCB ON | Status: Field breaker is ON (acknowledged); ready to start excitation. CMT status. DEFAULT: no programmable connection. | BO | - | - | - | - | DIAG | 74 |
| 10337 | FAULT | Status: FAULT (CHANNEL FAULT or TRIP signal) from fault logger present. CMT status. NOTE: ref. to CH_FAIL (10342) and CH_FAIL_LOGGED (10349). DEFAULT: not used. | BO | - | - | - | - | AL, DIAG | 123 |
| 10338 | ALARM | Status: ALARM from fault logger present. CMT status. If an existing ALARM is followed by a new one, this output will be reset for 1s. NOTE: The ALARM relay is only activated by the active channel. An ALARM of the standby channel is indicated via the active channel alarm 119 "Standby alarm". DEFAULT: connected to 2nd channel and DOX18.[IN] (717), which activates ALARM relay. | BO | - | - | - | - | AL, DIAG | 123 |
| 10339 | LOCAL | Status: LOCAL control activated by panel or CMT. 1==LOCAL, 0==REMOTE. DEFAULT: connected to DOX12.[IN] (711). | BO | - | - | - | - | DIAG, HID | 74 |

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|-----------------------|---|----|----|----|------|---|-----------|-----|
| 10340 | CH ON | Status: This physical channel is selected . Fix connected to ON_OFF logic, REF_MAX/MIN evaluation, GATE_CONTROL and CH_COMMUNICATION blocks. For panel/CMT indication ref. to 10301. CMT status. NOTE: In a single channel system (SFE) this output is unconditionally forced to TRUE. | BO | - | - | - | - | DIAG | 76 |
| 10341 | STBY ON | Status: This physical channel is not selected . Fix connected to CONVERTER and FOLLOW_UP_CTRL blocks. For panel/CMT indication ref. to 10301. NOTE: In a single channel system (SFE) this output is unconditionally forced to FALSE. | BO | - | - | - | - | DIAG | 76 |
| 10342 | CH FAIL | Common channel fault signal. DEFAULT: Fix connected to DOX01 and DO01E for optional I/O extension. (hard wired channel O.K. signal drop if CH_FAIL = TRUE). Channel fail relay (output 1) on UNS 0863 interface drops, if both CH_FAIL signals occur in a 2 channel system, which then trips the field breaker. If I/O extension is used, then the channel fail relay on 2nd UNS 0863 can be used for 2nd trip coil. Check system with ref. to specific indicated FAULTS and ALARMS in the provided physical channels according trouble shooting instructions. NOTE: This signal will not be TRUE if standby failed (STBY_FAIL (10346) = TRUE) before CH_FAIL, but will be TRUE if ALARM 113 "2 channel comerror" occurred while STBY_ON. Not used in a single channel system SFE. | BO | - | - | - | - | AL, DIAG | 76 |
| 10343 | XFER FAIL | Alarm: The status EXC_ON/OFF, AUTO/MAN, SUPERIMPOSED CTRL ON/OFF, CH_ON/STBY_ON of the 2 channels are not conform with reference configuration CH_CONFIG. DEFAULT: ALARM 107 „CH transfer failed“. Check system according trouble shooting instructions. NOTE: With a single channel configuration this signal is always forced to FALSE. | BO | - | - | - | - | AL, DIAG | 76 |
| 10344 | AFT CHANNEL 1 | Status: TRUE if this unit is physical channel 1 of a 2 channel system. It means that this unit serves as master for the serial 2-channel link (2nd RS 485). DEFAULT: not used. NOTE: Use this signal to multiplex I/O channels, so that identical application SW can be used in both channels. | BO | - | - | - | - | AL, DIAG | 76 |
| 10345 | LIM BLK | Status: TRUE if STBY_ON or MAN_ON. Used to block the limiter actions of non active system. DEFAULT: connected to BLK_LIMITER (7010). | BO | - | - | - | - | AVR, DIAG | 76 |
| 10346 | STBY FAIL | Common standby channel fault signal transmitted by serial or hard wired link. DEFAULT: ALARM 111 „Common STBY fault“. Check specific indicated FAULTS of standby system according trouble shooting instructions. NOTE: Use Panel communication to standby channel to read the fault logger there (done by connecting the Panel/CMT to standby channel) and RESET pending FAULTS. | BO | - | - | - | - | AL, DIAG | 76 |
| 10347 | CH1 FAN RUN | Control output for the channel 1 converter fan. Controls the fan of the active channel 1. NOTE: Connect this output to the same spare digital output number in both channels of a 2 channel system, since common output relay is driven by both channel SW (fulfilled if downloading identical parameter sets). | BO | - | - | - | - | DIAG, HID | 76 |
| 10348 | CH2 FAN RUN | Control output for the channel 2 converter fan. Controls the fan of the active channel 2. NOTE: Connect this output to the same spare digital output number in both channels of a 2 channel system, since common output relay is driven by both channel SW (fulfilled if downloading identical parameter sets). | BO | - | - | - | - | DIAG, HID | 76 |
| 10349 | CH FAIL LOGGED | Channel Fault output from fault logger. Includes all faults which lead to a channel fault. DEFAULT: connected to IN_CH_FAIL (5317). Ref. to specific indicated FAULTS. NOTE: SFE: Not used. The signal is internally transferred to EXC_TRIP (10350) (TRIP LEVEL1) AFT: If standby channel already failed (STB_FAIL (10346) = TRUE), this signal is internally transferred to EXC_TRIP (10350) (TRIP LEVEL1) | BO | - | - | - | - | AL, DIAG | 123 |
| 10350 | EXC TRIP | Excitation Trip output. Includes all faults which lead to a final excitation shut down (TRIP). Ref. to specific indicated FAULTS. DEFAULT: connected to DOX02 (701) and TRIP_CMD (5322). | BO | - | - | - | - | AL, DIAG | 123 |
| 10351 | INH OF START | Collection of all ALARMS which normally are blocking start up (if connected to BLOCK_START_UP (5301) = DEFAULT). | BO | - | - | - | - | AL, DIAG | 123 |

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|--------------------|---|------|-------|----------------|------|---|-----------|-----|
| 10352 | OUT RESET | STATUS: Collection of all RESET activities: from local panel, fieldbus, standby channel or remote. DEFAULT: not used. | BO | - | - | - | - | AL, DIAG | 123 |
| 10353 | REF ACT | Demultiplexed reference signal of the active controller AUTO (AVR), MANUAL, COS PHI (P.F.) or (VAR) CTRL. DEFAULT: not used. | 0.01 | 30000 | - 3000 0 | - | % | DIAG, HID | 78 |
| 10354 | FLDB REF OK | STATUS: Indicates to the fieldbus master, that received ref. signal IN_FLDB_REF (5334) from FB master is equal to the internal REF_ACT (10353) signal. If not equal, the FB master must balance to REF_ACT (10353). | BO | - | - | - | - | AL, DIAG | 77 |

4.4 CONVERTER CTRL Group 105

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|------------------------|--|------|----|----|------|----|--------------|----|
| 10501 | I EXC RELATIVE | Actual excitation current RELATIVE. DEFAULT: used for MANUAL CTRL, LIMITERS and MONITORING. NOTE: In the standby channel of a 2 channel system this signal is read from the active channel. | 0.01 | - | - | - | % | CON, SM, IMP | 73 |
| 10502 | I EXC A | Actual excitation current in AMPS. DEFAULT: used for panel and CMT only. NOTE: refresh cycle is 1s. Signal forced to zero when gate pulses blocked (PULSE_BLOCKING (10328) = TRUE). | 0.1 | - | - | - | A | CON, SM, IMP | 73 |
| 10503 | U SYN RELATIVE | Actual converter input voltage RELATIVE. DEFAULT: used for field flashing and Monitoring NOTE: Single phase operation of the converter (CONV_SUPPLY (515) set to 1_PH_CONV) causes sensing error between 0 and -15% (depending on firing angle). This signal will be forced to 100% in case of chopper converter UNS 4860 (type C5) because there is no converter input sensing available. | 0.01 | - | - | - | % | CON, SM, HID | 73 |
| 10504 | U SYN V | Actual converter input voltage in VOLTS. DEFAULT: used for panel and CMT only. NOTE: Single phase operation of the converter (CONV_SUPPLY (515) set to 1_PH_CONV) causes sensing error between 0 to -15% (depending on firing angle). This signal will be forced to 0V in case of chopper converter UNS 4860 (type C5) because there is no converter input sensing available. | 1 | - | - | - | V | CON, SM, HID | 73 |
| 10505 | U EXC RELATIVE | Actual excitation voltage RELATIVE. DEFAULT: used for Rotor Temperature measuring. | 0.01 | - | - | - | % | CON, SM, IMP | 73 |
| 10506 | U EXC V | Actual excitation voltage in VOLTS, DEFAULT: used for panel and CMT only. | 1 | - | - | - | V | CON, SM, IMP | 73 |
| 10507 | BRIDGE TEMP DEG | Actual converter heat sink temperature (air inlet temp. at type C4) used for Monitoring. Ref. to 10512 for more information. | 1 | - | - | - | °C | CON, IMP | 73 |
| 10508 | Udi0 V NOMINAL | Nominal voltage of full rectified supply voltage calculated by $1.35 * U_SYN_V_NOMINAL$ (504). DEFAULT: not used. | 1 | - | - | - | V | CON, HID | 73 |
| 10509 | I CONV A RATED | Rated output current of the converter set by hardware coding or parameter SET_I_CONV_A (507). The type code resistors, which define the rating plate value of C1, C2, C3, C5 types, are in use if parameter 507 is set to 0. | 0.1 | - | - | - | A | CON, HID | 73 |
| 10510 | I TRIP A LEVEL | Instantaneous Exc. overcurrent trip level in AMPS, set by parameter I_EXC_MAX_LEVEL (506). | 0.1 | - | - | - | A | CON, HID | 73 |
| 10511 | U CONV V RATED | Rated input voltage of the converter set by hardware coding or parameter SET_U_CONV (508). The type code resistors, which define the rating plate value of C1, C2, C3, C5 types, are in use if parameter 508 is set to 0. | 1 | - | - | - | V | CON, HID | 73 |
| 10512 | MAX BR TEMP DEG | Converter overtemperature TRIP LEVEL set by parameter SET_MAX_BR_TEMP (509). The type code resistors, which define the value of C1, C2, C3 types, are in use if parameter 509 is set to 0. FAULT 04 „Converter overtemp.“ is generated if set value is exceeded. ALARM 105 „Conv. overtemp. alarm“ is released 10K below the FAULT level. NOTE: At C4 type, the air inlet temperature is monitored instead of the heat sink temp. Set the parameter value 10K above the max. possible inlet air temp. | 1 | - | - | - | °C | CON, HID | 73 |
| 10513 | CONV TYPE | Converter type set by parameter SET_CONV_TYPE (510). The type code resistors, which define the type of C1, C2, C3, C5 converters, are in use if parameter 510 is set to 0. 1==C1, 2==C2, 3==C3, 4==C4, 5==C5 (Chopper) NOTE: At C4 type, this parameter must be set to 4, because there are no type code resistors available. | NUM | - | - | - | - | CON, HID | 73 |
| 10514 | QUADR TYPE | Type of converter function (1==TWO QUADRANT, 4==FOUR QUADRANT)==rating plate value, if parameter 511 is set to 0. NOTE: with this SW version the value 4 must not be used! | NUM | - | - | - | - | CON, HID | 73 |

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|-------------------------|---|----|----|----|------|------|---------------|----|
| 10515 | BRANCH NO | Status: Output of the CYCLE LOG. MEM. The RIPPLE MONITOR output will be logged by the CYCLE LOG. MEM. The logger will be stopped at the occurrence of ALARM 124 "Converter failed" or CH FAULT 34 „Converter fault“ depending on the parameter RIPPLE_MON_MODE (521). The value is set in case of detected branch faults as follows: Value 0 1 2 3 4 5 6 Panel/CMT NONE W+ V- U+ W- V+ U- NOTE: Only one branch fault can be logged. The status will be cleared at next excitation start only. | - | - | - | - | - | CON, DIAG | 73 |
| 10516 | FREEWHL CROWBAR | Freewheeling command during set time DLY_IE_MAX (513) + 83/100 ms (= 30*Tsyn) for the external freewheeling thyristor(s) of the CROWBAR unit at a 2 channel (TWIN converter) application. DEFAULT: not connected. Connect to spare digital output DOX17.[IN] (716) for freewheeling at 2 channel (TWIN converter) application. NOTE: Use exclusively DOX17 output since that one will be handled with priority (Tmed = 15 ms) if connected to 10516, or use a fast output of extended I/O if available.. | BO | - | - | - | - | CM, CON, DIAG | 73 |
| 10517 | P BLK INT | Blocks the thyristor firing (or turns IGBT off in case of chopper) instantaneously by the I_EXC_MAX_LEVEL (506) trigger prior to CH FAULT 2 „inst. exc. overcurrent“. In parallel the output FREEWHL_CROWBAR (10516) is TRUE during DLY_IE_MAX (513) + 30*Tsyn. DEFAULT: internally connected to P_BLK_INT input of EXCITATION-ON/OFF-CTRL Logic. | BO | - | - | - | - | CON, DIAG | 73 |
| 10518 | REVERSED SEQ | Status: If TRUE, converter input phase sequence has been reversed by parameter PHASE_SEQ_CW (503) or by input SEL_SEQUENCE (5501) to R-T-S. DEFAULT: not used. | BO | - | - | - | - | CON, DIAG | 73 |
| 10519 | ALPHA ACT | Actual firing angle value. (Value in degree). Type C5: 0° = 100% duty in Q1, 90° = 0% duty in Q1, 180° = 100% duty in Q4, ALPHA = f(UCTRL) = linear. DEFAULT: not connected. | 1 | - | - | - | °el. | CON, IMP | 47 |
| 10520 | ON INVERTER CTRL | Status: Firing pulses are forced to inverter position (ALPHA MAX LIM) via input INV_CTRL (5503) or while excitation is in OFF state. Type C5: Thyristor MIN. duty cycle in Q4. | BO | - | - | - | - | CON, DIAG | 47 |
| 10521 | U SYN FREQUENCY | Actual frequency of the converter supply voltage of types C1...C4. DEFAULT: internally used in firing unit only. | BO | - | - | - | - | CON, HID | 73 |

4.5 DATA LOGGER Group 106

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|--------------------|--|-----|----|----|------|---|-----------|-----|
| 10601 | DLOG STATUS | Status of Data Logger: 0 logger is empty. 1 logger is collecting data. 2 a trigger has occurred. 3 logger has stopped after a trigger. 4 logger has stopped after a stop command. 5 logger has stopped after a trigger and a stop command. | NUM | - | - | - | | DIAG, HID | 130 |

4.6 BASIC DIGITAL I/O GROUP 107

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|-------------------------|---|----|----|----|------|---|----------|----|
| 10701 | DIX01 | DEFAULT: connected to START_EXCITATION (5302). Excitation ON (START) command closes field breaker if not already closed and then starts excitation if all preconditions are fulfilled. | BO | - | - | - | - | IO | 26 |
| 10702 | DIX02 | DEFAULT: connected to EXC_OFF_CMD (5303). Fast input DI4 for Excitation OFF (STOP) command. Stops excitation by inverter mode and opens the field breaker as well, if RELEASE_FCB_OFF (301) is set to YES. After 60s inverter mode the firing pulses are blocked too. NOTE: At the configuration with field C.B. on converter input (parameter CB_CONFIG (309) = 0==AC SIDE) and parameter RELEASE_FCB_OFF (301) set to 0==NO, this input must only be used for the external F.C.B. TRIP command and must therefore be connected to input OFF_BLK_CMD (5335). For the normal EXC_OFF CMD input (5303) a spare digital input must be used. | BO | - | - | - | - | IO | 65 |
| 10703 | DIX03 | DEFAULT: connected to RAISE_CMD (5304), which is operating the active controller AUTO (AVR), MANUAL CTRL, COS PHI (P.F.) CTRL or Q (VAR) CTRL. | BO | - | - | - | - | IO | 28 |
| 10704 | DIX04 | DEFAULT: connected to LOWER_CMD (5305), which is operating the active controller AUTO (AVR), MANUAL CTRL, COS PHI (P.F.) CTRL or Q (VAR) CTRL. | BO | - | - | - | - | IO | 29 |
| 10705 | DIX05 | DEFAULT: connected to ON_AUTO_CMD (5306). Selects AUTO (AVR) mode if no AUTO_FAIL (5317) signal present. | BO | - | - | - | - | IO | 30 |
| 10706 | DIX06 | DEFAULT: connected to ON_MAN_CMD (5307). Selects MANUAL CTRL mode (field current regulator) if no MAN_FAIL (5318) signal present. | BO | - | - | - | - | IO | 31 |
| 10707 | DIX07 | DEFAULT: connected to ON_IMP_CMD (5310). Activates selected imposed controller if ON_LINE and in AUTO mode. This input can be used for other application if IMPOSED_CTRL_MODE (302) is set to NO. | BO | - | - | - | - | IO | 32 |
| 10708 | DIX08 | DEFAULT: connected to OFF_IMP_CMD (5311). Stops selected imposed controller. This input can be used for other application if IMPOSED_CTRL_MODE (302) is set to NO. | BO | - | - | - | - | IO | 33 |
| 10709 | DIX09 | DEFAULT: not used. Spare digital input for application. | BO | - | - | - | - | IO | 34 |
| 10710 | DIX10 | DEFAULT: not used. Spare digital input for application. | BO | - | - | - | - | IO | 35 |
| 10711 | DIX11 | DEFAULT: not used. Spare digital input for application. | BO | - | - | - | - | IO | 36 |
| 10712 | DIX12 | DEFAULT: not used. Spare digital input for application. | BO | - | - | - | - | IO | 37 |
| 10713 | DIX13 | DEFAULT: not used. Spare digital input for application. | BO | - | - | - | - | IO | 38 |
| 10714 | DIX14 | DEFAULT: connected to NO_EXT_ALARM (5904) input. Ref. to 5904 for more information. | BO | - | - | - | - | IO | 39 |
| 10715 | DIX15 | DEFAULT: connected to ON_LINE (5314). ON_LINE signal (machine connected to grid). Internally used for different processing. Ref. to 5314 at motor application. | BO | - | - | - | - | IO | 40 |
| 10716 | DIX16 | F.C.B. acknowledge input. TRUE if field breaker closed. Internally connected to CONTROL LOGIC group 3. | BO | - | - | - | - | IO | 70 |
| 10717 | FAIL FREQ A/B | Input from UNS 1860. TRUE if frequency x-ducer fault detected. Sets F_MACH_RELATIVE (10122) = 0 during STOP sequence until firing pulses will be blocked. Sets U_MACH_V (10102) = 0 too. Generates ALARM 121 „f sensing failed“ if ON_LINE and U_MACH_REL >30%. | BO | - | - | - | - | IO, HID | 64 |
| 10718 | DIODE ALARM | Input from UNS 0864. TRUE if rotating rectifier bridge arm interrupt detected. This output is internally connected to MONITORING group 9. Generates ALARM 115 „Rot. rectifier OC“ after DLY_DIODE_ALARM (906). | BO | - | - | - | - | AL, DIAG | 27 |
| 10719 | DIODE TRIP | Input from UNS 0864. TRUE if rotating rectifier bridge arm short circuit detected. This output is internally connected to MONITORING group 9. Generates FAULT 39 „Rot. rectifier SC“. Delay is set on UNS 0864 hardware. | BO | - | - | - | - | AL, DIAG | 66 |
| 10720 | FAIL 2ND CHANNEL | Input from UNS 0863. TRUE if second channel failed (or permanent TRUE at single channel system). This input is internally connected to STBY_FAIL_HW of the TRANSFER CTRL of group 3. | BO | - | - | - | - | AL, DIAG | 67 |

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|--------------------------|--|----|----|----|------|---|----------|----|
| 10721 | FAIL DIG OUT | Input from UNS 1860. TRUE when relay driver failure detected. Sets all digital outputs to "0", causing all interface output relays to drop and disconnects all digital inputs with UNS 1860a HW (with UNS 1860b and later HW, the inputs are not longer influenced by this failure). CHANNEL_OK Relay 1, driven by DOX01 of both channels, trips the field breaker at single channel, or forces channel changeover at 2 channel application when dropping. Generates channel fault 32 „D/O driver fault“. | BO | - | - | - | - | AL, DIAG | 68 |
| 10722 | FAIL AC/DC SUPPLY | Input from UNS 1860. Either AC or DC electronic supply input to POW-1 is missing. This output internally is connected to MONITORING group 9. UNS 1860b: DC input missing: output continuously TRUE. Generates ALARM 144 "Batt. fail". AC input missing: output toggles by 1 Hz. Generates ALARM 141 "Aux. AC fail". Ref. to 10902 and 10903 for more information's. | BO | - | - | - | - | AL, DIAG | 69 |

4.7 DIGITAL I/O EXT. Group 108

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|--------------|--|----|----|----|------|---|----------|----|
| 10801 | DI01E | DEFAULT: not used. Spare digital input for application. NOTE: Only available with optional I/O extension board UNS 0867 and 2nd I/O board UNS 0863. | BO | - | - | - | - | AFB, I/O | 87 |
| 10802 | DI02E | DEFAULT: not used. Spare digital input for application. NOTE: Only available with optional I/O extension board UNS 0867 and 2nd I/O board UNS 0863. | BO | - | - | - | - | AFB, I/O | 88 |
| 10803 | DI03E | DEFAULT: not used. Spare digital input for application. NOTE: Only available with optional I/O extension board UNS 0867 and 2nd I/O board UNS 0863. | BO | - | - | - | - | AFB, I/O | 89 |
| 10804 | DI04E | DEFAULT: not used. Spare digital input for application. NOTE: Only available with optional I/O extension board UNS 0867 and 2nd I/O board UNS 0863. | BO | - | - | - | - | AFB, I/O | 90 |
| 10805 | DI05E | DEFAULT: not used. Spare digital input for application. NOTE: Only available with optional I/O extension board UNS 0867 and 2nd I/O board UNS 0863. | BO | - | - | - | - | AFB, I/O | 91 |
| 10806 | DI06E | DEFAULT: not used. Spare digital input for application. NOTE: Only available with optional I/O extension board UNS 0867 and 2nd I/O board UNS 0863. | BO | - | - | - | - | AFB, I/O | 92 |
| 10807 | DI07E | DEFAULT: not used. Spare digital input for application. NOTE: Only available with optional I/O extension board UNS 0867 and 2nd I/O board UNS 0863. | BO | - | - | - | - | AFB, I/O | 93 |
| 10808 | DI08E | DEFAULT: not used. Spare digital input for application. NOTE: Only available with optional I/O extension board UNS 0867 and 2nd I/O board UNS 0863. | BO | - | - | - | - | AFB, I/O | 94 |
| 10809 | DI09E | DEFAULT: not used. Spare digital input for application. NOTE: Only available with optional I/O extension board UNS 0867 and 2nd I/O board UNS 0863. | BO | - | - | - | - | AFB, I/O | 95 |
| 10810 | DI10E | DEFAULT: not used. Spare digital input for application. NOTE: Only available with optional I/O extension board UNS 0867 and 2nd I/O board UNS 0863. | BO | - | - | - | - | AFB, I/O | 96 |
| 10811 | DI11E | DEFAULT: not used. Spare digital input for application. NOTE: Only available with optional I/O extension board UNS 0867 and 2nd I/O board UNS 0863. | BO | - | - | - | - | AFB, I/O | 97 |
| 10812 | DI12E | DEFAULT: not used. Spare digital input for application. NOTE: Only available with optional I/O extension board UNS 0867 and 2nd I/O board UNS 0863. | BO | - | - | - | - | AFB, I/O | 98 |

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|--------------------------|---|----|----|----|------|---|----------|-----|
| 10813 | DI13E | DEFAULT: not used. Spare digital input for application. NOTE: Only available with optional I/O extension board UNS 0867 and 2nd I/O board UNS 0863. | BO | - | - | - | - | AFB, I/O | 99 |
| 10814 | DI14E | DEFAULT: not used. Spare digital input for application. NOTE: Only available with optional I/O extension board UNS 0867 and 2nd I/O board UNS 0863. | BO | - | - | - | - | AFB, I/O | 100 |
| 10815 | DI15E | DEFAULT: not used. Spare digital input for application. NOTE: Only available with optional I/O extension board UNS 0867 and 2nd I/O board UNS 0863. | BO | - | - | - | - | AFB, I/O | 101 |
| 10816 | DI16E | DEFAULT: not used. Spare digital input for application. NOTE: Only available with optional I/O extension board UNS 0867 and 2nd I/O board UNS 0863. | BO | - | - | - | - | AFB, I/O | 102 |
| 10817 | FAIL DIG OUT EXTD | Input from UNS 0867. TRUE when relay driver failure detected. Sets all digital outputs to "0", causing all interface output relays to drop. CHANNEL_OK Relay 1 on 2nd UNS 0863, driven by DO01E of both channels, can be used for 2nd field breaker trip coil. (Ref. also to FAIL_DIG_OUT (10721)). Generates channel fault 32 „D/O driver fault“. | BO | - | - | - | - | AL, DIAG | 124 |

4.8 MONITORING Group 109

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|---------------------|---|----|----|----|------|---|----------|----|
| 10901 | TEST SUPPLY | Alarm: TEST_SUPPLY of converter was detected during stand still or excitation start up. DEFAULT: connected to SEL_PRESET2_MAN (7106) and ALARM 145 „Test supply“. Restore normal shunt supply for further operation. NOTE: Only available with shunt supply with type C1...C4 and C7. This is an ALARM which does not block excitation start. | BO | - | - | - | - | AL, DIAG | 80 |
| 10902 | AUX AC FAIL | Alarm: Missing AC input to power supply unit UNS 0861 or UNS 0868. DEFAULT: ALARM 141 „Aux AC fail“. Check, restore AC supply circuits. NOTE: This alarm works only while converter supply voltage >50%, and at type C5 (chopper) only 10s after excitation is switched on. With UNS0861 power pack (Parameter 919==0) also 24_PWR_FAIL (10904) must be TRUE. Ref. to param. PWR_PACK/I-O HW (919). | BO | - | - | - | - | AL, DIAG | 80 |
| 10903 | BATT FAIL | Alarm: Missing battery back up supply to power supply unit UNS 0861 or UNS 0868. DEFAULT: ALARM 144 „Batt fail“. Check, restore battery supply circuits. NOTE: With UNS0861 power pack (Parameter 919 = 0): This alarm works only while converter supply voltage >50%, 24_PWR_FAIL (10904) = TRUE and at type C5 (chopper) only 10s after excitation is switched on. Ref. to param. PWR_PACK/I-O HW (919). | BO | - | - | - | - | AL, DIAG | 80 |
| 10904 | PWR 24V FAIL | Alarm: 24 VDC output of power supply unit UNS 0861 or UNS 0868 is missing or FCB was switched off by external command or by hand. DEFAULT: ALARM 143 „PWR FCB off/24V fail“. Check FCB status or 24V supply unit UNS 0861 or UNS 0868. NOTE: This alarm works only while converter supply voltage >50% or type C5 and excitation ON. With a 2 channel system, the 24 VDC outputs of both power supply units UNS 0861 or 0868 are missing. | BO | - | - | - | - | AL, DIAG | 80 |
| 10905 | OC1 EXC CURR | Alarm: Overexcitation ALARM. The excitation current limiter was not successful. Ref. to 902 and 903. DEFAULT: ALARM 106 „OC1 exc curr“ and AVR_FAULT which forces transfer to MAN_CTRL (group 3). Check system according maintenance and trouble shooting instructions. | BO | - | - | - | - | AL, DIAG | 80 |
| 10906 | OC2 EXC CURR | Fault: Overexcitation TRIP. The transfer to MAN_CTRL, forced by (10905) was not successful within 3s. DEFAULT: FAULT 3 „Dlyd.exc.overcurrent“ which trips the system. Check system according maintenance and trouble shooting instructions. | BO | - | - | - | - | AL, DIAG | 80 |

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|--------------------------|---|----|----|----|------|---|----------|----|
| 10907 | UE1 FAULT | Channel fault: Loss of excitation step 1. UE limiter -Q(P) was not successful. Ref. to 904 and 905. DEFAULT: FAULT 14 „Loss of exc CHANNEL“ which forces transfer to 2nd CHANNEL at 2 channel system or trips a single channel system. Check system according maintenance and trouble shooting instructions. | BO | - | - | - | - | AL, DIAG | 80 |
| 10908 | U MACH FAIL | Alarm: Machine P.T. signal is missing. Ref. to 907 or 914...916. DEFAULT: ALARM 120 „Machine P.T. fail“ which forces transfer to MAN_CTRL (group 3). Check system according maintenance and trouble shooting instructions. | BO | - | - | - | - | AL, DIAG | 81 |
| 10909 | USYN FAIL | Channel fault: Converter power supply is missing at thyristor type C1...C4 and 3 PH shunt supply. Ref. to 907. DEFAULT: CH FAULT 23 „Loss conv. supply“ which forces transfer to 2nd CHANNEL at 2 channel system or trips a single channel system. Check system according maintenance and trouble shooting instructions. | BO | - | - | - | - | AL, DIAG | 81 |
| 10910 | AVR FAULT | Status: AVR failure detected: These are U_MACH_FAIL (10908) or OC1_EXC_CURR (10905). DEFAULT: connected to AUTO_FAIL (5317). Ref. to relevant signals for trouble shooting. | BO | - | - | - | - | AL, DIAG | 81 |
| 10911 | BR INTRPT ROT REC | Alarm: Rotating rectifier bridge arm interrupt was detected longer than set delay 906. DEFAULT: ALARM 115 „Rot. rectifier OC“. Check system according maintenance and trouble shooting instructions. | BO | - | - | - | - | AL, DIAG | 80 |
| 10912 | f MACH FAIL | Alarm: Frequency sensing disturbed, although U_MACH_REL is bigger than 30% and machine ON LINE. DEFAULT: ALARM 121 „f sensing failed“. Check system according maintenance and trouble shooting instructions. | BO | - | - | - | - | AL, DIAG | 80 |
| 10913 | UE2 FAULT | Channel fault: Loss of excitation step 2. The transfer to STBY_CH, forced by (10907) was not successful within 2s. DEFAULT: FAULT 5 „Loss of exc trip“ which trips the system. Check system according maintenance and trouble shooting instructions. | BO | - | - | - | - | AL, DIAG | 80 |
| 10914 | SYN2 FAULT | Channel fault: "Not in synchronism" detected at U_SYN_V >10V. Gate control synchronization is missing => HW failure expected. DEFAULT: FAULT 31 „Not in synchronism“ which forces transfer to 2nd CHANNEL at 2 channel system or trips a single channel system. Check system according maintenance and trouble shooting instructions. | BO | - | - | - | - | AL, DIAG | 80 |
| 10915 | LOSS EXC | Not applicable for this SW release 41.220 | BO | - | - | - | - | AL, DIAG | |
| 10916 | BOOST EXC | Not applicable for this SW release 41.220 | BO | - | - | - | - | AL, DIAG | - |
| 10917 | B/L FAULT | Not applicable for this SW release 41.220 | BO | - | - | - | - | AL, DIAG | - |
| 10918 | MAN FAULT | Not applicable for this SW release 41.220 | BO | - | - | - | - | AL, DIAG | - |
| 10919 | EXC SENSE FAIL | Not applicable for this SW release 41.220 | BO | - | - | - | - | AL, DIAG | - |
| 10920 | V/HZ FAULT | Fault: Overfluxing TRIP. The V/Hz limiter was not successful within set DLY_V/HZ_MON (913). DEFAULT: FAULT 46 „V/Hz fault“. Check system according maintenance instructions. | BO | - | - | - | - | AL, DIAG | 80 |
| 10921 | U MACH FAIL DYN | Output of the dynamic P.T. monitor. Mainly used for tuning of the monitor in TEST position selected by parameter SEL_PT_FAIL_DYN (914) (ref. to 915 and 916). DEFAULT: not used. | BO | - | - | - | - | AL, DIAG | 81 |
| 10922 | COMM FAULT | Communication to fieldbus master is disturbed. Depending on FLDBFAULT_MODE (917) either an „EVENT“, „ALARM“, „CHANNEL FAULT“ or „EXCITATION TRIP“ is generated after the set FLDBFAULT_TIMEOUT (918). DEFAULT: not used. | BO | - | - | - | - | DIAG | 81 |

4.9 RT MONITORING Group 110

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|--------------|--|------|----|----|------|----|-------------|-----|
| 11001 | RF RELATIVE | Calculated field winding resistance RELATIVE: $RF_RELATIVE [\%] = RE_TOT_RELATIVE * [U_EXC_RELATIVE - U_BRUSH_RELATIVE - (U_DROP_RELATIVE * IE [p.u.]) / 100$ DEFAULT: not used | 0.01 | - | - | - | % | SM, HID | 121 |
| 11002 | RTEMP DEG | Calculated field winding temperature in DEG CENTIGRADE: $RTEMP_DEG = RTEMP_DEG_NOM * (RF_RELATIVE - RF0_RELATIVE) / (100\% - RF0_RELATIVE)$ DEFAULT: not used | 1 | - | - | - | °C | IO, SM, HID | 121 |
| 11003 | HS RTEMP DEG | Calculated hot spot field winding temperature in DEG CENTIGRADE: $HS_RTEMP_DEG = RTEMP_DEG + ((HOT_SPOT_CONST/100) * IE^2[p.u])$ DEFAULT: not used | 1 | - | - | - | °C | SM, HID | 121 |
| 11004 | RTEMP ALARM | Alarm: Measured rotor temp. is above set RTEMP_DEG_ALARM (1009) value. DEFAULT: ALARM 104 „Rotor temp. Alarm“. Check system according maintenance instructions. | BO | - | - | - | - | AL, DIAG | 121 |
| 11005 | RTEMP FAULT | FAULT: Measured rotor temp. is above set RTEMP_DEG_FAULT (1010) value. DEFAULT: FAULT 7 „Rotor overtemp.trip“. Check system according maintenance instructions. | BO | - | - | - | - | AL, DIAG | 121 |
| 11006 | dIE/dt | Output of excitation current transitions: $dIE/dt = I_EXC_RELATIVE - [I_EXC_RELATIVE / (1+ pTC_SEL)]$ NOTE: TC_SEL = TC_OFF_LINE (1004) if OFF_LINE or TC_ON_LINE (1005) if ON_LINE DEFAULT: not used. | 0.01 | - | - | - | % | SM, HID | 121 |

4.10 FAULTS, ALARMS Group 111

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|-----------------|--|----|----|----|------|---|---------|-----|
| 11101 | FAULT WORD 1 | Signal from fault handler. Each bit represents one fault status, active fault sets bit to one. For bit allocation see SW diagram and maintenance and trouble shooting instructions. | - | - | - | - | - | AL, HID | 123 |
| 11102 | FAULT WORD 2 | Signal from fault handler. Each bit represents one fault status, active fault sets bit to one. For bit allocation see SW diagram and maintenance and trouble shooting instructions. | - | - | - | - | - | AL, HID | 123 |
| 11103 | FAULT WORD 3 | Not used in this firmware release 41.220. | - | - | - | - | - | AL, HID | |
| 11104 | ALARM WORD 1 | Signal from alarm handler. Each bit represents one alarm status, active alarm sets bit to one. For bit allocation see SW diagram and maintenance and trouble shooting instructions. | - | - | - | - | - | AL, HID | 123 |
| 11105 | ALARM WORD 2 | Signal from alarm handler. Each bit represents one alarm status, active alarm sets bit to one. For bit allocation see SW diagram and maintenance and trouble shooting instructions. | - | - | - | - | - | AL, HID | 123 |
| 11106 | ALARM WORD 3 | Signal from alarm handler. Each bit represents one alarm status, active alarm sets bit to one. (not used in this firmware release 41.220). | - | - | - | - | - | AL, HID | 123 |
| 11107 | LATEST FAULT | Error code of the latest fault. | - | - | - | - | - | AL | 123 |
| 11108 | LATEST ALARM | Error code of the latest alarm. | - | - | - | - | - | AL | 123 |
| 11109 | OPERATING HOURS | Operating hours in 0,1 h resolution. Counter is reset if auxiliary power of CON board is switched off for more than 8 hours (typical 24...96 hours). NOTE: This signal will not be indicated at CMT ParSig menu. It must be allocated to the object push button in the Trending menu. | - | - | - | - | - | | |

4.11 MAINTENANCE Group 112

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|------------------------|---|------|----|----|------|---|-----------|----|
| 11201 | BACKUPSTOREMODE | <p>Parameter handling function (overwriteable signal). Used to give commands to the parameter handling function in the system:</p> <p>0== NONE (DEFAULT after writing or reading of parameters to or from FEPROM).</p> <p>1== SAVE PARAM SET1 (Copies the RAM values as SET1 to FEPROM. Normally only this parameter set is used).</p> <p>2== SAVE PARAM SET2 (Copies the RAM values as SET2 to FEPROM. 2nd parameter can be activated by function no. 5 below or via input 5326 by an external order).</p> <p>CAUTION: the following operations should only be done at open field breaker, otherwise the alarm 134 „Backup not allowed“ will be generated, which only can be reset by power OFF.</p> <p>3== FACTORY SET VALUE (CAUTION: DEFAULT values are restored to RAM.).</p> <p>4== SELECT PARAM SET1 (The SET1 is read from FEPROM to RAM and becomes active).</p> <p>5== SELECT PARAM SET2 (CAUTION: The SET2 is read from FEPROM to RAM and becomes active. Same as by external order via input 5326).</p> <p>6== READ APPL BLOCKS (the order of AFB's is read from FEPROM to RAM. They become active at first with 2504==1).</p> <p>While the command is executing, the value of BACKUPSTOREMODE will show what is happening or the reason if the command fails:</p> <p>7== ERASE ERROR (FPROM can not be erased -> exchange CON-2 board).</p> <p>8== ERASING (indicating FEPROM erasing).</p> <p>9== PROGRAM ERROR => Alarm 136 „Write backup alarm“.</p> <p>10== PROGRAMMING (indicating FEPROM programming).</p> <p>11== ID ERROR</p> <p>12== READING (indicating FEPROM values are transferred to RAM).</p> <p>13== READ ERROR => Alarm 134 „Backup not allowed“ (FPROM can not be read -> exchange CON-2 board).</p> <p>14== reserved</p> <p>15== VERS ERROR (RAM and FEPROM parameter versions are not equal).</p> <p>16== reserved</p> <p>17== SIZE ERROR</p> | ENUM | - | - | - | - | CM, IMP | |
| 11202 | BC | <p>Status of the gate control unit:</p> <p>If one or more bits are set, gate control is forced to inverter operation (max. firing angle).</p> <p>B0==overcurrent == FAULT 02: „Inst.exc.overcurrent“</p> <p>B1==inverter control by control logic==EXC_OFF (10308) or [INV_CTRL](5503).</p> <p>B2==not used</p> <p>B3==not used</p> <p>B4==not used</p> <p>B5==not used</p> <p>B6==converter supply overvoltage == FAULT 30: „Conv. overvoltage“</p> <p>B7==not used</p> <p>B8==not used</p> <p>B9==not used</p> <p>B10==not used</p> <p>B11==not used</p> <p>B12==power failure on internal power supply POW-1==FAULT 01: „Auxil. undervoltage“</p> | - | - | - | - | - | DIAG, HID | |

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|-------------------------|--|------|----|----|------|---|-----------|----|
| | | B13==synchronizing signal missing ==FAULT 31: „Not in synchronism“ if Usyn > 10V eff. B14==pulse firing section not in synchronism ==FAULT 31: „Not in synchronism“ if Usyn > 10V eff. B15==not released == any alarm present | | | | | | | |
| 11203 | SQUARE WAVE | Output of square wave generator used for commissioning. For the parameters see 1204...1206. Normally used for manual tuning PI(D) controllers. | 1 | - | - | - | - | TUN | - |
| 11204 | CMT COM ERRORS | Number of transmission errors in CMT communication link. | 1 | - | - | - | - | DIAG, HID | - |
| 11205 | not used | Not used. | 1 | - | - | - | - | DIAG, HID | - |
| 11206 | CNT SW VERSION | UNITROL F software revision 41... The first two characters (41) indicating software from UNITROL-F family. | - | - | - | - | - | HID | - |
| 11207 | CNT BOOT SW VER. | UNITROL F bootstrap software revision. NOTE: Substatus are released after any bugfixes of the firmware. They have no influence to the parameter structure and application program. An up-date of the firmware can just be done by downloading the new xxxx.rom file to the target by donload.bat file. The existing parameter settings and application FB's are not influenced an will be valid again after power up. | - | - | - | - | - | HID | - |
| 11208 | SW SUBSTATUS | Indicates SW revision status 0, 1, 2...etc. within release 41.xxx | BO | - | - | - | - | HID | - |
| 11209 | PROGRAM LOAD | Calculated load of UNITROL-F control program. Calculation is started by setting TEST MODE (1201) = PROGRAM LOAD (2). The calculation will take about 20 s. | 0.01 | - | - | - | % | DIAG, HID | - |
| 11210 | ADDR 1 VAL DEBUG | Content of the memory address selected by DEBUG_ADDR_1 (1207). | 1 | - | - | - | d | DIAG | - |
| 11211 | ADDR 2 VAL DEBUG | Content of the memory address selected by DEBUG_ADDR_2 (1208). | 1 | - | - | - | d | DIAG | - |
| 11212 | ADDR 3 VAL DEBUG | Content of the memory address selected by DEBUG_ADDR_3 (1209). | 1 | - | - | - | d | DIAG | - |
| 11213 | ADDR 4 VAL DEBUG | Content of the memory address selected by DEBUG_ADDR_4 (1210). | 1 | - | - | - | d | DIAG | - |
| 11214 | ADDR 5 VAL DEBUG | Content of the memory address selected by DEBUG_ADDR_5 (1211). | 1 | - | - | - | d | DIAG | - |
| 11215 | ADDR 6 VAL DEBUG | Content of the memory address selected by DEBUG_ADDR_6 (1212). | 1 | - | - | - | d | DIAG | - |

4.12 IE LIMITER Group 113

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|------------------|---|------|-------|--------|------|---|-----------|----|
| 11301 | OUT IE LIMITER | Excitation current limiter output. DEFAULT: connected to IN_IELIM_ERR_A (7004). | 0.01 | 30000 | -30000 | - | % | HID, AVR | 55 |
| 11302 | START IE LIMITER | Status: Excitation current I_EXC_RELATIVE (10501) > selected REF1, 2_IETH). DEFAULT: not used. | BO | - | - | - | - | DIAG, HID | 55 |
| 11303 | REF IE LIM ACT | Actual reference value to summing point. This signal is used for IE_MONITORING (over excitation protection) in group 9. | 0.01 | 30000 | -30000 | - | % | HID, AVR | 55 |

4.13 I LIMITER Group 114

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|-----------------|---|------|-------|--------|------|---|-----------|----|
| 11401 | OUT IOE LIMITER | OE (lag) stator current limiter output. DEFAULT: not used. Connect to IN_IOEL_ERR_A (7005) if limiter required. NOTE: Ref. to 7005 prior to this action. | 0.01 | 30000 | -30000 | - | % | HID, AVR | 63 |
| 11402 | OUT IUE LIMITER | UE (lead) stator current limiter output. DEFAULT: not used. Connect to IN_IUEL_ERR_A (7008) if limiter required. NOTE: Ref. to 7008 prior to this action. | 0.01 | 30000 | -30000 | - | % | HID, AVR | 63 |
| 11403 | START IOE LIM | Status: Stator current I_MACH_RELATIVE (10103) > selected REF1/2_I_MACH_TH). DEFAULT: not used. | BO | - | - | - | - | DIAG, HID | 56 |
| 11404 | REF I LIM ACT | Active reference value to summing point. DEFAULT: not used. | 0.01 | - | - | - | % | HID, AVR | 56 |
| 11405 | ON QO CTRL | Status unity P.F. (Q=0) instead of limited stator current: If the I limiter tries to reduce reactive current below 2%, i.e. stator current can't be limited by excitation system because of too much ACTUAL power which can't be transmitted within stator current limits, then the power factor is kept to unity (Q=0) regardless of stator current level. | BO | - | - | - | - | DIAG, HID | 63 |

4.14 PQ IEMIN LIM Group 115

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|---------------|---|------|----|----|------|---|----------|----|
| 11501 | OUT Q(P) LI | UE Q(P) limiter output. DEFAULT: connected to IN_Q(P)_LIM_ERR (7007). | 0.01 | - | - | - | % | HID, AVR | 61 |
| 11502 | OUT IEMIN LIM | IE_MIN limiter output. DEFAULT: not used. NOTE: It is not required using this limiter to hold a minimum converter (thyristor hold) current, because the gate pulse train always ensures converter starting. Ref. to 7009 for limiter using. | 0.01 | - | - | - | % | HID, AVR | 62 |
| 11503 | REF Q(P) ACT | Actual reference value to summing point. This signal is used for UE_MONITORING (loss of excitation protection) in group 9. | 0.01 | | | | % | HID, AVR | 61 |

4.15 COSPHI CTRL Group 117

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|------------------|--|----|-------|--------|------|---|-----------|----|
| 11701 | REF HL COSPHI | Status: Output REF_COSPHI_AO (11709) and REF_COSPHI_ACT (11704) at max. limit. Internally connected to REF_MAX/MIN multiplexer (group 3) which generates REF_MAX_ACTIVE (10312) at COSPHI mode. For panel/CMT indication ref. to 10301. | BO | - | - | - | - | DIAG, HID | 58 |
| 11702 | REF LL COSPHI | Status: Output REF_COSPHI_AO (11709) and REF_COSPHI_ACT (11704) at min. limit. Internally connected to REF_MAX/MIN multiplexer (group 3) which generates REF_MIN_ACTIVE (10313) at COSPHI mode. For panel/CMT indication ref. to 10301. | BO | - | - | - | - | DIAG, HID | 58 |
| 11703 | PRST C ON COSPHI | Status: Acknowledge signal REF_COSPHI_AO (11709) = PRESET_REF_COSPHI (1705) if TRIG_PRESET_COS (6704) is TRUE. DEFAULT: not used. Consider the COSPHI setpoint characteristic of REF_COSPHI_AO (11709) | BO | - | - | - | - | DIAG, HID | 58 |
| 11704 | REF COSPHI ACT | Actual COSPHI reference value. The sign indicating whether it is in the overexcited (no sign) or underexcited (- sign) section of the machine: +/-10000==COSPHI 1, -3000==COSPHI 0.3 underexcited, 3000==COSPHI 0.3 overexcited. DEFAULT: internally used only for panel/CMT indication | 1 | 3000 | -3000 | - | - | HID, SIP | 58 |
| 11705 | REF TANPHI ACT | COSPHI reference transformed to TANPHI reference, which is the reference for the required reactive current I_SINPHI. This ensures stable COSPHI control even at zero active power. DEFAULT: Internally used only. | 1 | 3000 | -3000 | - | - | HID, SIP | 58 |
| 11706 | ERR COSPHI | COSPHI controller error output. DEFAULT: internally used only. | 1 | 30000 | -30000 | - | - | HID, SIP | 58 |
| 11707 | REF ISINPHI ACT | REF_TANPHI_ACT (11705) multiplied with actual active current ICOSPHI_IN (6708) to get the reference signal REF_ISINPHI_ACT for the required reactive current I_SINPHI. This ensures stable COSPHI control even at zero active power. DEFAULT: Internally used only. | 1 | 30000 | -30000 | - | - | HID, SIP | 58 |
| 11708 | ERR SUPERIMPOSED | Selected superimposed controller error output: either ERR_COSPHI (11706) or ERR_Q_CTRL (11804). DEFAULT: Internally connected to ERR_IMPOSED_AVR (6904). | 1 | 30000 | -30000 | - | - | HID, SIP | 58 |
| 11709 | REF COSPHI AO | Analog output signal for COSPHI ref. indication via analog output: -10000...0...10000 == COSPHI 0 underexcited...1...0 overexcited. The signal is limited by HL/LL_REF_COSPHI (1703/04) DEFAULT: Internally used only. E.g. to be connected to an instrument which indicates +/- 10V having a linear P.F. scale 0 lead...1...0 lag. Ref. to used analog output parameters for other indication range. | 1 | 30000 | -30000 | - | - | HID, SIP | 58 |
| 11710 | IMP REF | Reference signal of the selected imposed controller. Either REF_COSPHI_AO (11709) if COSPHI CTRL selected or REF_Q_ACTUAL (11805) if Q CTRL selected. DEFAULT: Internally fed to standby channel IMP_REF_STBY input. Standby imposed controller follow up CTRL. | 1 | - | - | - | - | HID, SIP | 58 |

4.16 Q CTRL Group 118

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|---------------|---|------|-------|--------|------|---|-----------|----|
| 11801 | REF HL Q CTRL | Status: Output REF_Q_ACTUAL (11805) is at max. limit. Internally connected to REF_MAX/MIN multiplexer (group 3) which generates REF_MAX_ACTIVE (10312) at Q_CTRL mode. For panel/CMT indication ref. to 10301. | BO | - | - | - | - | DIAG, HID | 57 |
| 11802 | REF LL Q CTRL | Status: Output REF_Q_ACTUAL (11805) is at min. limit. Internally connected to REF_MAX/MIN multiplexer (group 3) which generates REF_MIN_ACTIVE (10313) at Q_CTRL mode. For panel/CMT indication ref. to 10301. | BO | - | - | - | - | DIAG, HID | 57 |
| 11803 | PRST Q ON | Status: Acknowledge signal REF_Q_ACTUAL (11805) = PRESET_REF_Q_CTRL (1805) if TRIG_PRESET_Q (6804) is TRUE. DEFAULT: not used. | BO | - | | | - | DIAG, HID | 57 |
| 11804 | ERR Q CTRL | Q controller error output. DEFAULT: Internally connected to COSPHI_CTRL where the selection is made between Q_CTRL and COSPHI_CTRL. | 0.01 | 30000 | -30000 | - | % | HID, SIP | 57 |
| 11805 | REF Q ACTUAL | Actual Q controller reference value: -100%...0...+100% == 1p.u. underexcited ...0...1p.u. overexcited reactive power. The signal is limited by HL/LL_REF_Q_CTRL (1803/04). DEFAULT: Internally used only. E.g. to be connected to an instrument which indicates +/- 10V having a Q scale 0 lead...1...0 lag. Ref. to used analog output parameters for other indication range. | 0.01 | 30000 | -30000 | - | % | HID, SIP | 57 |

4.17 AVR CTRL Group 119

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|-----------------|---|-------|-------|--------|------|----|-----------|----|
| 11901 | REF1 AVR REL | AVR setpoint from setpoint generator (softpot). The signal is limited by HL_/LL_REF_AVR (1901/02). Consider the additional setpoint influences Q, P_DROOP/COMPENS (1909/10), ADD_IN_REF1_A (6908), ADD_INPUT_AVR (7002) which influence the active ref. signal at the AVR summing point too. Internally connected to AVR_REF_INFLUENCE block group 19. | 0.01 | 30000 | -30000 | - | - | HID, AVR | 43 |
| 11902 | REF HL AVR | Status: Output REF1_AVR_REL (11901) at max. HL_REF_AVR (1901). Internally connected to REF_MAX/MIN multiplexer (group 3) which generates REF_MAX_ACTIVE (10312) in AUTO mode. For panel/CMT indication ref. to 10301. | BO | - | - | - | - | AVR, DIAG | 43 |
| 11903 | REF LL AVR | Status: Output REF1_AVR_REL (11901) at min. LL_REF_AVR (1902). Internally connected to REF_MAX/MIN multiplexer (group 3) which generates REF_MIN_ACTIVE (10313) in AUTO mode. For panel/CMT indication ref. to 10301. | BO | - | - | - | - | AVR, DIAG | 43 |
| 11904 | PRSTA1 ON AVR | Status: Acknowledge signal REF1_AVR_REL = PRESET1 REF AVR (1903) if TRIG PRST AVR (6907) is TRUE and SEL_PRESET2_AVR (6906) is FALSE. DEFAULT: not used. | BO | - | - | - | - | AVR, DIAG | 43 |
| 11905 | PRSTA2 ON AVR | Status: Acknowledge signal REF1_AVR_REL = PRESET2 REF AVR (1904) if TRIG PRST AVR (6907) and SEL_PRESET2_AVR (6906) are TRUE. DEFAULT: not used. | BO | - | - | - | - | AVR, DIAG | 43 |
| 11906 | REF4 AVR REL | Finally processed AVR ref. signal after V/Hz limiter and softstart integrator. DEFAULT: connected to REF_INPUT_AVR (7001). | 0.01 | 30000 | -30000 | - | - | HID, AVR | 44 |
| 11907 | ON V/Hz LIMITER | Status: V/Hz limiter is active. DEFAULT: internally used to drive signal ON_OE_LIMITER (12002) if channel and excitation are ON. | BO | - | - | - | - | DIAG, HID | 44 |
| 11908 | ON SOFTSTART | Status: SOFTSTART is running. Internally used to inhibit auto follower action and limiter activities during start up. | BO | - | - | - | - | DIAG, HID | 44 |
| 11909 | OUT PID AVR | AVR PID controller output. Internally connected to AUTO-MAN selector in the FOLLOW_UP_CTRL (group 21). This signal is internally limited to +/- 10000. | 0.01 | 10000 | -10000 | - | % | AVR, HID | 42 |
| 11910 | SEL TB PID AVR | Output representing the active differentiation time constant TB1, TB2, TB3. DEFAULT: not used. | 0.001 | 30000 | -30000 | - | ms | AVR, HID | 42 |
| 11911 | SEL TA PID AVR | Output representing the active integration time constant TA1, TA2, TA3. DEFAULT: not used. | 0.01 | 30000 | -30000 | - | s | AVR, HID | 42 |

4.18 AVR IN, PSS Group 120

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|-------------------------|---|------|-------|--------|------|---|-----------|-----|
| 12001 | ERR1 AVR | Finally processed (AVR) PID controller error signal after Limiters interference. DEFAULT: connected to IN_AVR_ERR (6917). | 0.01 | 30000 | -30000 | - | % | HID, AVR | 41 |
| 12002 | ON OE LIMITER | Status: One of the AVR OE Limiters or the MAN_CTRL_OE restrict V_HZ_MANUAL_ON (12108) is active. DEFAULT: connected to digital output DOX10.[IN] (709). For panel/CMT indication ref. to 10301. | BO | - | - | - | - | DIAG, HID | 41 |
| 12003 | ON UE LIMITER | Status: One of the AVR UE Limiters or the MAN_CTRL_UE restrict UEL_ON_MAN (12106) is active. DEFAULT: connected to digital output DOX11.[IN] (710). For panel/CMT indication ref. to 10301. | BO | - | - | - | - | DIAG, HID | 41 |
| 12004 | ON IE LIMITER | Status: Excitation current limiter is active. DEFAULT: connected to PID_SET2_SEL1 (6909) which activates the 2nd set of PID controller time constants TA2 (1921) and TB2 (1924). | BO | - | - | - | - | DIAG, HID | 41 |
| 12005 | ON IOE LIMITER | Status: Stator OE current limiter is active. DEFAULT: connected to PID_SET3_SEL1 (6913) which activates the 3rd set of PID controller time constants TA3 (1922) and TB3 (1925). | BO | - | - | - | - | DIAG, HID | 41 |
| 12006 | ON OE USER LIM | Status: User defined limiter is active. DEFAULT: not used. | BO | - | - | - | - | DIAG, HID | 41 |
| 12007 | ON Q(P) LIMITER | Status: -Q = f(P) limiter is active. DEFAULT: connected to PID_SET3_SEL3 (6915) which activates the 3rd set of PID controller time constants TA3 (1922) and TB3 (1925). | BO | - | - | - | - | DIAG, HID | 41 |
| 12008 | ON IUE LIMITER | Status: Stator UE current limiter is active. DEFAULT: connected to PID_SET3_SEL2 (6914) which activates the 3rd set of PID controller time constants TA3 (1922) and TB3 (1925). | BO | - | - | - | - | DIAG, HID | 41 |
| 12009 | ON IEMIN LIMITER | Status: Minimum excitation current limiter is active. DEFAULT: connected to PID_SET2_SEL2 (6910) which activates the 2nd set of PID controller time constants TA2 (1921) and TB2 (1924). | BO | - | - | - | - | DIAG, HID | 41 |
| 12010 | PSS OUT | PSS output. This signal is limited to +/- the value set by PSS_VST_LIM (2019). DEFAULT: connected to ADD_IN1_AVR (6918). NOTE: Signal available only with optional PSS board UNS 0869. | 0.01 | - | - | - | % | HID, AVR | 122 |
| 12011 | ON PSS | Status: PSS is active. Connect to spare digital output if status is required for remote indication. DEFAULT: not used. NOTE: Signal available only with optional PSS board UNS 0869. | BO | - | - | - | - | AVR, DIAG | 122 |
| 12012 | PSS FAILURE | Status: PSS failed. This signal will be generated during F_MACH_FAIL (10912) = TRUE. Connect this to a spare USER_EVENT Block, if this signal should lead to an AVR_FAULT (USER_EVENTx.TYPE = 2 (AVR_FAULT)). NOTE: Signal available only with optional PSS board UNS 0869. | BO | - | - | - | - | AL, DIAG | 122 |
| 12013 | not used | Not used | | | | | | | |
| 12014 | DELTA fEP | Corrected rotor frequency signal fEP-10'000. DEFAULT: not used. NOTE: Signal available only with optional PSS board UNS 0869. | 0.01 | - | - | - | % | I/O, SM | 122 |
| 12015 | OUT P EL | Integral of electrical power variations (INT_DELTA_Pel). (Low Word of 32 BIT value. High Word is presented by TP1) DEFAULT: not used. NOTE: Signal available only with optional PSS board UNS 0869. | 0.01 | - | - | - | % | I/O, SM | 122 |
| 12016 | OUT P MECH | Integral of drive power variations (INT_DELTA_Pdrive). (Low Word of 32 BIT value. High Word is presented by TP3) DEFAULT: not used. NOTE: Signal available only with optional PSS board UNS 0869. | 0.01 | - | - | - | % | I/O, SM | 122 |
| 12017 | OUT P ACCEL | Integral of accelerating power variations (INT_DELTA_Paccel). (Low Word of 32 BIT value) DEFAULT: not used. NOTE: Signal available only with optional PSS board UNS 0869. | 0.01 | - | - | - | % | I/O, SM | 122 |

4.19 MANUAL CTRL Group 121

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|------------------|---|------|-------|--------|------|---|-----------|----|
| 12101 | REF HL MANUAL | Status: Output REF_MAN_ACTUAL (12105) at max. HL_REF_MANUAL (2106). Internally connected to REF_MAX/MIN multiplexer (group 3) which generates REF_MAX_ACTIVE (10312) at MANUAL mode. For panel/CMT indication ref. to 10301. | BO | - | - | - | - | DIAG, HID | 45 |
| 12102 | REF LL MANUAL | Status: Output REF_MAN_ACTUAL (12105) at min. LL_REF_MANUAL (2105). Internally connected to REF_MAX/MIN multiplexer (group 3) which generates REF_MIN_ACTIVE (10313) at MANUAL mode. For panel/CMT indication ref. to 10301. | BO | - | - | - | - | DIAG, HID | 45 |
| 12103 | PRSTM1 ON MANUAL | Status: Acknowledge signal REF_MAN_ACTUAL = PRESET1 REF MAN (2107) if TRIG PRST MAN (7107) is TRUE and SEL_PRESET2_MAN (7106) is FALSE. DEFAULT: not used. | BO | - | - | - | - | DIAG, HID | 45 |
| 12104 | PRSTM2 ON MANUAL | Status: Acknowledge signal REF_MAN_ACTUAL = PRESET2 REF MAN (2108) if TRIG PRST MAN (7107) and SEL_PRESET2_MAN (7106) are TRUE. DEFAULT: not used. | BO | - | - | - | - | DIAG, HID | 45 |
| 12105 | REF MAN ACTUAL | MANUAL setpoint from setpoint generator (softpot). The signal is limited by LL_/HL_REF_MAN (2106/05). | 0.01 | 30000 | -30000 | - | % | AVR, HID | 45 |
| 12106 | UEL ON MANUAL | Status: Underexcited MANUAL restrict is active. DEFAULT: not used. Panel/CMT indication = 1 UEL (ref. 10301). NOTE: If at MANUAL this status is indicated by ON_UE_LIMITER (12003) too. | BO | - | - | - | - | DIAG, HID | 45 |
| 12107 | V HZ ERROR | MANUAL V/Hz limiter error output. This signal decreases superimposed the MANUAL_CTRL setpoint as long as V_HZ_MANUAL_ON (12108) is active. DEFAULT: connected to ERR_IMPOSED_MAN (7102) | 0.01 | 30000 | -30000 | - | % | AVR, HID | 60 |
| 12108 | V HZ MANUAL ON | Status: MAN_CTRL_OE_RESTRICT is active. This releases the imposed action to the MANUAL_CTRL setpoint if OFF_LINE and V/Hz characteristic (set by 1911...13) is exceeded. (ref. 12107). Panel/CMT indication = 1 OEL (ref. 10301). DEFAULT: connected to SEL_IMPOSED_MAN (7101) and driving signal ON_OE_LIMITER (12002) if channel and excitation are ON. NOTE: If at MANUAL_CTRL, this status is indicated by ON_OE_LIMITER (12002) too, even if limiter has been switched off according 7101. | BO | - | - | - | - | DIAG, HID | 60 |
| 12109 | OUT MAN CTRL | MANUAL controller output. Internally connected to AUTO-MAN selector in the FOLLOW_UP_CTRL (group 21). This signal is internally limited to +/- 10000, except in case of chopper (type C5), where it is limited to 0 and +10000 because quadrant 4 is not available at manual control and type C5. | 0.01 | 10000 | -10000 | - | % | AVR, HID | 59 |
| 12110 | U CTRL OUT CH | Selected output signal either OUT_PID_AVR (11909) in AUTO mode or OUT_MAN_CTRL (12109) in MANUAL mode. DEFAULT: connected to gate control UCTRL (5502). | 0.01 | 30000 | -30000 | - | % | AVR, IMP | 46 |
| 12111 | ERRM FOLLOW MAN | Difference (error) between inactive OUT_MAN_CTRL (12109) and active controller output either OUT_PID_AVR (11909) or UCTRL (12402) of standby channel. Internally connected to ERRM_FOLLOW_MAN (group 21). | 0.01 | 30000 | -30000 | - | % | AVR, HID | 46 |
| 12112 | ERRA FOLLOW AUTO | Difference (error) between inactive OUT_PID_AVR (11909) and active controller output either OUT_MAN_CTRL (12109) or UCTRL (12402) of standby channel. Internally connected to ERRA_FOLLOW_AUTO (group 19). | 0.01 | 30000 | -30000 | - | % | AVR, HID | 46 |
| 12113 | FBA FOLLOW AUTO | Feedback signal to the inactive AVR, switched OFF during AUTO operation. DEFAULT: connected to FB_IN_FOLLOW_A (7003). | 0.01 | 30000 | -30000 | - | % | AVR, HID | 46 |
| 12114 | FBM FOLLOW MAN | Feedback signal to the inactive MAN controller, switched OFF during MANUAL operation. DEFAULT: connected to FB_IN_FOLLOW_MAN (7111). | 0.01 | 30000 | -30000 | - | % | AVR, HID | 46 |
| 12115 | ON FW AUTO | Status: Auto follower of the AVR is active. DEFAULT: Internally connected to ON_FW_AUTO (group 19). | BO | - | - | - | - | AVR, DIAG | 46 |
| 12116 | ON FW MANUAL | Status: Auto follower of MANUAL CTRL is active. DEFAULT: Internally connected to ON_FW_MAN in group 21. | BO | - | - | - | - | AVR, DIAG | 46 |

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|----------------------|--|------|-------|--------|------|---|-----------|----|
| 12117 | RDY XFER A M | Status: A-M difference (error) below NOT_OK_LEVEL (2120) for back indication „ready for transfer“ to control room. If FALSE, A-M transfer is not possible by local control panel. For panel/CMT indication ref. to 10301. DEFAULT: connected to DOX13,[IN] (712) and RDY_XFER_A_M (5315). | BO | - | - | - | - | AVR, DIAG | 46 |
| 12118 | A M DIFF | Output: A-M difference [OUT_PID_AVR (11909)] - [OUT_MAN_CTRL (12109)] which can be used for remote indication if connected to analog output. DEFAULT: not used. | 0.01 | 30000 | -30000 | - | % | AVR; HID | 46 |
| 12119 | CH STB DIFF | Output: Channel difference [UC_STB] - [U_CTRL_OUT_CH] (12110) which can be used for remote indication if connected to analog output. DEFAULT: not used. NOTE: Signal available only with 2 channel system (AFT) | 0.01 | 30000 | -30000 | - | % | AVR; HID | 46 |
| 12120 | RDY XFER TWIN | Status: Channel difference (difference between the outputs of the selected controllers A or M) is below NOT_OK_LEVEL (2120). If FALSE, channel transfer is not possible by local control panel. For panel/CMT indication ref. to 10301. DEFAULT: connected to READY_XFER_TWIN (5316). | BO | - | - | - | - | AVR, DIAG | 46 |

4.20 CH COMMUNICATION Group 124

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|---------------------|---|------|--------|--------|------|---|----------|----|
| 12401 | STBY STATUS | 2 channel interaction: Status WORD of the standby channel. Each bit represents one standby channel status (ref. to transmitted signals): Received signal from STBY Transmitted signal in STBY B0 STBY_EXC_ON EXC_ON (10307) B1 -- -- B2 A-M_STBY_OK A-M_CH_OK B3 STBY_RESET RESET B4 STBY_IMP_ON ON_SUPERIMPOSED (10314) B5 STBY_COSPHI_ON ON_COSPHI_CTRL (10315) B6 STBY_LOCAL LOCAL_CMD (TRUE if LOCAL control is active) B7 RDY_XFER_STBY RDY_XFER_CH B8 CHANGEOVER_STBY CHANGEOVER_CH B9 STBY_ALARM ALARM (10338) B10 STBY_TRIP EXC_TRIP (10350) B11 -- -- B12 STBY_FAIL_BU CH_FAIL (10342) B13 USER_DI (12407) USER_DO (7401) B14 -- -- | - | - | - | - | - | MON, HID | 82 |
| 12402 | UC STBY | 2 channel interaction: Transmitted U_CTRL_OUT_CH (12110) signal from standby CH. Ref. to 12110. DEFAULT: used for follow up ctrl (group 21) | 0.01 | +16383 | -16384 | - | % | MON, HID | 82 |
| 12403 | U MACH STBY | 2 channel interaction: Transmitted U_MACH_RELATIVE (10101) signal from standby CH. Ref. to 10101. DEFAULT: not used. NOTE: Since only 14 Bits are transmitted, the 2 LSB are set to 0. | 0.01 | +32764 | -32768 | - | % | MON, HID | 82 |
| 12404 | I EXC STBY | 2 channel interaction: Transmitted I_EXC_CH signal from standby CH. DEFAULT: used as I_EXC_RELATIVE signal as long as standby channel is active, but not at type C5 or if CONV_CT_LOCATION (514) is set to AT COMMON LINE. NOTE: Since only 14 Bits are transmitted, the 2 LSB are set to 0 | 0.01 | +32764 | -32768 | - | % | MON, HID | 82 |
| 12405 | U SYN STBY | 2 channel interaction: Transmitted U_SYN_RELATIVE (10503) signal from standby CH. Ref. to 10503. DEFAULT: not used. NOTE: Since only 14 Bits are transmitted, the 2 LSB are set to 0 | 0.01 | +32764 | -32768 | - | % | MON, HID | 82 |
| 12406 | U EXC STBY | 2 channel interaction: Transmitted U_EXC_RELATIVE (10505) signal from standby CH. Ref. to 10505. DEFAULT: not used. NOTE: Since only 14 Bits are transmitted, the 2 LSB are set to 0 | 0.01 | +32764 | -32768 | - | % | MON, HID | 82 |
| 12407 | USER DI | 2 channel interaction: Transmitted USER_DO (7401) signal from standby CH. Ref. to connected source signal. DEFAULT: not used. | BO | - | - | - | - | MON, HID | 82 |
| 12408 | IMP REF STBY | 2 channel interaction: Transmitted IMP_REF (11710) signal from standby CH. Ref. to 11710. DEFAULT: used as reference for selected imposed controller as long as channel not active (groups 17, 18). | 1 | +16383 | -16384 | - | - | MON, HID | 82 |
| 12409 | USER AI | 2 channel interaction: Transmitted USER_AO (7402) signal from standby CH. Ref. to connected source signal. DEFAULT: not used. NOTE: Since only 14 Bits are transmitted, the 2 LSB are set to 0 | 0.01 | +32764 | -32768 | - | % | MON, HID | 82 |

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------|------------|--|----|----|----|------|---|----------|----|
| 12410 | CH STATUS | 2 channel interaction: Channel status WORD which is transmitted to the standby channel. Ref. to signal STBY_STATUS (12401). Each bit represents one channel status (ref. to transmitted signals): Transmitted signal to STBY B0 EXC_ON (10307) B1 -- B2 A-M_CH_OK B3 RESET B4 ON_SUPERIMPOSED (10314) B5 ON_COSPHI_CTRL (10315) B6 LOCAL (10339) (TRUE if LOCAL control is active) B7 RDY_XFER_CH B8 CHANGEOVER_CH B9 ALARM (10338) B10 EXC_TRIP (10350) B11 -- B12 CH_FAIL (10342) B13 USER_DO (2401) B14 -- | - | - | - | - | - | MON, HID | 82 |

4.21 CONSTANTS Group 125

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP | |
|-------|------------|----------|--|----|----|------|--------|-------|-----|----|
| 12501 | CONSTANT | 0 | Value which always is ZERO (HEX 0000 == FALSE for logic inputs). | 1 | - | - | 0 | - | IMP | 54 |
| 12502 | CONSTANT | -1 | Value which always is -1 (HEX FFFF == TRUE for logic inputs). | 1 | - | - | -1 | - | IMP | 54 |
| 12503 | CONSTANT | 1 | Value which always is 1. | 1 | - | - | 1 | - | IMP | 54 |
| 12504 | CONSTANT | 2 | Value which always is 2. | 1 | - | - | 2 | - | IMP | 54 |
| 12505 | CONSTANT | 10 | Value which always is 10. | 1 | - | - | 10 | - | IMP | 54 |
| 12506 | CONSTANT | 100 | Value which always is 100. | 1 | - | - | 100 | - | IMP | 54 |
| 12507 | CONSTANT | 10000 | Value which always is 10000. | 1 | - | - | 10000 | - | IMP | 54 |
| 12508 | CONSTANT | -10000 | Value which always is -10000. | 1 | - | - | -10000 | - | IMP | 54 |
| 12509 | CONSTANT | 20000 | Value which always is 20000. | 1 | - | - | 20000 | - | IMP | 54 |
| 12510 | CONSTANT | -20000 | Value which always is -20000. | 1 | - | - | -20000 | - | IMP | 54 |

4.22 Function Blocks 1 Group 126

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------------|------------|--|----|----|----|------|---|-------|-----|
| 12601-12699 | | Signals for application function blocks See application function block data sheets. | - | - | - | - | - | AFB | 050 |

4.23 Function Blocks 2 Group 127

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------------|------------|--|----|----|----|------|---|-------|----|
| 12701-12799 | | Signals for application function blocks See application function block data sheets. | - | - | - | - | - | AFB | |

4.24 Function Blocks 3 Group 128

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------------|------------|--|----|----|----|------|---|-------|----|
| 12801-12899 | | Signals for application function blocks See application function block data sheets. | - | - | - | - | - | AFB | |

4.25 Function Blocks 4 Group 129

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------------|------------|--|----|----|----|------|---|-------|---------|
| 12901-12999 | | Signals for application function blocks See application function block data sheets. | - | - | - | - | - | AFB | 442,445 |

4.26 Function Blocks 5 Group 130

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------------|------------|--|----|----|----|------|---|-------|----|
| 13001-13099 | | Signals for application function blocks See application function block data sheets. | - | - | - | - | - | AFB | |

4.27 Function Blocks 6 Group 131

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------------|------------|--|----|----|----|------|---|-------|----|
| 13101-13199 | | Signals for application function blocks See application function block data sheets. | - | - | - | - | - | AFB | |

4.28 Function Blocks 7 Group 132

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------------|------------|--|----|----|----|------|---|-------|----|
| 13201-13299 | | Signals for application function blocks See application function block data sheets. | - | - | - | - | - | AFB | |

4.29 Function Blocks 8 Group 133

| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------------|------------|--|----|----|----|------|---|-------|----|
| 13301-13399 | | Signals for application function blocks See application function block data sheets. | - | - | - | - | - | AFB | |

4.30 Function Blocks 9 Group 134


| INDEX | INDICATION | FUNCTION | SC | HL | LL | DEF. | U | CLASS | SP |
|-------------|------------|--|----|----|----|------|---|-------|----|
| 13401-13499 | | Signals for application function blocks See application function block data sheets. | - | - | - | - | - | AFB | |

Excitation System

UNITROL[®] F Series

Maintenance and Trouble Shooting Instructions

SW version 41.22x
Converter types C1, C2, A5

| | | | | | | | | | | |
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1 General

1.1 Safety regulations

Extreme caution must be exercised when work is being performed inside the excitation system cabinets. Severe personal injury can result from contact with the system's voltage carrying parts. For this reason, all components in the excitation cabinet with voltages above 50 volts are designed to prevent accidental contact. The maintenance personnel may **not** carry out any work inside the excitation cabinets without appropriate training and without taking the necessary precautionary measures.

The following applies particularly in the case of high power excitation systems!


Components in the excitation cabinet (heat sinks, copper bus bars etc.) which are directly connected to the secondary side of the excitation transformer and rotor field winding voltage present extreme dangers of electric shock through contact. For this reason, barriers have been installed to prevent accidental contact with these components. This safety guard needs to be removed in order to carry out electrical measurements while the installation is running. Extreme caution must be exercised by the maintenance personnel. Only that work which is absolutely necessary should be carried out.

Caution: Enormously high short circuit currents can be generated in the excitation cabinet due to the presence of the secondary voltages of the excitation transformer and the rotor field winding.

In particular, the field breaker and components in the field discharge circuit, which are connected directly to the rotor field winding, present a great danger of electric shocks. For this reason, the cabinets are fitted with safety guards to prevent accidental contact with live parts.

If the removal of the safety guard is unavoidable, the personnel must be aware of the dangerously high voltages and the enormously high short circuit currents and act accordingly.

Warning signs are placed on all cabinet doors to warn of the operating voltages present in the control cabinets (over 50 volts), but most importantly to warn of the voltages occurring in the power section (possibly over 1000 volts) and the enormously high short circuit currents. These signs are intended to prevent the doors being opened during operation.

| Sign | Meaning |
|---|-----------------------|
|  | Danger, High Voltage! |

Maintenance work may only be carried out on the electrical system once the exposed voltage-carrying parts have been completely switched off and protective grounds installed. If this is not possible, the following special precautions must be taken:

- Access to the work area must be restricted by means of a safety zone (fence) with a yellow warning sign "Danger! High Voltage".

- Countermeasures should be taken to prevent the system being switched on again through a control error or by a third party after it has been switched off (e.g. prevent switching on by means of keyswitches, etc.).

1.2 Consequences of negligence

- Failure to comply with safety regulations can result in serious damage to the equipment.

Warning: If the safety guards in the cabinets are removed while the system is under voltage, there is an increased danger of electric shock, not only to the personnel carrying out work, but also to any third parties who approach the installations.

If the scheduled maintenance work is not carried out, or is only partially carried out, damage can occur which results in high repair costs. In particular, accumulations of dirt and dust on the converter lead to a high risk of voltage flash-overs which can cause enormous damage.

1.3 Requirements for the personnel carrying out work

- The maintenance personnel must be familiar with this document.
- They must be familiar with the operation of the installation and trained to carry out maintenance and repair work.
- They must be familiar with the control elements, operation and alarm signals for the excitation system, both on the excitation equipment itself (local control) and in the control room (remote control etc., see operating manual).
- They must be informed about the power supply concept for the excitation equipment as well as emergency shutdown measures and must be capable of turning off the system in case of emergency.
- They must be familiar with the accident prevention measures at their workplace and must be trained in first aid and fire-fighting.

1.4 Instructions for emergency situations

1.4.1 Instructions in case of fire

All personnel must know the location of fire extinguishers and emergency exits and know how to operate the fire extinguishers. Fire extinguishers are either halon, carbonic acid (CO₂) or foam based.

- **CO₂ fire extinguishers** are intended for fighting fires in electrical installations and may not be directed at persons.
- **Foam extinguishers** are intended for fighting fires in non-electrical equipment. They may not be used to fight fires in electrical equipment. They may be directed at persons.

In case of fire in the system:

First switch off excitation, either locally or from the control room, or if necessary through

the emergency shutdown mechanism (see operating manual). Then switch off all power supplies to the system.

When fighting fires in energized cabinets, only use CO₂ fire extinguishers, **no foam, no water!**

1.4.2 First aid measures at electrical installations

1. First switch off excitation, either locally or from the control room, or if necessary through the emergency shutdown mechanism (see operating manual). Then switch off all power supplies to the system.
2. Rescue the injured person from their dangerous location and lay them down flat. Administer first aid in accordance with training and taking into account the applicable rules for electrical installations. Call for emergency assistance.

2 Maintenance

2.1 Introduction

Although electronic components show no signs of wear and only slight signs of ageing, the excitation equipment contains a series of conventional electromechanical components such as breakers, contactors and fans which are subject to a certain amount of mechanical wear.

While in operation, the correct function of the control electronics is constantly checked by automatic self diagnostic functions. Redundant circuits, such as the non-active channel in the two channel version, are also monitored as far as possible. However, protection equipment cannot be automatically checked, since it is only active in fault situations. The periodic function checks serve to check this equipment and activate all redundant circuits for test purposes.

In addition to the periodic check, a more thorough function check, as described below, is required after cleaning work on components and/or plug-in assemblies.

Dust builds up in electronic circuits and in the converter due to air circulation. Vibrations may cause screw terminal connections to be loosened.

High voltages and currents (direct current!) occur in the excitation circuit. Soiled insulation increases the risk of serious damage due to voltage flashover. Periodic maintenance of the system reduces this risk considerably.

This manual covers the maintenance work for normal operation. Special operating modes, such as short-circuit tests, inputs etc., are not covered. Such operating modes require extensive knowledge of all parts of the system (excitation, generator, etc.), and should therefore only be carried out by a specialist.

2.2 Operating conditions during maintenance work

When carrying out maintenance work, attention should be paid to the operating condition of the system when carrying out the various checks. A distinction is made between:

- ① Shut down: all power supplies (main and auxiliary power supplies) disconnected
- ② Auxiliary power supplies (battery and AC supply) present
- ③ Actuator power supply present
- ④ In operation (synchronised)

Caution: Observe safety regulations (see safety regulations 1.1)

2.3 Maintenance schedule

| | Object | Every 3 months | Annual |
|----------------------------------|---|--|--|
| Excitation transformer: | | | |
| 1 | -Excitation transformer only if >20 kVA | Check for dust, dirt etc., abnormal noises | Check for dust, dirt etc., abnormal noises |
| Converter: | | | |
| 2 | - Fans | Check for dust, dirt etc., normal airflow, abnormal noises | Check for dust, dirt etc., normal airflow, abnormal noises |
| 3 | - Filter cartridges | Visual check (dirt, dust etc.) | Visual check (dirt, dust etc.) |
| 4 | - Heat sinks | Visual check (dirt, dust, temperature etc.) | Visual check (dirt, dust, temperature etc.) |
| 5 | - Converter | -- | Check firing of all thyristors |
| Power switches, bus bars: | | | |
| 6 | -Field breaker -Q02 | -- | Visual check (dirt, charring etc.) |
| 7 | -Bus bars (if provided) | -- | Check all connections |
| 8 | -Insulators (if provided) | -- | Check for dirt, dust, etc., tighten connections |
| Control electronics: | | | |
| 9 | -Printed circuit boards | -- | Visual check (dirt, dust, etc.) |
| 10 | -Function check | Check redundant circuits (for short time only) | Check all redundant and safety circuits |

Table 1

The individual points in the maintenance table will be subsequently explained in more detail. Both groups, 3-monthly and annual maintenance, will be handled separately. The first group essentially only involves visual inspections, whereas the actual maintenance work is listed in the second group.

The intervals in the maintenance schedule at which maintenance work is to be carried out must be strictly adhered to, especially in the first year of operation. An optimum maintenance interval can then be worked out on the basis of the results of the regular inspections. In particular, the accumulation of dirt must be monitored in the first year of operation. If a lot of dirt has accumulated, then the interval should be reduced; if the level of dirt is very high, the IP mode of protection must be re-evaluated or changed.

2.4 Three-monthly maintenance work (operating condition ④)

| | |
|--------------------------------|--|
| Excitation transformer: | |
|--------------------------------|--|

- 1 Visual inspection of the excitation transformer for dirt and abnormal noises.

| | |
|-------------------|--|
| Converter: | |
|-------------------|--|

- 2 **Inspection of the converter fans for dirt, normal airflow and abnormal noises:** Since it is not possible to lubricate the bearings, fans with increased noise must be replaced at the next overhaul.

Standby fans:

Single channel system: If the converter is equipped with standby fans, their operation should be checked by switching over from the running fan to the standby fan for a short period. This can also be done while the system is in operation.

Double channel system: The fan of the second channel is automatically checked when switching to the second channel (see point 10c).

- 3 **Checking the air filters for contamination:** The filter cartridges are to be changed if they are very dirty.
- 4 **Check the heat sink temperature** by displaying the signal BRIDGE TEMP DEG (10507) and comparing with previously measured values at the same current and ambient temperature. If a remarkable increase is observed in comparison with the last inspection, the fans, filter cartridges and converter should be checked for accumulated dirt.

| | |
|-----------------------------|--|
| Control electronics: | |
|-----------------------------|--|

10 Function checks:

- a **Check the control panel:** No fault should be indicated on the control panel. Check the function by switching the excitation over to local control (see function description for control panel UNS 0874).
- b **Comparison of the measured values:** The following measured values appear on the control panel and should be compared with an independent measurement, e.g. those in the control room or those for the 2nd channel, if provided. This should at least be possible for the generator voltage and active power. If no measured values are available for comparison for the other parameters, the accuracy of the results must be evaluated on the basis of previously measured values.

| | | |
|-------|-------------|----------------------|
| 10102 | U MACH V | (Generator voltage) |
| 10104 | I MACH A | (Generator current) |
| 10107 | P MACH KW | (Active power) |
| 10108 | P MACH MW | (Active power) |
| 10111 | Q MACH KVAR | (Reactive power) |
| 10112 | Q MACH MVAR | (Reactive power) |
| 10502 | I EXC A | (Excitation current) |
| 10506 | U EXC V | (Excitation voltage) |

Table 2

- c **Test of the redundant regulation circuits:** On double channel systems, both the inactive second channel and the normally inactive field current regulator (MANUAL mode) are checked. However, only the inactive field current regulator (MANUAL mode) is checked on single channel systems.

Double channel systems (AFT):

Testing the regulator's follow-up with the control panel.

It is only possible to switch over from the control panel if the AUTO and MANUAL regulators have been balanced. If they are not balanced, this is indicated in the 2nd line with XFER BLKD.

Caution: Under extreme operating conditions, the MANUAL channel may not always track the AUTO channel because of its restricted functions.

NOTE: There are no separate pushbuttons on the control panel for selecting the operating mode. The operating mode is selected with the signal MODE SELECTION (10302) when the control panel is in LOCAL mode (see also function description for the control panel UNS 0874).

After a change in the setpoint, the inactive channel should follow the active channel. While balancing is taking place, "XFER BLKD" is displayed on the control panel.

NOTE: The regulator takes some time to balance the two channels.

However, operation under extreme conditions is possible in AUTO mode, in which case the field current regulator (MANUAL mode) is unable to follow. Balancing can only be achieved if the operating point is brought within the range of the field current regulator by adjusting the setpoint value, provided this is permitted by the operating requirements for the system.

After these tests, operation is switched over to the previously inactive channel. If the field current and/or generator voltage change noticeably, switch back immediately to the previous channel. If no change is noted, the measured values can also be checked in this channel as described above.

It is now possible to switch over into MANUAL mode.

However, the limiter functions are no longer available in MANUAL mode. The operation of the machine must therefore be carefully monitored.

Switching back to the previous channel is now done in MANUAL mode. If all changeovers proceed smoothly, then all redundant circuits can be considered functional. If a changeover leads to a noticeable change in operation, the cause of the fault is to be determined in accordance with the chapter 0 Trouble Shooting

Caution: After testing has been completed, switch back to AUTO mode.

2.5 Annual maintenance work (during planned shutdown of the plant)

In addition to the usual 3-monthly maintenance work, the following checks should be carried out:

Special attention should be paid to the circuit breakers. Visual inspections should be carried out to determine whether dirt, dust or damage of any kind is present. In addition, the amount of wear on the contacts should be checked. Circuit breakers which are seldom used must be operated occasionally to prevent them jamming and to ensure that switching speed is not reduced.

| | |
|---|--|
| Excitation transformer >20 kVA: | |
|---|--|

- 1 (Operating condition ①) Clean off dirt with a dry cloth, vacuum cleaner or compressed air (not high pressure!). Do not use any solvents.

| | |
|-------------------|--|
| Converter: | |
|-------------------|--|

- 2 **Inspection of the converter fans for dirt, normal airflow and abnormal noises** (operating condition ② or ③): Since it is not possible to lubricate the bearings, fans with increased noise must be replaced.

- a **Door fans:** Door fans must be replaced after approximately 40,000 hours of operation.
- b **Converter fans:** Fans must be replaced after approximately 25,000 hours of operation.

- 3 **Inspect air filter for contamination** (operating condition ①): change the filter cartridges if they are very dirty.

- 4 **Check the heat sink temperature** (operating condition ④): by displaying the signal BRIDGE TEMP DEG (10507) and comparing with previously measured values at the same current and ambient temperature. If a remarkable increase is observed in comparison with the last inspection, continue with step 2.

- a **Inspection of the heat sinks for dirt** (operating condition ①): Clean with brush and vacuum cleaner or compressed air (not high pressure!). **On no account use solvents!**

- 5 **Check firing of thyristors:** This is done automatically if the output current is >6% of the nominal actuator current.

Warning: Danger, high voltage, observe the safety regulations!

Circuit breakers:

- 6 **Field breaker (Q02)** (operating condition ①): Check for dirt and contact charring. Clean with a brush and dry cloth. If necessary, remove charring using emery paper. Lubricate all sliding surfaces using an appropriate grease. Check the arc chamber each time the breaker is tripped due to short circuit, remove smoke residue and dust using compressed air, scrub off cinder. Consult the separate maintenance instructions for the breaker.
- 7 **Check screw connections** (operating condition ①): Check that all screw connections on screw terminals, bus bars etc. are tight.
- 8 **Check insulators for dirt and loose screws** (operating condition ①): If necessary, clean with a dry cloth. We recommend that all screw connections are checked (point 7 & 8) after the first year of operation, thereafter approximately every 4 years.

Control electronics:

- 9 **Check the printed circuit boards for dirt** (operating condition ①): Use compressed air to clean the boards (not high pressure!).
 - a **Check plug-in components (printed circuit boards) and connector boards in the chassis for dirt:** Dirt and dust should not accumulate on the printed circuit boards under normal conditions. If the printed circuit boards are dirty, it is possible that the wrong IP protection type was chosen. Use compressed air (not high pressure!) or vacuum cleaner to clean the boards. **On no account use solvents!**
- 10 **Functional testing of the electronic circuits:**
 - a **Check the control panel** (operating condition ④).
 - b **Compare measured values** (operating condition ④)
 - c **Test redundant regulation circuits** (operating condition ④)
 - d **Check protective devices provided** (operating condition ②)

Caution: When carrying out function checks while the system is switched off, the power section of the excitation transformer must be isolated from the generator and AC and DC sources grounded.

Open the field breaker and install grounds on both sides of the exciter. The regulator electronics continue to be supplied from the station's battery through the input circuit.

After switching over to local operation, the field breaker can be closed from the control panel again when the system is under no voltage. The following protection equipment and functions can now be tested, if they are part of the system. The fault must be reset and the field breaker re-closed each time a protection feature has been triggered.

Temperature monitoring of the excitation transformer (only with static exciters): An overtemperature situation is simulated by disconnecting the measuring cable on one side of the input terminals (see terminals plan).

Rotor ground fault protection UNS 3020: Press the TEST key on unit -F75. This has the effect of simulating a ground fault. This is indicated by the illumination of the LEDs LED ST1 and ST2 on the unit itself. No signal to the regulator electronics is triggered. To check the controller for a trip or an alarm signal, the soldering bridge has to be swapped from S1202 to S1201 and the external test input 3_09 must be activated (jumper from 3_08 to 3_09). For further information, see "Instructions for installation and operation" for the unit UNS 3020, HIER 95 140 E.

Restore the bridge to its original position after completion of the test.

Tripping through the generator protection: The external protection trip is tested by placing a jumper between the corresponding terminals, or better yet through a simulated triggering at the generator protection.

Internal protection trip: The internal protection trip is tested through simulation of the internal monitoring functions.

- e **Verification of the external control signals** (operating condition ②): When carrying out major overhauls, it is a good idea to test the inputs and outputs of the controls. To test the inputs, locate the sources of the signals with the aid of the hardware schematic diagram and simulate the triggering of the indicator contact. The corresponding LED on the peripheral unit (U11) must light up. The external inputs can be located using the terminal diagram (from sheet 900) and verified in the same manner.

The outputs include the commands and indicators for the field breaker (see hardware schematic diagrams). The output to the control room can be simulated on unit U11 by jumpering the contacts.

- f **Checking the AC supply voltage for the power supply unit UNS 0868** (operating condition ③): To check the AC supply, the battery supply (station battery) must be switched off while the AC power supply is present (only possible following the next start-up of the system). The alarms 143 "FCB off / 24 V fail" and 144 "Batt. fail " are indicated when excitation is on and converter voltage present.

3 Trouble Shooting



Work may only be carried out on the converter cabinet if the voltage carrying parts have been switched off on all sides and earthed.

The personnel carrying out the work are responsible for this themselves and must follow the safety procedures described in Chapter 1.

The following points must be observed before work is started on the excitation system:

1. Disconnect the supply voltage at the main switch. Voltage measurements should be carried out to ensure that no voltage is still present.

Note: The field breaker may not be switched either ON or OFF while voltage is present.

2. Measure the voltage between terminals L1 - L2 - L3 - PE. The measuring range of the voltmeter should be at least $U_{ac} = 1000$ V. Although the supply voltage has been disconnected with the main switch of the excitation system, voltage may still be present from the auxiliary power supply.

Consult the supply circuit diagrams before commencing work!

Note: Are uninterrupted power supplies in use?

Danger, high voltage:

As soon as voltage is present at the connections, the input circuit is also live, even if the system is not switched on.

3. Voltage withstanding tests may not be carried out on **any** component of the system.
4. In general, due to the danger of static discharges, no components inside the UNITROL[®] F system may be touched. This applies particularly to CMOS circuits on the printed circuit boards. Static discharge voltage can destroy these circuits.

3.1 Principles of trouble shooting

In most cases, the diagnostic displays can be used for preliminary tracing of faults. These also allow faults to be reset without opening the doors of the system cabinets.

The following fault tracing method (from chapter 3.7) is based on a systematic tracing of the cause of the fault. If spare circuit boards are available, the fault tracing is done by systematically replacing boards. Special attention should be paid to the remarks in the trouble shooting tables.

In preliminary fault tracing, the possible fault location is traced mainly on the basis of the fault message on the control panel or a source outside of the UNITROL[®] F system.

3.2 Working methods

In most cases, it is possible to reset the fault message on the control panel and try to restart the excitation system before attempting involved trouble shooting procedures. If this eliminates the fault, the system will resume normal operation. If the fault is still present, the fault signal will be tripped again.

Before the fault is assumed to lie within the UNITROL[®] F system, it must be checked carefully that the fault signal was not caused by external faults.

If an alarm or fault occurs, an error code is displayed. This error code is stored in the fault logger (99 storage places), together with the fault signal and event time. Previous alarm and fault occurrences can be read from the fault logger (max. 99 events) and displayed, even if the original fault indication has been reset.

The fault messages can be displayed on the control panel or using the CMT tool.

A fault can be reset by pressing the RESET button on the control panel or using the CMT tool. Another possibility is to switch off the power supply for a short time. If the fault has been removed, the UNITROL[®] F system will resume normal operation.

3.2.1 Electrostatic sensitive devices

The CMOS components used on the control circuit boards can be damaged by electrostatic discharges. Static charges are generated by friction of materials made of synthetic fibres, for example.

In order to avoid damage through static discharge, the following rules must be followed when handling the circuit boards:

- check that there is no voltage in the converter
- use an antistatic mat on a table near the cabinet and connect the mat's earth cord to the unit's frame
- use a wrist strap which is earthed at the same point as the mat
- in an emergency, if no wrist strap is available, discharge your own static by touching an unpainted part of the cabinet before touching the boards
- keep spare boards and semiconductors in their original packages as long as possible.

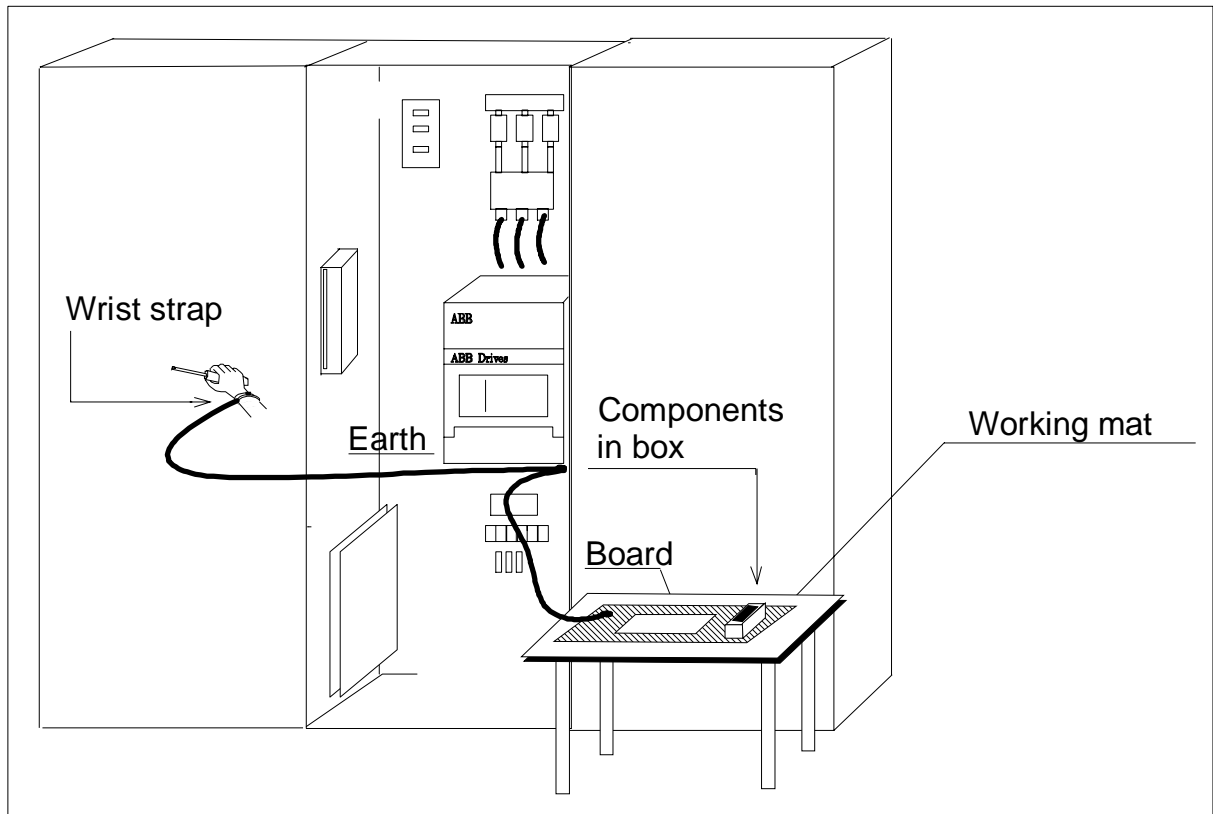


Figure 1 Connection of wrist strap

3.2.2 Installation of memory circuits

If you have to change the memory circuits, always use a special tool (similar to the one illustrated). Never try to use other tools such as screwdrivers otherwise you will damage the socket.

Make sure the new circuit is installed the right way round (align corners as shown in Fig. 3).

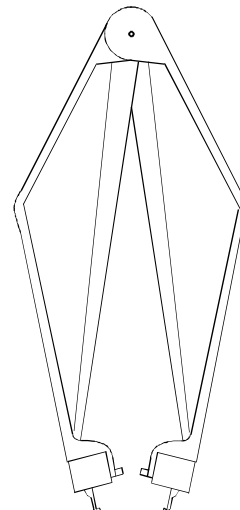


Figure 2 Tool for exchanging memory circuits

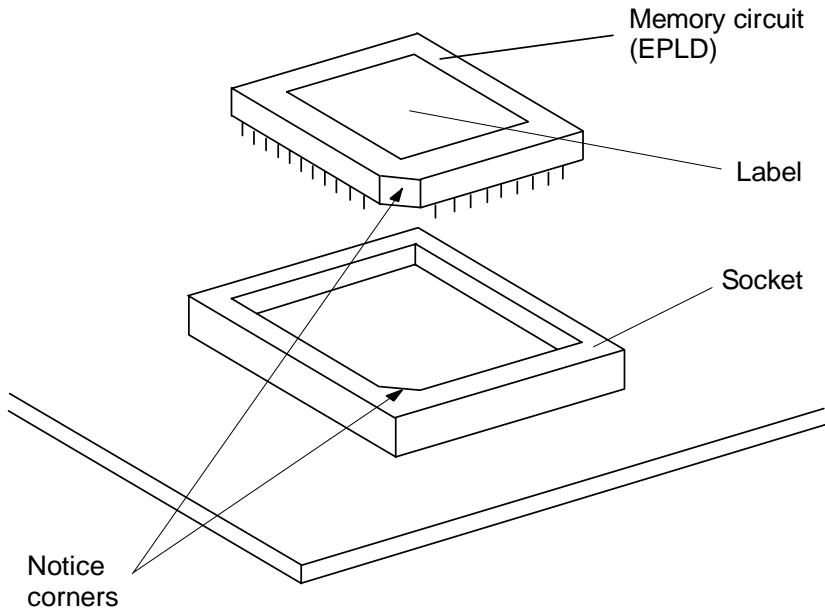


Figure 3 Installation of memory circuit

3.3 Instructions on how to replace printed circuit boards

Before replacing circuit boards, read paragraph 3.2 "Working methods". Switch off the power supply before replacing the circuits.

Remove all flat cables and/or screw terminal blocks from the board. Remove all screws holding the board.

Check that the new board and defective board have the same type designation or that the new board is compatible with the defective one. Compare the jumper settings, the components on solder posts (adjustable or burden resistors) and the identification number of the exchangeable programmable components (EPLDs) with those on the defective board. All settings must be identical, otherwise correct function is not guaranteed.

3.3.1 How to replace the SDCS-CON-2 board

No settings should be necessary when installing an updated replacement SDCS-CON-2 board for the corresponding system. Nonetheless, to be on the safe side, the program version and parameters should be compared.

1. Replace SDCS-CON-2 (possibly with SDCS-CON-1)
2. Switch on power supply to the electronics. The main circuits remain voltage-free
3. Check the program version which is recorded in the IBS protocol, with the following parameters:

| | |
|-------|------------------|
| 11206 | CNT SW VERSION |
| 11207 | CNT BOOT SW VER. |
| 11208 | SW SUBSTATUS |

Using the CMT software (Commissioning and Maintenance Tool), compare the data on the original upgraded diskette with those on the board (upload, compare); see description of the CMT software. If these differ, the program must be downloaded from the current, updated original diskette onto the board using the CMT software (download).

If no CMT software is included in the delivery, the parameters are to be compared with the control panel UNS 0874 and the list in the IBS protocol. If these differ, the parameters must be adjusted using the control panel UNS 0874. If other program versions are loaded, these can only be downloaded from the current, updated original diskette onto the board using the CMT software (download).

When replacing a new SDCS-CON-2 board, the program must be downloaded from the current, updated original diskette onto the board using the CMT software (download).

3.4 Semiconductors

3.4.1 Safety regulations



Work may only be carried out on the converter cabinet if the voltage carrying parts have been switched off on all sides and earthed.

The personnel carrying out the work are responsible for this themselves and must follow the safety procedures described in Chapter 1.

Fuses may only be replaced and measurements carried out on semiconductors if the converter has been disconnected beforehand by a circuit breaker or emergency switch.

In addition, to ensure the safety of personnel, a voltmeter should be used to check whether any voltage is present at terminals L1 - L2, L1 - L3, L2 - L3, L1 - PE, L2 - PE and L3 - PE. Countermeasures should be taken to prevent the system being switched on again through a control error or by a third party after it has been switched off.

3.4.2 Carrying out measurements on the semiconductors

Short circuits can be detected using a standard multimeter. The semiconductor does not need to be removed for this purpose.

The resistance between A (Anode) - K (cathode) - G (gate) must be measured on every thyristor. When measuring the resistance between K - G, the firing pulse connection to the SDCS-PIN-xxx board must be interrupted.

If a short circuit is detected, the input side of each converter must be isolated prior to further trouble shooting. Burnt-out branch fuses indicate defective paths.

The defective thyristor branch can be identified using an ohmmeter. Fuses may never be replaced without first checking the **bridge circuit for short circuits!**

The measured resistance values depend on the type of measuring instrument used and on the type of thyristors.

Typical values are:

- A - K > 10 k Ω
- A - G > 10 k Ω
- 10 Ω < (K - G) < 100 Ω

Connections within the main circuit of the converter depend on the type, C1, C2, or A5 of the converter.

The figure below shows the location of thyristors in the module UNS x875Vx005-...Vx0090 (DCS501B-0050 – DCS501B-1000).

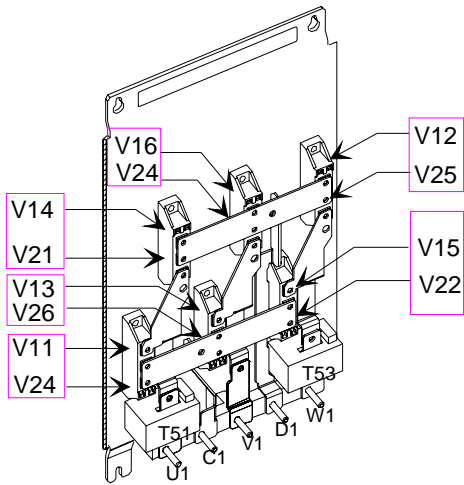


Figure 4 Location of thyristors in C1 and C2 frame

The figure below shows the location of thyristors in the modules UNS 7875Vx090-...Vx200 (DCB505-0903 – DCB505-2003).

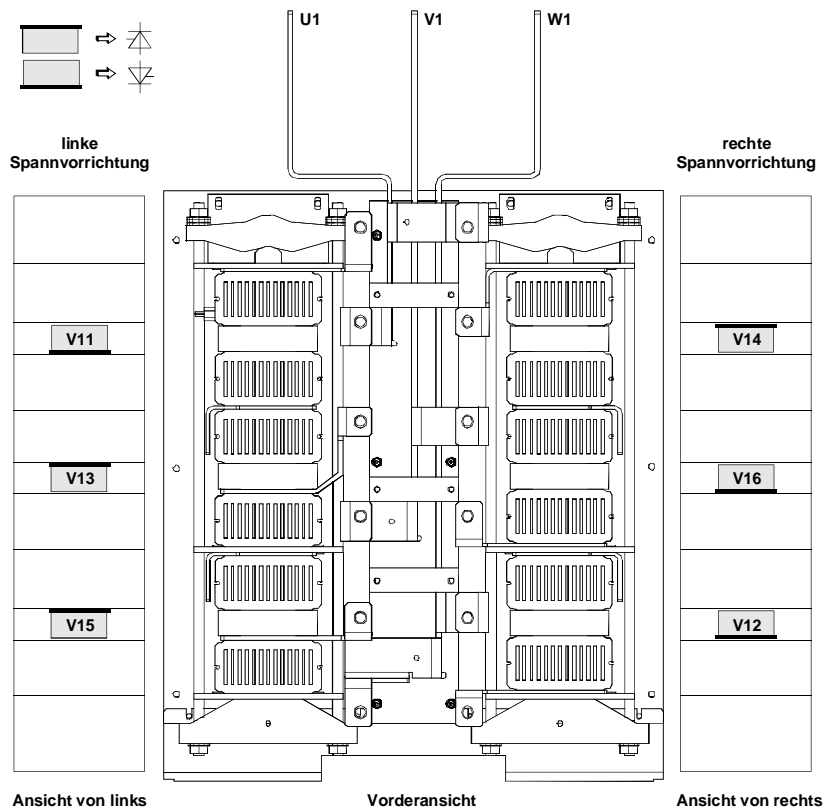


Figure 5 Location of thyristors in A5 frame

3.5 General Instruction how to handle the Semiconductors

Thyristor modules, busbars and fuses have to be mounted with the correct torque using a torque screw driver or torque wrench.

In converters sizes A5 (900 to 2000 ADC) the mounting force is indicated by an indicating spring welded to the mounting clamp, which is inside the unit.

Always mark suspected damaged components clearly after removing them from the circuit, to avoid confusion with "good" components.

When removing a damaged semiconductor, write down how and where it was installed (direction, location and connected gate leads).

Check that the new and old component have the same type designation or that the new component can replace the old one. A semiconductor can be replaced by different compatible semiconductor according to the codes in the manufacturers' table.

Semiconductor components are high-precision products. All unnecessary used tools and objects might damage the easily dented and scratched surfaces of the semiconductors.

1. Keep new semiconductors as long as possible in their original packages.
2. Use protective gloves if possible.
3. Clean work area and hands frequently.
4. Use good illumination.

3.5.1 Exchange of thyristors for sizes C1/C2/C2b

Installation of thyristor modules in converters size C1/C2/C2b (25 to 1000 A)

All converters sizes C1/C2/C2b are equipped with thyristor **modules**.

In order to keep the operating temperature of the semiconductor module low, the joint between the heat sink and the module should have a good heat conducting ability. The electrical conductivity of the connectors must also be good. For this reason the following instructions must be observed with particular care.

Required tools

Special tools or material needed in addition to standard tools for the exchange of thyristor modules:

- torque spanner: mounting torques for thyristor module to heat sink and electrical connections see table "Nominal mounting torques for thyristor modules" in this chapter;
- screws are metric type; use appropriate nuts
- Tissue paper / solvent (e.g. ethanol): Grafol fluid, ABB Code 35065351
- Thermal joint compound: General Electric G 322 L, ABB Code 35063048



Before the work is started, disconnect the converter from the power supply completely, then check the voltage free condition and make sure, everything is located in an electrical and mechanical safe condition!

Remove faulty thyristor modules

- Tilt out the electronics casing.
- Remove the gate leads from the faulty thyristor module and mark the position of the trigger connections on the cable.
- Remove only as many parts as is needed around the faulty module. If the current transformer must be removed, mark the position and the connections!
- Remove the faulty thyristor module and mark it.

Install new thyristor modules

- Remove old thermal joint compound (grease) from the heat sink. Preparation of the heat sink: if the area is clean, spread out the heat-conducting compound with a rubber spatula or by hand. If the area is dirty, clean the heat sink surface with tissue paper. Clean the mounting surfaces with an appropriate solvent (e.g. ethanol).
- Apply a thin coat of thermal joint compound to the new module. Spread the thermal joint compound evenly by moving the module forward and backward on the heat sink.
- Tighten the clamping screws by hand until the screw heads touch the bottom of the module. Then tighten the screws to 2.5 Nm torque. If the module is mounted using four screws, tighten the screws crosswise.
- Tighten the screws to nominal torque (see table 3 and 4).
- Reinstall the busbars; make sure, the correct torque is applied and reconnect all cables.

Module terminals

The next figures show a few examples and terminals of thyristor modules. The terminals of modules are also stamped or marked by a sticker.

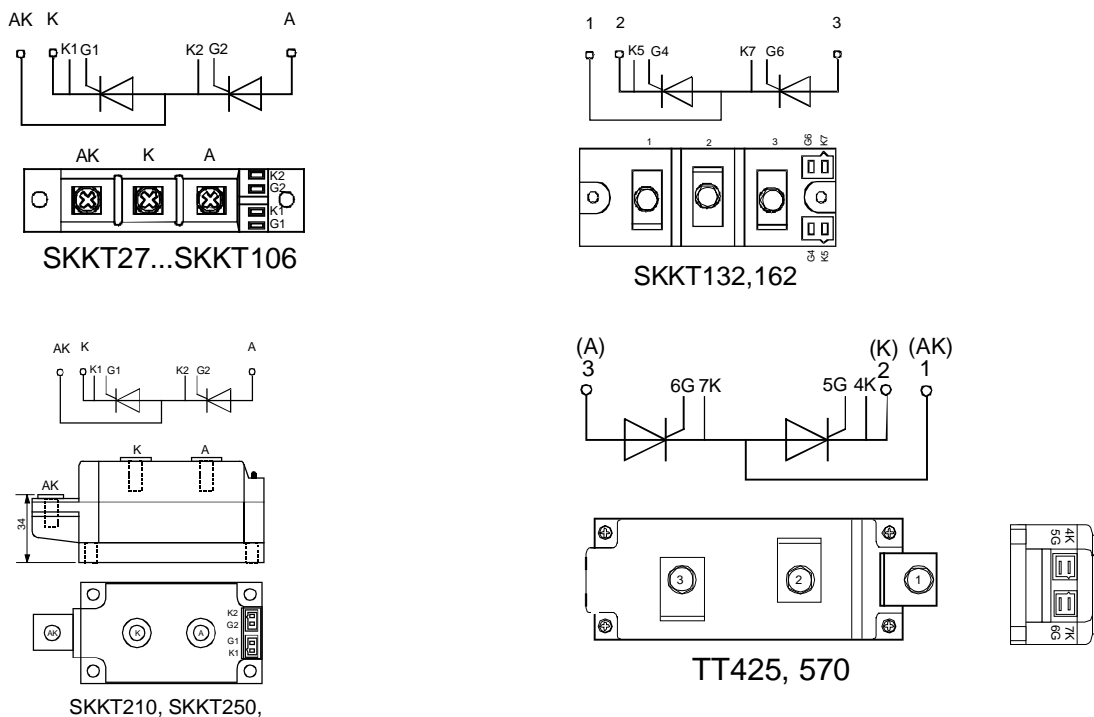


Figure 6 Terminals of half-bridge thyristor modules

3.5.2 Exchange of thyristors for size A5

Installation of "Disc Type" thyristor in converters size A5 (900 to 2000 A)

All converters sizes A5 are equipped with disk type thyristors. The structure of the "Disc type" semiconductor component is such that it requires a certain compression force to operate. The prevention of overheating of the component essentially depends on a well heat dissipation between the semiconductor and the conducted heat sink. It is thus important that all joints have good thermal and electrical conduction.

Required tools

Special tools or material needed in addition to standard tools for the exchange of thyristor modules:

- Torque spanner for electrical connections: 13 Nm (M8)
25 Nm (M10)
50 Nm (M12)
- Screws are metric type; use appropriate nuts.
- 17 mm ring spanner for fuse and busbar connections.
- 17 mm ring spanner for press clamp.
- Tissue paper / solvent (e.g. ethanol): Grafol fluid, ABB Code 35065351
- Thermal joint compound: General Electric G 322 L, ABB Code 35063048
- Disassembly tool: 3ADT 621 023 P1

Therefore strict observance of the build in instructions given below is of utmost importance. Make sure that the new component can replace the old one in accordance with the spare part list.

Semiconductors and heat sinks are to be handled carefully to avoid scratches and other damage. Avoid touching the contact surfaces. Do not lift the semiconductor with the gate wire. Do not lift the semiconductor unit touching the current contact surfaces. Do not damage the welding flange or the contact surface.



Before the work is started, disconnect the converter from the power supply completely, then check the voltage free condition and make sure, everything is located in an electrical and mechanical safe condition!

Find faulty thyristor

1. Find the defective branches by performing an OHM test (both polarities) between U1, V1, W1 and C1, D1 (see figure 7)

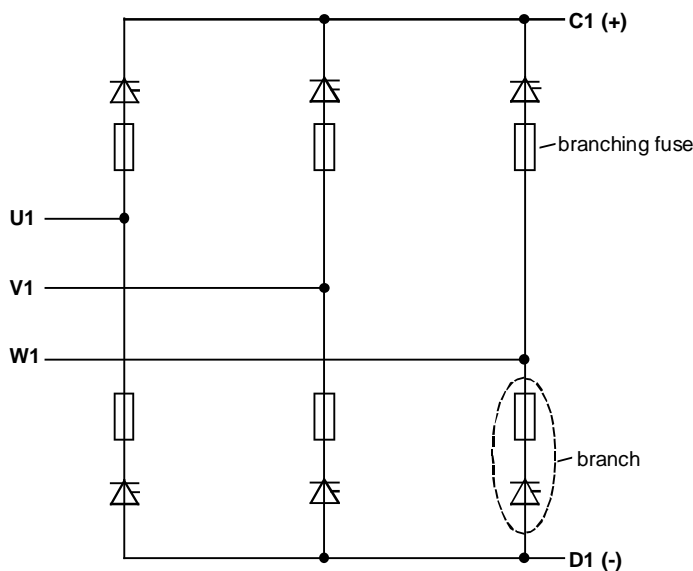


Figure 7 Basic B6-bridge with branching fuses

2. Disconnect the branch fuses of the defective branches.
3. Find the defective thyristors by performing an OHM test (both polarities) over their heat sinks.

Note: Because “Disc Type” semiconductors need a certain compression force to operate properly a measurement outside the clamped heat sinks might be wrong. To be sure change only one thyristor, clamp the heat sinks again and repeat step three.

Remove faulty thyristor

1. Remove the screws of the DC – busbars and branch fuses preventing the stack to be prized open.
Note: It depends on the location of the defective thyristor which DC – busbar and fuses have to be disconnected.
2. Write down the direction and location of the thyristors to be removed and mark their gate leads.
3. Remove the gate leads if possible.
4. Loosen the mounting clamp (see figure 9) at the top of the thyristor stack.

Attention: While loosen the mounting clamp the indicating spring must be pulled out a little, otherwise the spring will be damaged!

5. Attach the disassembly tool at the faulty thyristor and prize open the upper and lower heat sinks (see figure 8).
5. Remove the thyristors.

Attention: To centre the thyristors spring pins are used. The pins are inlaid into all lower heat sinks. Open the gap wide enough that the thyristor and the pins are not damaged while removing the thyristor!

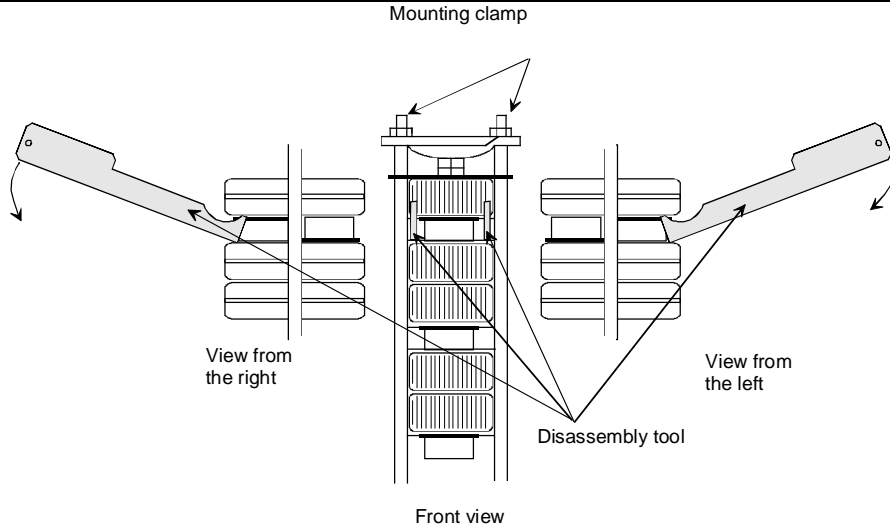


Figure 8 How to use the disassembly tool

Install new thyristor

1. Ensure that the new thyristor is of the correct type (see *Appendix A*). Keep the semiconductor and its surroundings clean. If necessary clean them with a piece of tissue paper moistened with solvent.

Note: Do not touch the polished surfaces of the thyristor.
 2. Clean the polished surfaces of the semiconductor with a piece of tissue paper moistened with solvent. Dry all surfaces. Spread a **thin** layer of heat conducting paste on both sides of the thyristor, if necessary use a rubber spatula.
 3. Connect the gate leads if possible.
 4. Clean all parts with tissue paper moistened with solvent, which have had or will have contact with the thyristor or each other (lower / upper heat sink). Do not clean the surfaces of grease too thoroughly, because the aluminium surfaces will oxidise in a few seconds. Dry all surfaces.
 5. Centre the thyristors by means of the spring pins.

Note: Be sure that the thyristor is installed in the right direction. Do not pinch or cut the gate leads or any other cable.
- Turn the thyristor so that the gate leads point in the right direction.

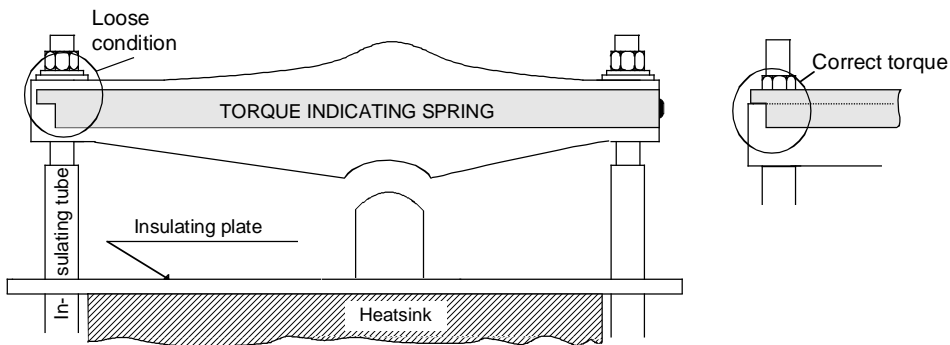


Figure 9 Aluminium spring with welded indicating spring

6. Tighten the nuts of the mounting clamp by hand so that the clamp is in parallel with the contact surface of the heat sinks.
Note: The indicating spring is a very sensitive instrument and must be handled with care.
7. Tighten each nut in turn, half a turn at a time with the help of a ring spanner until the indicating spring clicks into position “correct torque” (see figure 9). Do not tighten the screws any further.
Note: The correct torque is indicated by means of the welded indicating spring.
8. Perform an OHM test to make sure the thyristor is ok.
9. Reconnect the DC – busbars, branch fuses and all other dismantled parts.
10. Perform an OHM test between U1, V1, W1 and C1, D1 to make sure the power part is ok.

3.5.3 Semiconductor types

The thyristors types are listed in the following tables.

Thyristor modules

| 400 V...500 V | Type of thyristor | Mounting torque to heat sink | Terminal connecting torque |
|------------------|-------------------|------------------------------|----------------------------|
| DCS501B-0050-51- | SKKT42/16E | 5 Nm +/- 15% | 3 Nm +/- 15% |
| DCS501B-0075-51- | SKKT57/16E | 5 Nm +/- 15% | 3 Nm +/- 15% |
| DCS501B-0100-51- | SKKT106/16E | 5 Nm +/- 15% | 3 Nm +/- 15% |
| DCS501B-0140-51- | SKKT106/16E | 5 Nm +/- 15% | 3 Nm +/- 15% |
| DCS501B-0200-51- | SKKT106/16E | 5 Nm +/- 15% | 3 Nm +/- 15% |
| DCS501B-0250-51- | SKKT106/16E | 5 Nm +/- 15% | 3 Nm +/- 15% |
| DCS501B-0350-51- | SKKT162/16E | 5 Nm +/- 15% | 5 Nm +/- 15% |
| DCS501B-0450-51- | SKKT250/16E | 5 Nm +/- 15% | 9 Nm +/- 15% |
| DCS501B-0520-51- | SKKT250/16E | 5 Nm +/- 15% | 9 Nm +/- 15% |
| DCS501B-0680-51- | TT425N16KOF | 6 Nm +/- 15% | 12 Nm +5%/-10% |
| DCS501B-0820-51- | TT570N16KOF | 6 Nm +/- 15% | 12 Nm +5%/-10% |
| DCS501B-1000-51- | TT570N16KOF | 6 Nm +/- 15% | 12 Nm +5%/-10% |
| 600 V | | | |
| DCS501B-0110-61- | SKKT72/20E | 5 Nm +/- 15% | 3 Nm +/- 15% |
| DCS501B-0270-61- | SKKT132/20E | 5 Nm +/- 15% | 5 Nm +/- 15% |
| DCS501B-0450-61- | SKKT210/20E | 5 Nm +/- 15% | 9 Nm +/- 15% |

Table 3

Disc type thyristor with indicating spring

| 400 V to 500 V | Type of thyristor |
|-----------------------|-------------------|
| DCB505-1203-51- | T589N18TOF |
| DCB505-1503-51- | 5STP18F1800 |
| DCB505-2003-51- | 5STP1818F003 |
| 600 V to 690 V | |
| DCB505-0903-61- | T459N24TOF |
| DCB505-1503-61- | 5STP16F2400 |
| DCB505-2003-61- | 5STP24L2800 |

Table 4

3.6 Hardware faults

For more information on the functions of the individual circuit boards and other hardware, see "Hardware Description".

3.6.1 Fault messages on the SDCS-CON-2 board

There is a seven segment display (H1) on the control board. Alarms and fault messages are indicated in a periodically-recurring sequence (duration of cycle = 0.7 sec.). In this way, the messages are transmitted step by step, with a letter at the start followed by two or three numbers. The result is shown in the table below.

| | |
|---------------------|---|
| 0.7s 0.7s 0.7s 0.7s | |
| E 0 1 | ROM memory test error |
| E 0 2 | RAM memory test error |
| E 0 4 | Bad COM-1 on COM-5 board |
| E 0 5 | No control program in memory |
| 8 | Program is not running |
| . | Normal situation, no error no alarm |
| L | During download sequence |
| A | Alarm, number same as in fault logger. Alarm will be shown only if no fault is active, see following alarm table. |
| F | Fault, number same as in fault logger, see following fault table. |

Example: The display shows "E" for 0.7 sec., then "0" for 0.7 sec. and "1" for 0.7 sec. After this, the sequence starts again from "E", i.e. the display is indicating a ROM memory error.

3.6.2 Table for hardware trouble shooting

The following table is intended to assist the user in interpreting hardware fault messages and contains instructions on eliminating the faults.

NOTE: The individual alarms and faults are described in the following chapter 0 "Alarm and fault messages".

If this message appears there is no communication with the CON2-Board.

| Error code | Possible Error / Action |
|------------------|---|
| <p>01</p> | <p>ROM memory test error</p> <p>Operator Information The test of the ROM (Read Only Memory) failed, e.g. due to a defective system program having been stored.</p> <p>Trouble Shooting</p> <ul style="list-style-type: none"> • Replace the SDCS-CON-2 board. |
| <p>02</p> | <p>RAM memory test error</p> <p>Operator Information A fault was detected in the RAM memory circuit.</p> <p>Trouble Shooting</p> <ul style="list-style-type: none"> • Try to restart the UNITROL[®] F system. • If this error message appears again after restarting the UNITROL[®] F system, replace the SDCS-CON-2 board. |
| <p>04</p> | <p>Bad COM-1 or COM-5 board</p> <p>Operator Information This error message appears if the UNITROL[®] F system encounters transmission problems in communication via an optic fibre cable.</p> <p>Trouble Shooting</p> <ul style="list-style-type: none"> • Check that the SDCS-COM-1 or COM-5 board is present, correctly plugged in to the SDCS-CON-2 board and that the hardware settings are correct (see "Hardware Description"). • Check the fibre optics connections. • Replace the SDCS-COM-1 or COM-5 board. • Exchange the SDCS-CON-2 board. |

| Error code | Possible Error / Action |
|------------------|---|
| <p>05</p> | <p>No control program in memory</p> <p>—</p> <p>Operator Information There is no system program loaded in the Flash PROM D33.</p> <p>Trouble Shooting</p> <ul style="list-style-type: none"> • Because there is no program stored in the Flash PROMs (not even a boot-up program), no new program can be downloaded. • If the fault is repeated, replace the SDCS-CON-2 board. |
| <p>06</p> | <p>After systemstart: ASIC not OK During operation: CPU-SW-Reset</p> <p>Trouble Shooting</p> <ul style="list-style-type: none"> • Replace the SDCS-CON-2 board. |

3.7 Alarm and fault messages

All faults generate fault messages. A distinction is made between the following types of message:

- **Alarms** warn of a malfunction. No protective function is tripped, nor is the operation of the excitation system interrupted.
- **Faults** are divided into the following categories:

CH FAIL always relates to the physical channel where it occurs. In a two-channel system, this means the loss of redundancy, because the system automatically changes over to the standby channel. In the single-channel system, **CH FAIL** has the same meaning as a fault.

Faults switch off the excitation system and protect it against damage.

Every alarm and fault message is coded with an individual error code.

As soon as an alarm or fault occurs, an error code is generated. These error codes are transferred to the fault logger (FIFO, maximum 99 error codes) together with the time of occurrence. Alarm and fault messages in the fault logger which have occurred previously can also be read and displayed using the control panel or the CMT tool.

Some faults and alarms are automatically reset by the system as soon as the fault is no longer present, others have to be reset by the operating personnel. These different resetting procedures are shown in the tables.

In the event of a supply voltage failure, the data in the fault logger and buffer are stored in a protected memory on the SDCS-CON-2 board.

The SDCS-CON-2 control board features a seven-segment display which indicates the current operating condition of the system. The error messages are described in 3.6.2 "Hardware Faults".

Each fault and alarm is coded as an individual error code. LATEST FAULT (11107) or LATEST ALARM (11108) display the error code. The fault words FAULT WORD1 (11101), FAULT WORD2 (11102), FAULT WORD3 (11103) and the alarm words ALARM WORD1 (11104), ALARM WORD2 (11105), ALARM WORD3 (11106) contain the status bits for all possible faults and alarms in the UNITROL[®] F system.

3.7.1 Definition of terms for channels

The following terms are used in the description:

- Channel:** Physical channel which communicates with the control panel of CMT software in the case described.
- Active channel** Preselected channel in operation
- Standby channel** The other channel in standby mode

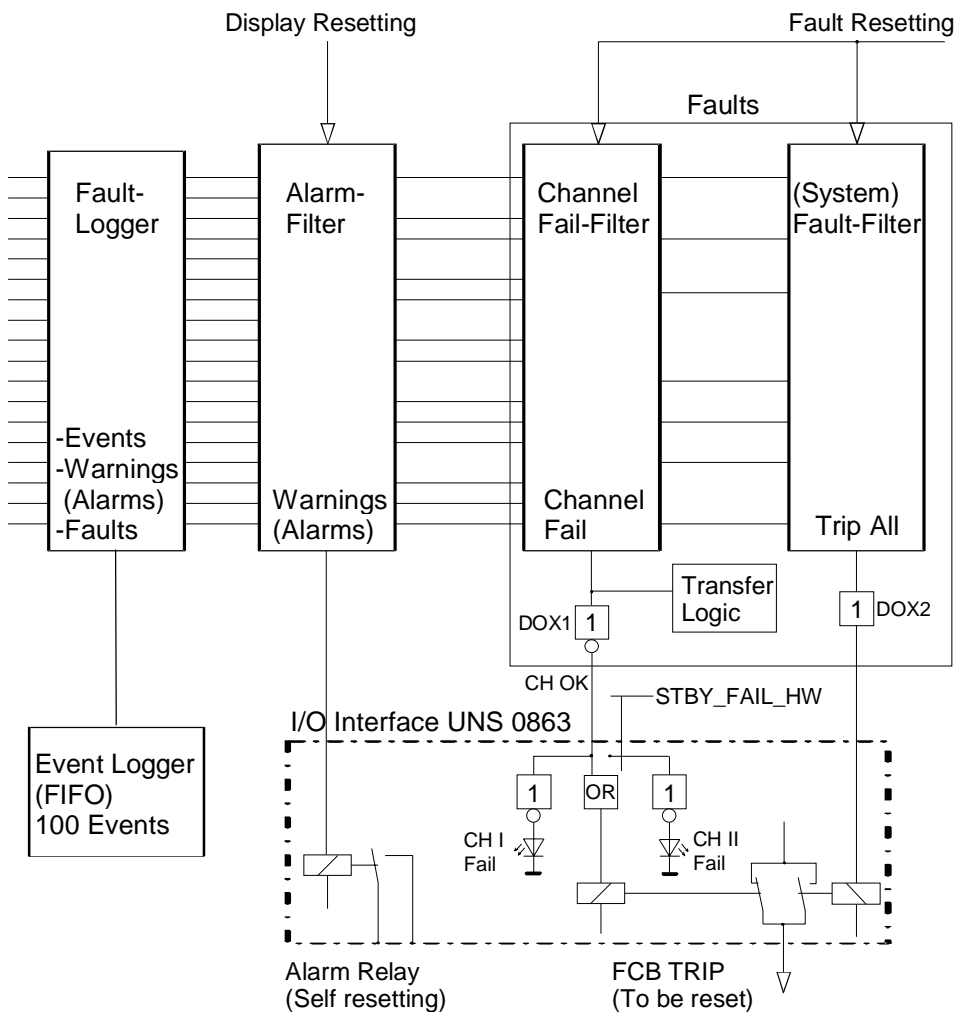


Fig. 6 Principle of fault and alarm handling

3.7.2 Table of alarm messages

The alarm messages of the system software of UNITROL® F do not lead to interruption of operation of the excitation system. Nonetheless, if an alarm occurs, the cause should be identified as soon as possible in order to guarantee perfect operation of the excitation system.

The following table contains, in alphanumeric order, the ALARM TEXTS (WARNINGS) which are displayed on the control panel and by the „UPLOAD FAULT LOGGER“ in the CMT.

| ALARM TEXT „WARNING“ on panel / CMT | Code |
|--|-------------|
| 2 channel comerror | 113 |
| AI failed | 123 |
| Aux. AC fail | 141 |
| Backup not allowed | 134 |
| Batt. fail | 144 |
| CH transfer failed | 107 |
| Common CH fault | 109 |
| Common STBY fault | 111 |
| Conv. overtemp. alarm | 105 |
| Conv. undervoltage | 118 |
| Converter failed | 124 |
| Crowbar failed | 135 |
| Ext. alarm | 146 |
| f sensing failed | 121 |
| FCB failed | 127 |
| FCB off / 24 V fail | 143 |
| Fieldbus timeout | 122 |
| Init values read | 138 |
| Init values read, S2 | 130 |
| Machine P.T. fail | 120 |
| OC1 inverse time | 106 |
| Panel disconnected | 128 |
| Param set 2 missing | 132 |
| RAM-backup failed | 108 |
| Rot. rectifier OC | 115 |
| Rotor temp. alarm | 104 |
| Standby Alarm | 119 |
| Standby trip | 137 |
| System restart | 110 |
| Test supply | 145 |
| Trafo temp. alarm | 103 |
| Type code changed | 129 |
| Write backup alarm | 136 |

Table 5

The following table contains, in alphanumeric order, all the ALARM CODES (WARNINGS) of the seven-segment display on the CON-2 board.

| Code | Fault text | Type | Clearing | WORD*/BIT | Source |
|------------|------------------------------|---------------------------|--|-----------|--|
| 103 | Trafo temp. alarm | Alarm | Self reset | 1/2 | [OVT1 TRAF0] 5902 |
| 104 | Rotor temp. alarm | Alarm | Self reset | 1/3 | RTEMP ALARM 11004 |
| 105 | Conv. overtemp. alarm | Alarm | Self reset | 1/4 | Converter |
| 106 | OC1 inverse time | Alarm | Self reset | 1/5 | OC1 EXC CURR 10905 |
| 107 | CH transfer failed | Alarm | Self reset | 2/15 | XFER FAIL 10343 |
| 108 | RAM-backup failed | Alarm | Reset man. | 1/7 | Operating system |
| 109 | Common CH fault | Alarm | Self reset | 2/14 | STBY STATUS 12401 |
| 110 | System restart | Event | Self reset (after 1st run) | | Operating system |
| 111 | Common STBY fault | Alarm | Self reset | 2/6 | CH COMMUNICATION |
| 113 | 2 channel comerror | Alarm | Self reset | 1/0 | CH COMMUNICATION |
| 115 | Rot. rectifier OC | Alarm | Self reset | 2/11 | BR INTRPT ROT REC 10911 |
| 118 | Conv. undervoltage | Event | Self reset | | Converter |
| 119 | Standby alarm | Event | Self reset | | CH COMMUNICATION |
| 120 | Machine P.T. fail | Alarm | Reset if 914=ON | 1/13 | U MACH FAIL 10908 |
| 121 | f sensing failed | Alarm | Self reset | 2/12 | F MACH FAIL 10912 |
| 122 | Fieldbus timeout | Alarm | Self reset | 1/6 | COMM FAULT 10922 |
| 123 | AI failed | Alarm | Self reset | 1/8 | AITAC FAILURE 10119 AI2 FAILURE 10116 AI1E FAILURE 10127 AI2E FAILURE 10130 |
| 124 | Converter failed | Alarm | Self reset | 2/0 | Converter |
| 127 | FCB failed | Alarm | Self reset | 1/15 | FCB FAILURE 10306 |
| 128 | Panel disconnected | Event | Self reset | | Operating system |
| 129 | Type code changed | Alarm | Self reset | 2/1 | SET CONV TYPE 510 |
| 130 | Init values read, S2 | Alarm | Self reset | 2/2 | CON-2 board, S2 in Pos. 1:2 |
| 132 | Param SET2 fehlt | Alarm | Self reset | 2/3 | BC 11202 |
| 134 | Backup not allowed | Alarm | Self reset / power off | 2/4 | Operating system |
| 135 | Crowbar failed | Alarm | Self reset | 1/1 | MONITORING 1 |
| 136 | Write backup alarm | Alarm | Self reset | 2/5 | BC 11202 |
| 137 | Standby trip | Alarm | Self reset | 2/0 | CH COMMUNICATION |
| 138 | Init values read | Event | Self reset | | Operating system |
| 141 | Aux. AC fail | Alarm | Self reset | 2/8 | AUX AC FAIL 10902 |
| 143 | FCB off / 24 V fail | Alarm | Self reset | 2/10 | PWR 24 FAIL 10904 |
| 144 | Batt. fail | Alarm | Self reset | 2/9 | BATT FAIL 10903 |
| 145 | Test Speisung EIN | Alarm | Self reset | 2/7 | TEST SUPPLY 10901 |
| 146 | Ext. alarm | Alarm | Self reset | 2/13 | [NO EXT ALARM] 5904 |
| 210 to 264 | User Event 1 to 6 | Trip, Fault, Alarm, Event | Reset man. Resetman. Self reset Self reset | | See SW-Schemata |

* 1 = 11104 = Alarmword 1 | 2 = 11105 = Alarmword 2 | 3 = 11106 = Alarmword 3

Table 6

3.7.3 Fault-tracing instructions for alarm messages

In addition to showing the alarm number and text, the following tables also include instructions on how to locate the cause of the fault. It is not feasible to provide exact instructions on fault-tracing since, depending on the application, the prerequisites depend on the environmental conditions and are different for each installation. Other procedures are therefore possible and lead to the same goal.

| Alarm code | Possible reason / Action |
|-------------------|---|
| <p>103</p> | <p>Trafo temp. alarm</p> <p>Operator Information The temperature of the excitation transformer has risen higher than the alarm level (determined by the first stage temperature monitoring UNS 0006). Try to prevent a trip due to maximum transformer overtemperature by reducing the excitation current.</p> <p>Trouble Shooting</p> <ul style="list-style-type: none"> • Check if the transformer was overloaded for a long time. • Check transformer cooling and the ambient temperature around the transformer. If the transformer is overheating despite normal environmental conditions, the transformer may be incorrectly dimensioned. An internal fault could also be the cause. Keep an eye on the transformer temperature. • Check transformer temperature. If the transformer temperature is not as high as the alarm temperature, check the function of the PTC and temperature relay UNS 0006. Detect overtemperature. This fault has to be reset on the UNS 0006 itself. • Check the wiring from the UNS 0006 to the PTC (a broken connection will cause an alarm!). |

| Alarm code | Possible reason / Action |
|-------------------|--|
| <p>104</p> | <p>Rotor temp. alarm</p> <p>Operator Information UNITROL® F monitors the rotor temperature, which is calculated from the excitation current, excitation voltage and the resulting field resistance. If this value exceeds the set alarm level for the rotor temperature, an alarm is triggered.</p> <p>Trouble Shooting</p> <ul style="list-style-type: none"> • Check whether the rotor has been overloaded for a long time and whether the rotor cooling system is working properly. • NOTE: The calculated temperature value is very sensitive to fluctuations in the measuring signal. Verify that the displayed field resistance RF RELATIVE (11001) is comparable with other measured values (field voltage / field current) in % (see parameter and signal list). If only measuring drift is expected, tune the parameters of group 10 again. In the event of transducer abnormalities (e.g. temperature fluctuations), consult ABB service. |
| <p>105</p> | <p>Conv.overtemp. alarm</p> <p>Operator Information The temperature of the heat sink measured by UNITROL® F is less than 10°K below the set maximum temperature MAX BRIDGE TEMP DEG (10507) determined by the hardware code or the parameter SET MAX BR TEMP (509). Try to prevent a trip due to converter overtemperature by reducing the excitation current.</p> <p>Trouble Shooting</p> <ul style="list-style-type: none"> • Check that the airflow is not obstructed by foreign bodies. Check that: <ul style="list-style-type: none"> - the fans are functioning properly. <p>NOTE: Fans only work when the excitation is switched on.</p> <ul style="list-style-type: none"> - the heat sinks are not dirty. Remove any dust and dirt. - the filter cartridges are not too dirty. - the airflow is not restricted by any objects inside or outside the cabinets. <ul style="list-style-type: none"> • Check that the ambient temperature is < 40°C. • Ensure that the UNITROL® F system has not been overloaded for too long and that the converter is dimensioned correctly. |

| Alarm code | Possible reason / Action |
|-------------------|---|
| <p>106</p> | <p>OC1 inverse time</p> <p>Operator Information The excitation current was above set limits START IE MONITOR (902) during the set delay DLY IE MONITORING (903). This means that the excitation current limiter was not able to limit the excitation current to the set value of REF1 IETH (1301) or REF1 IEMAX (1303) within the set delay DLY IE MONITORING (903). This caused a changeover to MANUAL mode or the standby channel.</p> <p>Trouble Shooting</p> <ul style="list-style-type: none"> • Single-channel system: If the system remains stable in MANUAL operation, no fault is to be expected from the gate control (thyristor firing). Try to switch back to AUTO mode. • Two-channel system: • Changeover to the standby channel takes place first. If it is not possible to switch back because the automatic follow-up control cannot follow (no "Ready for transfer" RDY XFER TWIN (12120) or if the same faults occur again, the fault could lie in the gate control or in the measurement of the excitation current (section I EXC). Check the relevant channel at the next shutdown. NOTE: The standby channel receives I EXC signals from the active channel. • It is possible that the excitation current limiter is too sluggish or the gain and/or boundary values are set too low. Check the relevant parameter settings of the excitation current limiter (group 13, 19) and monitoring (group 9). |

| Alarm code | Possible reason / Action |
|-------------------|--|
| <p>107</p> | <p>CH transfer failed</p> <p>Operator Information The operating modes AUTO, MANUAL, excitation ON/OFF, superimposed regulator ON/OFF and their pre-selection (COS PHI or Q-controller) are the same for both channels and only one channel may be active.</p> <p>Trouble Shooting</p> <ul style="list-style-type: none"> • Notify ABB service if the fault occurs repeatedly |
| <p>108</p> | <p>RAM-backup failed</p> <p>Alarm No Battery Backup Function for RAM</p> <p>Capacitor for RAM backup has discharged (perhaps unit has been stored for too long without the electronics voltage switched on?); load capacitor by leaving unit electronics switched on for a lengthy period.</p> |
| <p>109</p> | <p>Common CH fault</p> <p>Operator Information This is the common alarm (collective signal) for all CH FAILs which can occur in a 2-channel system of type AFT. It is used to generate the hard-wired signal CH OK (TCHFEN) in the other channel, which is output via DOX01 (and DO01E, if the I/O expansion is used). This alarm is also transmitted to the standby channel via the serial bus [CH FAIL (10342) ⇒ STBY FAIL BU] to trigger channel changeover.</p> <p>Trouble Shooting</p> <ul style="list-style-type: none"> • This alarm is generated through the occurrence of one or more other faults, or by the alarm 113 "2 channel comerror" on the standby channel. For trouble shooting, all these other fault and alarm messages should be taken into account. |
| <p>110</p> | <p>System restart</p> <p>Operator Information This is simply a display which appears following a cold start-up, but it is stored in the fault logger.</p> |

| Alarm code | Possible reason / Action |
|-------------------|---|
| <p>111</p> | <p>Common STBY fault</p> <p>Operator Information The active channel has received the common CH FAIL (10342) signal from the standby channel. This causes switchover to this channel, if the necessary conditions are fulfilled (see Alarm 109).</p> <p>Trouble Shooting</p> <ul style="list-style-type: none"> • Connect the control panel (or CMT) with the standby channel, which is now the active channel, and read the entries in the fault logger. • See also alarm 109. |
| <p>113</p> | <p>2 channel comerror</p> <p>Operator Information There is an interruption in the serial communication link between the two channels. Emergency changeover caused by a CH FAIL is still possible via the hardwire connection (TCHFEN), as is changeover to MANUAL mode.</p> <p>Trouble Shooting</p> <ul style="list-style-type: none"> • Check the serial connection between the channels (X16: 1-2-3). • Other faults and alarms which could cause a communication interruption, e.g. loss of power supply to one channel, should also be considered. • Replace SDCS-CON-2 board(s) (only one at a time) if no other cause for the communication interruption could be identified. |

| Alarm code | Possible reason / Action |
|-------------------|---|
| <p>115</p> | <p>Rot. rectifier OC</p> <p>Operator Information An open circuit of a rotating rectifier bridge arm was detected (brushless excitation system). It is not necessary to stop the machine immediately, but the excitation current should be reduced as much as possible (preferably in MANUAL mode), and the fault should be remedied as soon as possible.</p> <p>Trouble Shooting</p> <ul style="list-style-type: none"> • Check the rotating rectifier for open circuits (especially the diodes and any branch fuses). • If the alarm can be reset at an excitation current higher than no load, the fault could be caused by machine transients, triggered by excessively sensitive setting of the diode failure monitoring UNS 0864. Check the relay settings with reference to the commissioning instructions at the next shutdown of the system. The ripple signal can be checked on the I/O interface UNS 0863 and should be compared with the data in the commissioning report. • If additional unexplained events occur, replace the diode failure monitoring circuit UNS 0864. |
| <p>118</p> | <p>Conv. undervoltage</p> <p>Operator Information The converter supply voltage has dropped below the set value U SYN MIN (505) during operation (EXC ON). This event is entered in the fault logger as an EVENT and does not lead to the generation of an alarm message. If this is the only entry in the fault logger, the fault could have been caused by line transients.</p> |
| <p>119</p> | <p>Standby alarm</p> <p>Operator Information There is an alarm of some type present in the standby channel of a 2 channel system. This event (119) is only logged as an ALARM in the fault logger for this channel.</p> <p>Trouble Shooting</p> <ul style="list-style-type: none"> • Select the standby channel on the control panel or connect to PC (CMT software). Read the entries in the fault logger. |

| Alarm code | Possible reason / Action |
|-------------------|---|
| <p>120</p> | <p>Machine P.T. fail</p> <p>Operator Information</p> <ul style="list-style-type: none"> • 3-phase shunt supply: The measured generator voltage has dropped below the converter supply voltage minus the margin set by the parameter DEV U MONITORING (907). This means that there is a problem with the measurement of the generator voltage. This fault message causes a changeover to the second channel (if provided) or to MANUAL mode. • All other supply modes: (Only if the parameter SEL PT FAIL DYN (914) is set to "ON"). The dynamic P.T. monitoring system has been tripped by excessive du/dt of the machine voltage, although no load changes had taken place on the machine previously. • User input IN PT FAIL (5908): The input IN PT FAIL (5908) is available for the use of other P.T. circuit monitoring functions (customer-specific application). <p>Trouble Shooting</p> <ul style="list-style-type: none"> • Check the voltages from the P.T. (generator terminal voltage) to the software signal U MACH RELATIVE (10101) according to the hardware diagrams. If everything is O.K., the setting of the dynamic P.T. failure monitor may be too sensitive. Check the settings in accordance with the instructions in the parameter list and commissioning instructions. • Compare the measured values with values from other instruments • Check the signal scaling of the machine voltage U MACH RELATIVE (10101): This must be 100% of the rated voltage. • Check the cable connections between the AC measuring unit UNS 0862 and the I/O interface UNS 0863 (flat cable X11), I/O interface UNS 0863 and signal processing device UNS 1860 (flat cables X3 and X4) and between the signal processing device UNS 1860 and the SDCS-CON-2 board (flat cables X1, X2, X14, X17). If the alarm is still present, replace these boards (one after the other). |

| Alarm code | Possible reason / Action |
|-------------------|---|
| <p>121</p> | <p>F sensing failed</p> <p>Operator Information Fault in the frequency measurement. The machine need only be shut down if it is unstable (PSS blocked). The cause of this fault must be rectified as soon as possible.</p> <p>Trouble Shooting</p> <ul style="list-style-type: none"> • Check the plug connection between the PSS transducer UNS 0869 and the signal processing device UNS 1860 if PSS is used. If an alarm occurs when ON LINE, check the connections between the signal processing device UNS 1860 and the SDCS-CON-2 board (flat cables X1, X2, X14 and X17). • Replace the PSS transducer UNS 0869 where PSS is used. Otherwise, if an alarm occurs when ON LINE, replace the UNS 1860 signal processing device. |
| <p>122</p> | <p>Fieldbus timeout</p> <p>Operator Information Transmission between SDCS-CON-2 and the bus adapter module is disturbed (see operating instructions for bus adapter)</p> <p>Trouble Shooting</p> <ul style="list-style-type: none"> • Check connection with the bus adapter. • Replace the cable. • Replace the bus adapter. • Replace the SDCS-CON-2 board. |

| Alarm code | Possible reason / Action |
|-------------------|--|
| <p>123</p> | <p>AI failed</p> <p>Operator Information The value of one of the spare inputs "AITAC, AI2, AI1E or AI2E" has dropped below the programmed live zero value [parameter LIVE ZERO (112, 109, 116, 119)].</p> <p>NOTE: AI1E and AI2E are only available with the optional I/O expansion card UNS 0867, which is plugged onto the SDCS-CON-2 (X21), and an additional second I/O interface UNS 0863.</p> <p>Trouble Shooting</p> <ul style="list-style-type: none"> • Check the whole signal circuit to see whether a connection or cable is broken. • Check the corresponding burden resistors on the I/O interface board UNS 0863 (R1001 to R1004). • Check the connections between the first I/O interface UNS 0863 and the signal processing device UNS 1860 (flat cables X3 and X4) and between the signal processing device UNS 1860 and the SDCS-CON-2 board (flat cable X1, X2, X14 and X17) for the analogue inputs AITAC and AI2 as well as between the second I/O interface UNS 0863 and the optional I/O expansion card UNS 0867 (flat cables X3 and X4) for the analogue inputs AI1E and AI2E. • Replace I/O interface UNS 0863, signal processing device UNS 1860, I/O expansion card UNS 0867, or the SDCS-CON-2 board. |
| <p>124</p> | <p>Converter failed</p> <p>Operator Information</p> <p>Converter type C1, C2, A5 Interruption in a thyristor branch. This can also be the result of a short circuit which was switched off by the fuses. Depending on the design, the system can continue operation, possibly with reduced current.</p> <p>Trouble Shooting</p> <ul style="list-style-type: none"> • The signal BRANCH NO (10515) indicates the defective branch. The branch must be repaired at the next shutdown. See fault 34 for further checks. |

| Alarm code | Possible reason / Action |
|------------|---|
| 127 | <p>FCB failed</p> <p>Operator Information The feedback signal "Field breaker closed" was not received within 1 sec. of the closing command being triggered.</p> <p>Trouble Shooting</p> <ul style="list-style-type: none"> • If the field breaker did not close, check the wiring of the field breaker control circuit according to the hardware diagrams. • Check whether the coils of the field breaker (Q02) are damaged. • If the field breaker did close, check the wiring of the feedback circuit of the field breaker according to the hardware diagrams. • Check the function of the I/O interface UNS 0863 (check the relevant input LED) and the connection to the signal processing device UNS 1860 (flat cable connectors X3 and X4). • Check the connection between the signal processing device UNS 1860 and the SDCS-CON-2 board (flat cable connectors X1, X2, X14 and X17). Replace I/O interface UNS 0863, signal processing device UNS 1860 or SDCS-CON-2 board. |
| 128 | <p>Panel disconnected</p> <p>Operator Information The control panel UNS 0874 was disconnected. If the excitation was driven in LOCAL control, there will be an automatic changeover to REMOTE control. If the excitation is already being driven in REMOTE mode, only the alarm message appears.</p> <p>Trouble Shooting</p> <ul style="list-style-type: none"> • Check connection between the control panel UNS 0874 and the SDCS-CON-2 board (flat cable X34). • Replace control panel UNS 0874 or the SDCS-CON-2 board. |

| Alarm code | Possible reason / Action |
|-------------------|---|
| <p>129</p> | <p>Type code changed</p> <p>Operator Information This message informs the operator that hardware settings (type code resistors on the power interface SDCS-PIN-XX or the corresponding parameters of parameter group 5) of the converter configuration have been changed since the last shutdown of the system.</p> <p>Trouble Shooting</p> <ul style="list-style-type: none"> • Ensure that these changes were actually made intentionally by yourself or other personnel. If not, check the hardware settings of the SDCS-PIN-XX board according to the "Hardware Description" and the setting of the parameters of parameter group 5. • Check connection between the SDCS-PIN-XX and the SDCS-CON-2 board. Replace the SDCS-PIN-XX or the SDCS-CON-2 board. |

| Alarm code | Possible reason / Action |
|------------|--|
| 130 | <p>Init values read, S2</p> <p>Operator Information During start-up (start of the system program), the default values were read from the FEPROM as a result of the hardware setting (jumper S2 on the SDCS-CON-2 board). This means that all the parameters have been set to their initial values, and the customer-specific user parameters are no longer effective.</p> <p>Trouble Shooting</p> <ul style="list-style-type: none"> • If the initial values were downloaded intentionally, this alarm can be ignored (don't forget to reset the jumper (S2). • If you did not wish to read the initial values, check the setting of the jumper on the SDCS-CON-2. For normal start-up (reading of user-specific parameters), the jumper must be in the position 3-4 (right-hand side). Shut down the UNITROL[®] F system, fit the jumper in the correct position and start up again. • If the fault is still present, replace the SDCS-CON-2 board. |
| 132 | <p>Param set2 missing</p> <p>Operator Information Parameter set 2 was activated, either through the parameter PARAMETER SET2 (5326) or by setting the signal BACKUPSTOREMODE (11201) to 5 = SELECT PARAMETER SET2 (5326). However, no parameters are stored in parameter set 2.</p> <p>Trouble Shooting</p> <ul style="list-style-type: none"> • If it was your intention to use the second parameter set, check the setting of the parameter PARAMETER SET2 (5326) and the signal BACKUPSTOREMODE (11201). • Save the settings of the parameters selected as the second parameter set by setting the signal BACKUPSTOREMODE (11201) to 2 = SAVE PARAM2 SET • Replace SDCS-CON-2 board. |

| Alarm code | Possible reason / Action |
|-------------------|--|
| <p>134</p> | <p>Backup not allowed</p> <p>Operator Information Using the command BACKUPSTOREMODE (11201), an attempt was made to load a parameter set from the FEPROM under the wrong conditions (e.g. field breaker was closed). If this is the case, the alarm can only be reset again when the field breaker is open.</p> <p>Trouble Shooting</p> <ul style="list-style-type: none"> • The field breaker must be open in order to load a parameter set. |
| <p>135</p> | <p>Crowbar failed</p> <p>Operator Information Only with static field discharge circuit (without discharge contact): There was no current feedback signal from the crowbar during field discharge.</p> <p>Trouble Shooting</p> <ul style="list-style-type: none"> • Check crowbar current monitor up to firmware input OVP CURRENT (5901). NOTE: The input OVP CURRENT must be connected to the corresponding digital input. • Check whether the crowbar is flashed correctly in the event of a field breaker trip command. |
| <p>136</p> | <p>Write backup alarm</p> <p>Operator Information The saving of the parameters with the command BACKUPSTOREMODE (11201) failed.</p> <p>Trouble Shooting</p> <ul style="list-style-type: none"> • Try to save the parameters again. If the alarm is repeated, the SDCS-CON-2 board must be replaced. |
| <p>137</p> | <p>Standby trip</p> <p>Operator Information In a 2 channel system, a trip EXC_TRIP (10350) of some kind has occurred in the standby channel. This event (137) is only logged as an ALARM in the fault logger for this channel.</p> <p>Trouble Shooting</p> <ul style="list-style-type: none"> • Select the standby channel with the control panel or connect to the PC (CMT software) and read the entries in the fault logger. |

| Alarm Code | Possible reason / Action |
|-------------------|---|
| <p>138</p> | <p>Init values read</p> <p>Operator Information As a result of action by the operator (jumper on CON-2, CMT software or control panel), the default values are read into the system from the program FEPROM. This means that all the parameters are set to their initial values and the customer-specific user parameters are no longer effective. The default values were read into the system either following the user command BACKUPSTOREMODE (11201) or following a download (Note: RAM and FEPROM parameter versions are not necessarily the same).</p> <p>Trouble Shooting</p> <ul style="list-style-type: none"> • If it was your intention to read the initial values, this alarm can be ignored. It will be reset by the next BACKUPSTOREMODE (11201). |
| <p>141</p> | <p>Aux. AC fail</p> <p>Operator Information The input voltage to the power supply unit UNS 0868 has failed. The system continues to remain in operation (power supply from the backup battery) but this problem should be rectified as soon as possible in order to maintain full redundancy.</p> <p>Trouble Shooting</p> <ul style="list-style-type: none"> • Check the circuit breakers of the AC power supply inside and outside the excitation cabinet. • Check the AC input voltage on the power supply unit UNS 0868, terminals (1,2). • Check the internal fuse -F2 in the power supply unit UNS 0868. • Check the wiring of the whole AC electronics supply system according to the hardware diagrams (LED "AC ON" on the power supply unit UNS 0868 indicates that the AC voltage is present). <p>NOTE: With shunt excitation, this alarm is only released at EXCITATION OFF</p> |

| Alarm Code | Possible reason / Action |
|-------------------|--|
| <p>143</p> | <p>FCB OFF / 24V fail</p> <p>Operator Information The +24 V output voltage from the power supply unit UNS 0868 has failed. Although the system continues to remain in operation, this problem should be rectified immediately. This is because the system no longer responds to remote commands (commands and displays no longer function perfectly). In the event of a trip command, only the field breaker is opened, the firing pulses of the thyristors are neither blocked nor set to converter end position.</p> <p>Trouble Shooting Measure the 24 VDC supply voltage at terminals 6/7 (+) and 8/9 (-) of the power supply unit UNS 0868.</p> <ul style="list-style-type: none"> • If the 24 VDC is not present: <ul style="list-style-type: none"> – Check the wiring of the whole 24 VDC circuit from terminals 6/7 (+), 8/9 (-) according to the hardware diagrams. A short circuit within the circuit is also possible. – Replace power supply unit UNS 0868. • If the 24 VDC supply is present, carry out the following steps: <ul style="list-style-type: none"> – Check whether the status display for the field breaker is functioning correctly. – Replace power supply unit UNS 0868 <p>NOTE: This alarm is only possible if the excitation is switched on and the actuator power supply is present.</p> |

| Alarm code | Possible reason / Action |
|------------|---|
| 144 | <p>Batt. fail</p> <p>Operator Information The DC input voltage of the power supply unit UNS 0868 has failed. Although the system continues to remain in operation (supply from AC source), it is important that this problem should be rectified immediately. This is because neither the field breaker nor the field flashing can be operated.</p> <p>Trouble Shooting</p> <ul style="list-style-type: none"> • Check the circuit breakers of the DC power supply inside and outside the excitation cabinet. • Check the DC input voltage on the power supply unit UNS 0868, terminals 5 (+) and 4 (-). • Check the fuse F1 in the power supply unit UNS 0868 • Check the wiring of the whole DC electronics supply system according to the hardware diagrams (LED "DC ON" on the power supply unit UNS 0868 indicates that the DC voltage is present). • Check the connections between the power supply unit UNS 0868 (connections 14 and 15) and signal processing device UNS 1860 (connections 15, 16 and 17 on the orange-coloured connector) according to the circuit diagram. |
| 145 | <p>Test Supply</p> <p>Operator Information The excitation system with a shunt supply system was switched over to auxiliary supply. The reference value for MANUAL mode is set to the second preset value PRESET2 REF MAN (2108).</p> <p>Trouble Shooting</p> <ul style="list-style-type: none"> • Switch over to normal mode = shunt supply • Check the setting of the parameter SUPPLY MODE (901). <p>NOTE: For safety reasons, the field breaker is automatically opened when switching over and with indirect excitation.</p> |

| Alarm code | Possible reason / Action |
|---|---|
| <p>146</p> | <p>Ext. alarm</p> <p>Operator Information "External alarm" indicates that no signal is present at the digital input block DIX14. This means that circuit breakers have been switched off or fuses burnt out (refer to the specific hardware application drawing to find out which component is responsible for the missing signal).</p> <p>Trouble Shooting</p> <ul style="list-style-type: none"> • Check that all circuit breakers, fuses are OK. • If the alarm is still present, check the wiring of this alarm circuit according to the hardware diagram. <p>NOTE: The connection terminal input 14 on the I/O interface UNS 0863 is inverted by means of the software. This means that this input must be at +24 V (condition). You should therefore check whether the +24 V supply is present.</p> |
| <p>21x 22x 23x 24x 25x 26x</p> | <p>User Event 1 User Event 2 User Event 3 User Event 4 User Event 5 User Event 6</p> <p>x =</p> <ul style="list-style-type: none"> 0: Excitation trip 1: Channel fault 2: AVR fault 3: Alarm 4: Event <p>Note: The SW-Schemata shows the kind of user event .</p> |

3.7.4 Table of fault messages

The following list contains all the fault messages. These are divided into 2 categories:

1. **CH FAIL** - automatically forces transfer to the standby channel in a 2-channel system. In a single-channel system, CH FAIL has the same meaning as a fault.
2. **Faults** - which immediately switch off the excitation system (trip). The system can only be restarted if the fault has been eliminated.

The following table contains, in alphanumeric order, the FAULT TEXTS (TRIP) which are displayed on the control panel UNS 0876 and following „Upload Fault Logger“ in the CMT.

| FAULT TEXT „TRIP“ on panel / CMT | Code |
|----------------------------------|------|
| Auxil. undervoltage | 1 |
| Backup read fault | 18 |
| Compounding trip | 27 |
| Conv. overvoltage | 30 |
| Converter fault | 34 |
| Converter overtemp. | 4 |
| D/O driver 867 fault | 36 |
| D/O driver fault | 32 |
| Ext. CH fault | 47 |
| Field flash. fault | 28 |
| Field overvoltage | 35 |
| Inst.exc.overcurrent | 2 |
| Loss conv. supply | 23 |
| Loss of exc. channel | 14 |
| Loss of exc. trip | 5 |
| Not configured ! | 13 |
| Not in synchronism | 31 |
| OC2 inverse time | 3 |
| Rot. rectifier SC | 39 |
| Rotor overtemp. trip | 7 |
| Trafo overtemp. trip | 6 |
| Type coding fault | 17 |
| UNS 1860 missing | 44 |
| V/Hz fault | 46 |

Table 7

The following table contains, in alphanumeric order, the FAULT CODES (TRIP) of the seven-segment display on the CON-2 board.

| Code | Fault text | Type | Clearing | WORD */BIT | Source |
|--|-----------------------------|--------------------|------------------|---------------|---------------------------------|
| 1 | Auxil. undervoltage | CHANNEL FAULT | To be reset | 1/0 | SDCS-CON-2 |
| 2 | Inst.exc.overcurrent | CHANNEL FAULT | To be reset | 1/1 | Converter |
| 3 | OC2 inverse time | EXCITATION TRIP | To be reset | 1/2 | OC2 EXC CURR 10905 |
| 4 | Converter overtemp. | CHANNEL FAULT | To be reset | 1/3 | Converter |
| 5 | Loss of exc. trip | EXCITATION TRIP | To be reset | 1/4 | UE2 FAULT 10913 |
| 6 | Trafo overtemp. trip | EXCITATION TRIP | To be reset | 1/5 | MONITORING 1 |
| 7 | Rotor overtemp. trip | EXCITATION TRIP | To be reset | 1/6 | ROTOR OVERTEMP TRIP 11005 |
| 13 | Not configured ! | CHANNEL FAULT | To be reset | 2/10 | CH CONFIG 308 |
| 14 | Loss of exc. channel | CHANNEL FAULT | To be reset | 2/5 | UE1 FAULT 10907 |
| 17 | Type coding fault | CHANNEL FAULT | Can not be reset | 2/8 | Converter |
| 18 | Backup read fault | EXCITATION TRIP | Can not be reset | 2/9 | Operating system |
| 23 | Loss conv. supply | CHANNEL FAULT | To be reset | 2/14 | USYN FAIL 15902 |
| 27 | Compounding trip | EXCITATION TRIP | To be reset | 1/9 | CMPD FAILURE 10332 |
| 28 | Field flash. fault | EXCITATION TRIP | To be reset | 1/8 | FLASH FAILURE 10331 |
| 30 | Conv. overvoltage | CHANNEL FAULT | To be reset | 1/12 | Converter |
| 31 | Not in synchronism | CHANNEL FAULT | To be reset | 1/13 | SYN2 FAULT 10914 |
| 32 | D/O driver fault | CHANNEL FAULT | To be reset | 1/14 | FAIL DIG OUT 10721 |
| 34 | Converter fault | CHANNEL FAULT | To be reset | 2/0 | Converter |
| 35 | Field overvoltage | EXCITATION TRIP | To be reset | 2/1 | [OVP CURRENT] 5901 |
| 36 | D/O driver 867 fault | CHANNEL FAULT | To be reset | 1/15 | FAIL DIG OUT EXTD 10817 |
| 39 | Rot. rectifier SC | EXCITATION TRIP | To be reset | 2/4 | DIODE TRIP 10719 |
| 44 | UNS 1860 missing | CHANNEL FAULT | Can not be reset | 1/7 | Operating system |
| 46 | V/Hz fault | CHANNEL FAULT | To be reset | 2/12 | MONITORING 1 |
| 47 | Ext. CH fault | CHANNEL FAULT | To be reset | 2/13 | CONTROL LOGIC |
| * 1 = 11101 = Faultword 1 2 = 11102 = Faultword 2 3 = 11103 = Faultword 3 (not used) | | | | | |

Table 8

3.7.5 Fault tracing instructions for fault messages

In addition to showing the fault number and text, the following tables also include instructions on how to locate the cause of the fault. It is not feasible to provide exact instructions on fault-tracing since, depending on the application, the prerequisites depend on the environmental conditions and are different for each installation. Other procedures are therefore possible and lead to the same goal.

| Error Code | Possible reason / Action | | | | | | | | | | |
|--------------------------------|---|----------------|-------------------------|-------|----------|-------|---------|-------|-------|-------|-------|
| CHANNEL FAULT 1 | <p>Auxil. undervoltage</p> <p>Operator Information The control board has supply monitoring functions for the following voltage levels:</p> <table border="0"> <tr> <td>Supply voltage</td> <td>Undervoltage trip limit</td> </tr> <tr> <td>+ 5 V</td> <td>+ 4.55 V</td> </tr> <tr> <td>+15 V</td> <td>+12.4 V</td> </tr> <tr> <td>+24 V</td> <td>+19 V</td> </tr> <tr> <td>+48 V</td> <td>+38 V</td> </tr> </table> <p>Trouble Shooting</p> <ul style="list-style-type: none"> • Reset the fault message. If the fault message is repeated, the fault may lie in the SDCS-CON-2 or SDCS-POW-1 board • Check the connection between the SDCS-POW-1 and SDCS-CON-2 board (X37). • Switch off power supply to the SDCS-POW-1 board. Disconnect flat cables X1, X2, X13, X14 and X17 from the SDCS-CON-2 board. Switch power supply to SDCS-POW-1 board on again. If fault 1 "Auxil. undervoltage" no longer appears, try to locate the source of the fault by repeating the above test, but only plug in the five connectors of the flat cable connections one at a time. Other fault messages may appear during this test, e.g. fault 44 "UNS 1860 missing"). If this fault appears when X1 is plugged in and disappears when X1 is disconnected, this fault may be caused by a defective signal processing device UNS 1860 or I/O interface UNS 0863. To identify the defective board, disconnect X4 on the UNS 1860 board. <p>If fault 1 "Auxil. undervoltage" cannot be traced in this way, the SDCS-CON-2 board should first be exchanged. If the fault is still present, the SDCS-POW-1 board should be exchanged. If this remedies the fault, try replacing the original SDCS-CON-2 board.</p> | Supply voltage | Undervoltage trip limit | + 5 V | + 4.55 V | +15 V | +12.4 V | +24 V | +19 V | +48 V | +38 V |
| Supply voltage | Undervoltage trip limit | | | | | | | | | | |
| + 5 V | + 4.55 V | | | | | | | | | | |
| +15 V | +12.4 V | | | | | | | | | | |
| +24 V | +19 V | | | | | | | | | | |
| +48 V | +38 V | | | | | | | | | | |

| Error Code | Possible reason / Action |
|---------------------------------------|--|
| <p>CHANNEL FAULT 2</p> | <p>Inst.exc.overcurrent</p> <p>Operator Information This is a very fast short circuit of protection circuit. It protects against short circuits inside or at the output of the converter as well as big transients in the synchronous machine (3- or single-phase short circuits). The excitation current is higher than the set maximum current I EXC MAX LEVEL (506) for more than the set delay DLY IE MAX (513).</p> <p>NOTE: Short delay times are only used in 2-channel systems in order to achieve converter redundancy.</p> <p>Trouble Shooting</p> <ul style="list-style-type: none"> • If the fault can be reset, check whether: <ul style="list-style-type: none"> - the converter bridge is OK (normally indicated by fault 34 "Converter failed"). - all thyristor fuses in the converter section are OK (normally indicated by fault 34 "Converter failed"). - the converter is dimensioned correctly or that no changes in load have occurred [normally protected by limiters and overcurrent protection (alarm 106 "OC1 inverse time“, fault 03 "OC2 inverse time“)]. - converter output cables are OK. - the field circuit is OK (no short circuits). • If the fault message is repeated several times, the converter may be overloaded. • Check that the hardware coding of the SDCS-PIN-XX board has been set correctly (see "Hardware Description") and check the connection between the SDCS-PIN-XX and the SDCS-CON-2 board (X12 and X13). • Check whether the setting of the parameter I EXC MAX LEVEL (506) is correct. • If the fault message is repeated, replace the SDCS-PIN-XX board (measurement of excitation current) or the SDCS-CON-2 board. |

| Error Code | Possible reason / Action |
|--|---|
| <p>EXCITATION TRIP 3</p> | <p>OC2 inverse time</p> <p>Operator Information This fault message is generated due to automatic changeover to the standby channel (if provided) or MANUAL mode initiated by alarm 106 "OC1 inverse time". This changeover failed to take place within 3 sec.</p> <p>Trouble Shooting</p> <ul style="list-style-type: none"> • In addition to the checks for alarm 106 "OC1 inverse time", the backup system (second channel) must be checked as follows: <p>Single-channel system:</p> <ul style="list-style-type: none"> - MANUAL mode was also not able to take over control. This means that there is a fault in the gate control unit. - Check the converter in accordance with the commissioning instructions. - Replace the SDCS-CON-2 or SDCS-PIN-XX board. <p>Two-channel system:</p> <ul style="list-style-type: none"> - The standby channel and/or its MANUAL control were not able to take over control. This means that there is a fault in the gate control unit of the active channel and the standby channel or a short circuit on the output side of the converter. - Check the converter in accordance with the commissioning instructions. - Replace the SDCS-CON-2 or SDCS-PIN-XX board. |

| | |
|---|---|
| <p>CHANNEL FAULT</p> <p>4</p> | <p>Converter overtemp.</p> <p>Operator Information</p> <p>The temperature measured on the heat sink is higher than the configured maximum temperature, determined by the hardware coding MAX BR TEMP DEG (10512) or by the parameter SET MAX BR TEMP (509). With type C4, the temperature of the intake air is measured.</p> <p>Before this fault is triggered, alarm 105 "Conv. overtemp. alarm" will already have responded [approx. 10°K below the alarm level for the fault message (see alarm 105)].</p> <p>In a two-channel system, channel changeover has first priority. This has the advantage that changeover to a "cold" standby converter takes place.</p> <p>Trouble Shooting</p> <ul style="list-style-type: none"> • In addition to the checks for alarm 105, check whether the temperature sensing is OK. <p>Compare the temperature BRIDGE TEMP DEG (10507) with the ambient temperature, previously measured values and the set value MAX BR TEMP DEG (10512). If the value is far from the expected one, replace the temperature sensor and/or the SDCS-CON-2 board.</p> |
|---|---|

| Error Code | Possible reason / Action |
|--|---|
| <p>EXCITATION TRIP 5</p> | <p>Loss of exc. trip</p> <p>Operator Information This fault message occurred due to previous initiation of CH fault 14 „Loss of exc. channel“, changeover to second channel (if provided) failed to take place within 2 sec.</p> <p>Trouble Shooting</p> <ul style="list-style-type: none"> • single-channel system: <ul style="list-style-type: none"> - See fault 14 • Two-channel system: <ul style="list-style-type: none"> - Check both channels in accordance with description of fault 14. |
| <p>EXCITATION TRIP 6</p> | <p>Trafo overtemp. trip</p> <p>Operator Information The temperature of the excitation transformer has risen higher than the maximum permitted value (determined by the 2nd stage temperature relay UNS 0006).</p> <p>Trouble Shooting</p> <ul style="list-style-type: none"> • If this fault occurs without alarm 103 "Trafo temp. alarm" having responded beforehand, then this fault may have been caused by a bad connection to the PTC temperature sensor (a broken connection will cause a trip!). • If both stages have responded, follow instructions for alarm 103 "Trafo temp. alarm". <p>NOTE: The exciter and synchronous machine must be shut down to prevent damage to the transformer. Report the problem to ABB.</p> |

| Error Code | Possible reason / Action |
|--|--|
| <p>EXCITATION TRIP 7</p> | <p>Rotor overtemp. trip</p> <p>Operator Information This is the 2nd stage of the temperature monitoring described under alarm 104 "Rotor temp. alarm". The measured temperature has reached the set value RTEMP DEG FAULT (1010).</p> <p>Trouble Shooting</p> <ul style="list-style-type: none"> • If the fault and alarm are triggered practically simultaneously (see entry in fault logger), the measuring circuits for excitation voltage and excitation current should be checked first. • If there is a delay between the triggering of the fault and alarm messages, fault tracing should be carried out as described for alarm 104. |
| <p>CHANNEL FAULT 13</p> | <p>Not configured !</p> <p>Operator Information The system is not configured after the program has been loaded ("Software Update").</p> <p>Trouble Shooting</p> <ul style="list-style-type: none"> • The system should be configured according to its function using the parameter CH CONFIG (308). Single-channel (SFE), channel 1 (AFT CH1) or channel 2 (AFT CH2). For a "software update", refer to the document update.doc on the installation diskette. |

| Error Code | Possible reason / Action |
|---|---|
| <p>CHANNEL FAULT 14</p> | <p>Loss of exc. channel</p> <p>Operator Information The excitation dropped below the set limits START UEL MONIT (904) for longer than the set delay DLY UEL MONITOR (905). This means that the underexcitation limiter was not able to keep the excitation at the set limiting characteristic [parameter REFx Q(P) LIM (1501-1505)] within the set delay DLY UEL MONITOR (905) and margin START UEL MONIT (904). This causes a changeover to the standby channel (if provided). In single-channel systems, fault message 5 "Loss of exc. trip" appears.</p> <p>Trouble Shooting</p> <ul style="list-style-type: none"> • If the system remains stable in the second channel, the converter supply of the faulty channel must be checked first. This is normally indicated by fault 23 "Loss conv. supply". In a single-channel system, check the power supply from source to the converter input according to the commissioning instructions. • If this fault was the result of severe voltage drop at the generator terminals caused by an external fault (e.g. line short circuit), then no fault is to be expected within the excitation system. Change back to first channel or restart the system following a trip. • It is possible that the underexcitation limiter is too sluggish or the gain and/or boundary values are set too low. Check the relevant parameter settings of the underexcitation limiter (group 15) and monitoring (group 9). • If the power supply is O.K., also check the gate control and converter in accordance with the commissioning instructions (faulty converter functions are normally indicated by fault 34 "Converter failed"). • In a two-channel system, changeover to the standby channel (second channel) always has first priority. Check the relevant transducer functions (UNS 1860) and the required signals (I, P, Q, I SINPHI, I COSPHI) of group 1 using the control panel or CMT software, and compare them with those of the running (intact) channel. |

| Error Code | Possible reason / Action |
|--|--|
| <p>CHANNEL FAULT 17</p> | <p>Type coding fault</p> <p>Operator Information The SDCS-PIN-XX board is not connected to the SDCS-CON-2 board or SDCS-PIN-XX is not coded correctly. The parameters 507 to 511 have been changed, e.g. for fine tuning or for the converter type C2b, which does not have any hardware coding. Carry out BACKUPSTOREMODE (11201) SAVE PARAM1 SET or SAVE PARAM2 SET if parameters 507to 511 have been changed.</p> <p>Trouble Shooting</p> <ul style="list-style-type: none"> • Carry out BACKUPSTOREMODE (11201) SAVE PARAM1 SET or SAVE PARAM2 SET if parameters 507 to 511 have been changed. • Check the connection between the SDCS-CON-2 and SDCS-PIN-XX boards (flat cable X12 and X13). • Check that the coding of the SDCS-PIN-XX board was done correctly (see "Hardware Description"). |
| <p>EXCITATION TRIP 18</p> | <p>Backup read fault</p> <p>Operator Information This fault indicates that the parameter formats of the system program (stored in Flash PROM D33) are not the same as the stored parameter values (stored in PROM D35).</p> <p>Trouble Shooting</p> <ul style="list-style-type: none"> • Usually, this fault occurs after a download of a new program. In this case, the problem can be solved as follows: Save the new parameters to PROM D35 using the command BACKUPSTOREMODE (11201). Activate the command SAVE PARAM1 SET. During saving, the display on the control panel first changes to 8 = ERASING..., then to 10 = PROGRAMMING and finally to 0 = NONE. • It is possible that the Flash PROMs D33 or D35 are defective. Replace the SDCS-CON-2 board. |

| Error Code | Possible reason / Action |
|--|---|
| <p>CHANNEL FAULT 23</p> | <p>Loss conv. supply</p> <p>Operator Information Single-channel system: The converter supply voltage has temporarily dropped below the relative synchronous machine voltage minus the margin set by parameter DEV U MONITORING (907).</p> <p>Possible causes:</p> <ul style="list-style-type: none"> - Converter supply switched off - Converter fuse burnt out - Excitation transformer secondary short circuit (including connections up to converter input). <p>NOTE: This monitoring is only active for a 3-phase shunt supply [see CONV SUPPLY (515) and SUPPLY MODE (901)].</p> <p>Trouble Shooting</p> <ul style="list-style-type: none"> • Check the whole converter supply system from the source to the converter input of the faulty channel. • Check the excitation transformer and connections up to the converter input for short circuit. • Check the so-called "synchronous voltage" U SYN RELATIVE (10503) and U SYN V (10504) (which is responsible for the converter supply) and compare with the reference measurements at the converter input. U SYN RELATIVE (10503) is 100% at the set parameter value U SYN V NOMINAL (504). <p>NOTE: U SYN RELATIVE (10503) drops several per cent with increasing excitation. This must be taken into consideration when setting the margin DEV U MONITORING (907).</p> <ul style="list-style-type: none"> • Check the connection between the SDCS-PIN-XX and SDCS-CON-2 boards (flat cables X12 and X13). Replace the SDCS-PIN-XX or SDCS-CON-2 board. |

| Error Code | Possible reason / Action |
|---|--|
| <p>EXCITATION TRIP 27</p> | <p>Compounding trip</p> <p>Operator Information The battery compounding was active for longer than the delay CMPD MAX TIME (307) (only applies to indirect excitation systems with shunt supplies). This message is only displayed in the active channel of a 2-channel system.</p> <p>Trouble Shooting</p> <ul style="list-style-type: none"> • Check whether a generator short circuit occurred for longer than CMPD MAX TIME (307). • Check whether the compounding supply (batteries) is present. • If the compounding effect is too great or too small, check the compounding control circuit (K30 and K40). Check the compounding current at standstill by switching on the excitation. <p>NOTE: On no account use or simulate "TEST SUPPLY" from the auxiliary power circuit for this test.</p> <ul style="list-style-type: none"> • Check whether the parameters CMPD ON LEVEL (306), CMPD MAX TIME (307) and SUPPLY MODE (901) have been set correctly. |

| Error Code | Possible reason / Action |
|---|--|
| <p>EXCITATION TRIP 28</p> | <p>Field flash. fault</p> <p>Operator Information The excitation system was not able to build up the generator voltage to FLASH OFF LEVEL (304) within the maximum permitted field flashing period FLASH MAX TIME (305) (only applies to systems with shunt supply). This message is only displayed in the active channel of a 2-channel system.</p> <p>Trouble Shooting</p> <ul style="list-style-type: none"> • Check if field flashing supply (battery or AC line) is present. • Check that the field breaker is closed and that no de-excitation command is in effect. • Ensure that the field flashing current is > 15% Ifo (no-load field current) (setting of resistor R30 / R40). The field flashing circuit must be able to increase the generator voltage so high that the synchronous voltage reaches at least 10 V, otherwise the firing pulses for the converter remain blocked. • Check the field flashing circuit and the function of the field flashing contactor (also the compounding contactor, if installed). • Check the measurement circuits for generator voltage from the voltage transformer to the software and the synchronous voltage from the converter input terminals to the software. Use a multimeter to check whether the real measured values correspond with the software signals U MACH RELATIVE (10101) and U SYN RELATIVE (10503). • Ensure that the parameters FLASH OFF LEVEL (304), FLASH MAX TIME (305) and SUPPLY MODE (901) are set correctly. <p>NOTE: In a static excitation system, the field flashing circuit may only be activated for one minute per hour. After six (10 second) unsuccessful attempts to activate, a period of at least one hour must be paused before field flashing is attempted again.</p> |

| Error Code | Possible reason / Action |
|--|--|
| <p>CHANNEL FAULT 30</p> | <p>Conv. overvoltage</p> <p>Operator Information The converter supply voltage, signal U SYN RELATIVE (10503), has been higher than the limit of 130% for 10 sec. (not used for chopper units type C5).</p> <p>Trouble Shooting</p> <ul style="list-style-type: none"> • Check if there was (or is) a real overvoltage between the converter terminals U1, V1 and W1. • Check whether the displayed measured value U SYN RELATIVE (10503) corresponds to the real voltage at the terminals U1, V1 and W1. If not, check setting of the parameter U SYN V NOMINAL (504). • Check the hardware setting of the SDCS-PIN-XX board according to the "Hardware Description" • Check the connection between the SDCS-PIN-XX and SDCS-CON-2 boards (flat cables X12 and X13). If the fault message is repeated, replace the SDCS-PIN-XX or SDCS-CON-2 board. |
| <p>CHANNEL FAULT 31</p> | <p>Not in synchronism</p> <p>Operator Information Although the converter supply is present, the gate control has fallen out.</p> <p>Trouble Shooting</p> <ul style="list-style-type: none"> • If fault 23 "Loss conv. supply" occurs with shunt supply, one phase (U or V) of the synchronous voltage is missing. • Hardware fault on the SDCS-CON-2-board. The NMI signal for the CPU is missing. • Check the connection between the SDCS-PIN-XX and SDCS-CON-2 boards (flat cable X12, X13). If the fault occurs again, replace the SDCS-PIN-XX or SDCS-CON-2 board. |

| Error Code | Possible reason / Action |
|--|--|
| <p>CHANNEL FAULT 32</p> | <p>D/O driver fault</p> <p>Operator Information The relay driver on the signal processing device UNS 1860 is defective.</p> <p>Trouble Shooting</p> <ul style="list-style-type: none"> • Check the connection between the signal processing device UNS 1860 and the SDCS-CON-2 board (flat cables X1, X2, X14 and X17). • Check the connection between the signal processing device UNS 1860 and the external I/O interface UNS 0863 (flat cables X3 and X4). • Replace signal processing device UNS 1860, I/O interface UNS 0863 or SDCS-CON-2 board. |

| Error Code | Possible reason / Action |
|--|--|
| <p>CHANNEL FAULT 34</p> | <p>Converter failed</p> <p>Operator Information</p> <p>Interruption in a thyristor branch. This can also be due to a short circuit which was switched off by the fuses.</p> <p>Trouble Shooting</p> <ul style="list-style-type: none"> • Check the phase sequence of the converter supply and that the parameter PHASE SEQ CW (503) is set correctly. Check that the input [SEL SEQUENCE] (5501) corresponds to the actual phase sequence. • Check that all thyristors are fired correctly by checking converter output voltage with an oscilloscope. There should be 6 pulses (3 phase system) or 2 pulses (single phase system) during a supply voltage cycle. • Check the connections of the gate unit. • Check that the measured value U SYN V (10504) displayed on the control unit corresponds to the real voltage at the converter input. If the displayed value is lower, it is possible that a phase is missing. Check the connections and fuses (F101 to 103) on the PIN 20xB board (type C2). In a 3 phase shunt supplied system, this failure is indicated by fault 23 "Loss conv. supply". • Check branch fuses (type A5) • Measure the gate-cathode resistance of all thyristors (with an ohmmeter). Compare these results and if one resistance value is clearly higher than the others, exchange this thyristor as described in chapter 3.4 "Semiconductors" and 3.5 General Instruction how to handle the Semiconductors "). • If no thyristor fault can be found and the fault cannot be reset, also check the connections between the current transformers and the SDCS-PIN-XX board and between the SDCS-PIN-XX board and SDCS-CON-2 board. The ripple voltage across the burden resistor must be less than 90 mV (<6% converter rated current). <p>Replace current transformers (C.T.), the SDCS-PIN-XX or SDCS-CON-2 board.</p> |

| Error Code | Possible reason / Action |
|---|--|
| <p>EXCITATION TRIP 35</p> | <p>Field overvoltage</p> <p>Operator Information The field overvoltage protection (crowbar) was fired due to a positive or negative field overvoltage</p> <p>Trouble Shooting</p> <ul style="list-style-type: none"> • Negative field overvoltage occurs if the excitation circuit fails to function correctly (field discharge contact or controlled de-excitation via the crowbar) or if another interruption occurs in the power supply or field circuit (e.g. fuses, circuit breakers) Check: <ul style="list-style-type: none"> - the function of the field breaker at the input or output of the converter - line and insulation resistance of the field winding - line and insulation resistance of the whole field circuit. • Positive field overvoltage is usually caused by a generator fault with negative field current, e.g. pole slip, short circuit at the generator terminals etc. Check whether there is (or has been) a problem with the generator. If no such situation exists, report the problem to ABB. |
| <p>CHANNEL FAULT 36</p> | <p>D/O driver 867 fault</p> <p>Operator Information The relay driver on the I/O expansion board UNS 0867 is defective.</p> <p>Trouble Shooting</p> <ul style="list-style-type: none"> • Check the <u>connection</u> between the I/O expansion board UNS 0867 and the second external I/O interface UNS 0863 (flat cables X3 and X4). • Replace the I/O expansion board UNS 0867, second I/O interface UNS 0863 or SDCS-CON-2 board. |


| Error Code | Possible reason / Action |
|---|---|
| <p>EXCITATION TRIP 39</p> | <p>Rot. rectifier SC</p> <p>Operator Information A short circuit of a diode of the rotating rectifier was detected (only applies to AC excitation machines).</p> <p>Trouble Shooting</p> <ul style="list-style-type: none"> • Check the rotating rectifier for short circuits (especially the diodes). • Check the settings of the diode failure monitoring UNS 0864 according to the data sheet and the "Commissioning instructions". • Check the connections between the diode failure monitoring UNS 0864 and the signal processing device UNS 1860 (X24) and between the signal processing device UNS 1860 and the SDCS-CON-2 board (X1, X2, X14 and X17). • Replace the diode failure monitoring UNS 0864, signal processing device UNS 1860 or the SDCS-CON-2 board. |
| <p>CHANNEL FAULT 44</p> | <p>UNS 1860 missing</p> <p>Operator Information The UNITROL[®] F system has no connection to the signal processing device UNS 1860.</p> <p>Trouble Shooting</p> <ul style="list-style-type: none"> • Check the connections between the signal processing device UNS 1860 and the SDCS-CON-2 board (X1, X2, X14 and X17). • Replace the signal processing device UNS 1860 or the SDCS-CON-2 board. |

| Error Code | Possible reason / Action |
|---|---|
| <p>CHANNEL FAULT 46</p> | <p>V/Hz fault</p> <p>Operator Information The machine voltage was higher than the V/Hz limiter characteristic (set by parameters 1911...1913) START V/HZ MON (912) for longer than the set delay DLY V/HZ MONITOR (913). The V/Hz limiter was not able to limit the machine voltage to the set V/Hz characteristic.</p> <p>Trouble Shooting</p> <ul style="list-style-type: none"> • If everything else is O.K., it is possible that the safety margin or delay time were set too restrictively. • A voltage transformer failure was not detected correctly. <p>NOTE: In MANUAL mode, the V/Hz limiter does not function when ON LINE.</p> <ul style="list-style-type: none"> • If the system remains stable after switching channels, check the voltage transformer circuit, the AVR, gate control and converter of the faulty channel. If it is not possible to change back to the original channel, because the autofollower doesn't work (no RDY XFER), or if the same fault occurs again, then there could be a fault in the gate control circuit. Check the relevant channel at the next shutdown. |
| <p>CHANNEL FAULT 47</p> | <p>Ext. CH fault</p> <p>Operator Information This fault is caused by an external CHANNEL FAULT (e.g. auxiliary breakers of fuses or contact breakers in the converter supply line, fan fuses, fan monitoring delta P).</p> <p>Trouble Shooting</p> <ul style="list-style-type: none"> • In chopper applications (C5) this fault occurs in addition to fault 34 "Converter failed" if the circuit breaker in the actuator supply is tripped by the chopper hardware. • Check the protected components for overload, short circuits etc. with reference to the hardware diagrams. |

Excitation System

UNITROL[®] F Series

Erection Instructions

| | | | | | | | | | |
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1 General

In the following sections, these installation instructions describe the complete installation / erection of an excitation system of type UNITROL® F, with all the information required for this purpose. A distinction is made between three different forms of delivery:

- Delivery of components as spare parts, fully tested.
- Delivery of fully-tested “Lütze“ frame as a system (mounting frame) for installation in the operator’s cabinet.
- Delivery of fully-tested equipment in the form of an installation cabinet with one or more sections.

The different sections include all the necessary information for each form of delivery. In addition, the sections include information on correct storage, transport and erection.

These instructions are intended for technical personnel who are qualified to carry out installation work on electrical equipment. These personnel must already be familiar with this document and with the accident-prevention regulations for power station installations!

The following safety instructions must be observed before installation is commenced!

1.1 Safety instructions

All relevant safety instructions must be followed during installation, commissioning and maintenance work. It is essential to read the safety instructions and observe the following points before starting any work on the system.

- The power supply diagram must be consulted before any work is carried out!

Note: Attention is to be paid to the possible power supply of USV installations!

- The supply voltage is to be disconnected from the terminals before starting work! After the supply voltage has been isolated from the terminals, always ensure by measurement that the voltage has really dropped! Voltages may still be present in excitation equipment due to auxiliary or battery power supplies!
- No equipment may be connected to the terminals while under voltage!
- No voltage tests may be carried out on the converter modules!
- Be aware of the fact that electrostatic discharge (ESD) can damage electric circuits. Electronic components must be treated with care!

1.2 Receipt of the delivery

All crates should be checked on delivery, before unpacking, for external transport damage. If the packing shows signs of damage, the equipment must only be unpacked in the presence of representatives of the insurers and the manufacturer. External damage must be recorded immediately on the shipping papers! Damage which is only discovered after unpacking must be reported in writing to the insurers and the manufacturer within 1 week!



The manufacturer will not accept any liability unless the damage is reported!

1.2.1 Transporting the packed equipment

The equipment can be unloaded from the transport vehicle by crane or forklift truck.

When moving crates with lifting gear, they may only be suspended from the points marked with the chain symbol according to DIN 55402, symbol G. ①

When raising and moving crates using a forklift truck, the fork may only be inserted parallel to the skids on the bottom. ②

To avoid the risk of crates tipping over, attention must be paid to the centre of gravity, which is marked with the symbol F in accordance with DIN 55402, when moving the fork into position and when raising crates. ③



Only remove the packing after delivery of the equipment to the site of installation!

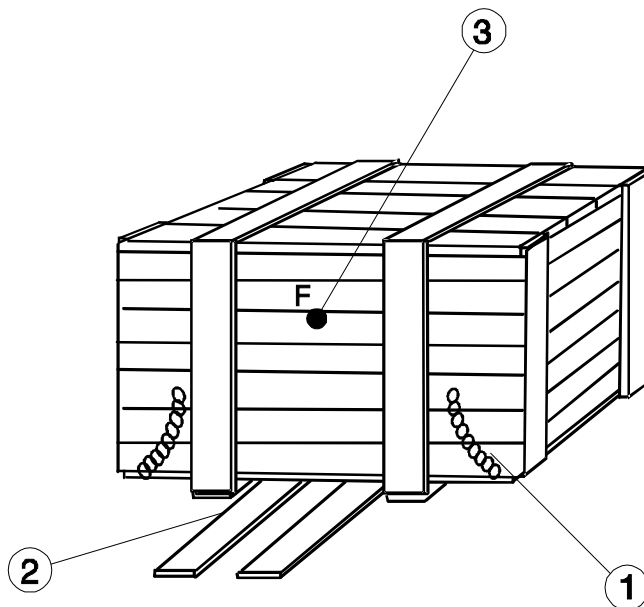


Fig. 1 Transporting crates

1.3 Storage

This section describes the duties and responsibilities of those persons in charge of storing the equipment.

The storage procedures described below are intended to exclude the possibility of damage or a degradation of quality due to corrosion, dirt or mechanical damage. The corresponding precautions must be observed from the time the equipment is put into storage until the time it is taken out of storage and erected!

1.3.1 Storage conditions

The equipment must be stored, in its original packing, in a closed room and must be placed on pallets or wooden supports. The storage room must be clean, dry and dust-free. Make sure that the storage area meets the environmental requirements defined below:

- permissible storage temperature -25...+55 °C / -13...+131°F
- relative humidity (no condensation allowed) 5...85 %

1.3.2 Storage buildings and locations

Access to the stores should be controlled and should be restricted to authorised personnel.

Fire-fighting equipment suitable for the type of stores and material should be provided and kept in good order. The place of storage should be kept clean at all times and the accumulation of waste and old packing material should be avoided! In order to prevent soiling or damage to the equipment, precautions must be taken to prevent insects and small animals from getting into the storage area.

1.3.3 Storage methods

In order to minimise the risk of damage, all the equipment must be stored in such a way that it is easily accessible for inspection and/or repairs.

The equipment must be stacked in such a way that the items below do not suffer damage due to the weight of those above.

1.3.4 Checks during storage

The checks to be carried out concern the following points:

- identification and markings
- covers and seals
- protective coatings and materials
- desiccants
- mechanical damage
- cleanliness

To ensure that the quantities and condition of the goods are in order, they should be inspected periodically (at least every 2 months). Any deterioration or discrepancies must be noted and corrective action taken as soon as possible!

If, when checking the humidity indicators, the humidity inside the foil is found to be over 40%, or the activity of the desiccant is reduced, the desiccant must be regenerated or replaced. The foil is to be opened and the desiccant replaced. New desiccant can be inserted or the existing desiccant can be regenerated by heating it in a dryer to between 120°C / 248°F and 140°C / 284°F. The foil must be resealed after the desiccant has been replaced.

1.3.5 Handling the goods in storage

All covers, bungs and other seals must be intact. Covers and hoods which are removed or opened for inspection must be replaced and resealed immediately after the inspection.

Temporary protective foils (for protection against humidity) must be kept intact at all times. Should it become necessary to replace a foil, only properly tested and approved material may be used.

1.4 Unpacking

The equipment which is delivered must be checked against the order on the basis of the labels and nameplates. If there are any discrepancies between the items delivered and the order, this must be reported to the responsible project or sales management at ABB!



NOTE: Only remove the packing after delivery to the site or place of installation!

1.4.1 Unpacking the components



NOTE: All electrical components must be handled with care.

Be aware of the fact that electrostatic discharge (ESD) can damage electronic circuits. Electronic components must be handled with care!

1.4.2 Unpacking the mounting frame

The following procedure should be followed when unpacking the mounting frame:

1. Remove the top of the crate.
2. Remove all supports inside.
3. Remove the side walls, then remove the plastic foil.
4. Check the mounting frame for transport damage.
5. Record any damage as instructed in section 1.2

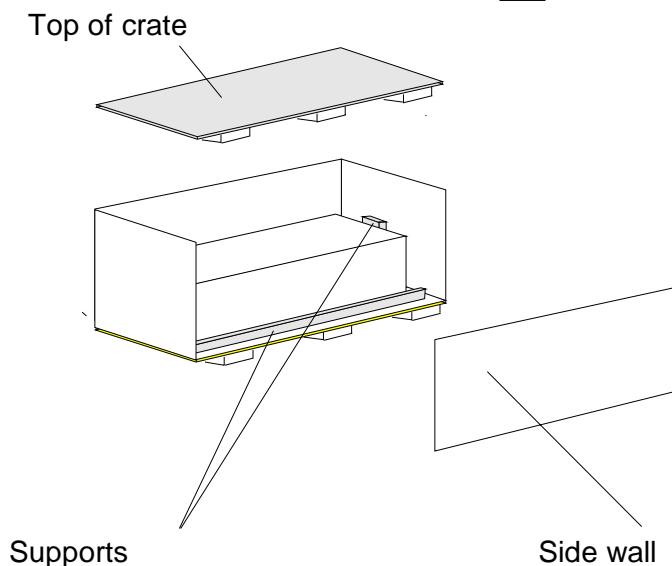


Fig. 2 Unpacking the mounting frame

1.4.3 Unpacking the equipment / cabinets

The following procedure should be followed when unpacking the equipment / cabinets:

1. Remove the top of the crate
2. Remove the front, rear and side walls
3. Release the floor of the crate
4. Check the cabinets for transport damage
5. Record any damage as instructed in section 1.2

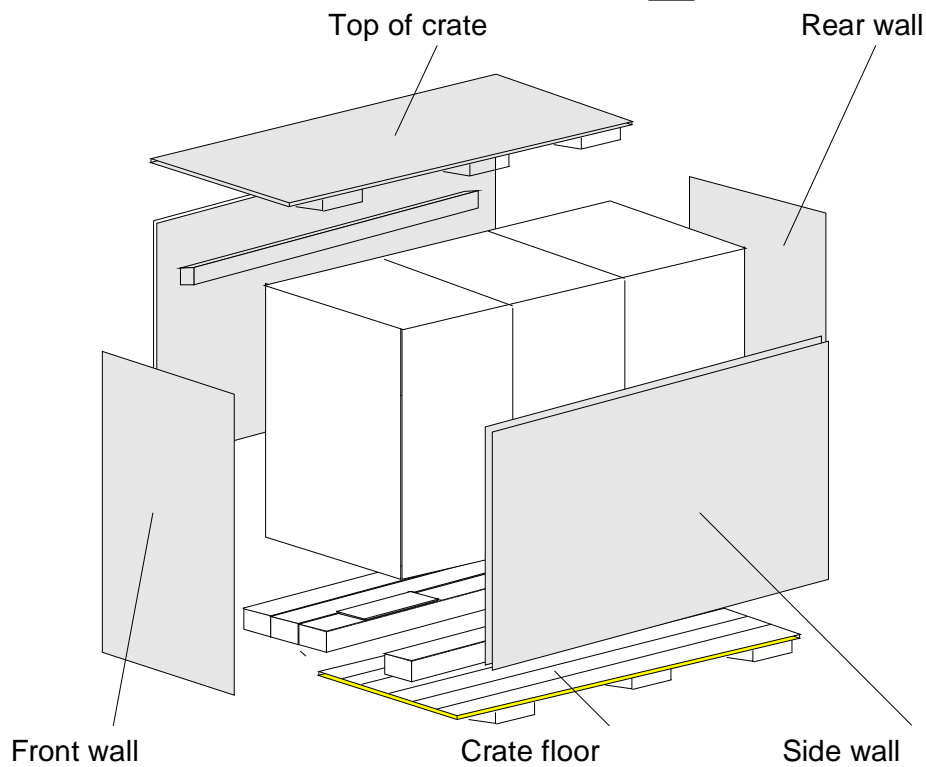


Fig. 3 Unpacking the equipment / cabinet

1.5 Transport of equipment / cabinets

After unpacking, the equipment can be unloaded and moved to the place of installation by crane or forklift. The equipment may only be set down on a level surface! Ensure that the equipment cannot fall over while being moved!

1.5.1 Transport by crane

The equipment / cabinets are equipped with lifting posts on the base frame (see [Fig. 4](#)) or with transport brackets on the top (see [Fig. 5](#)).

The following points must be observed when transporting the cabinets by crane using lifting posts:

- Only the lifting posts attached to the base frame of the cabinets may be used when lifting the cabinets by the base frame!
- The cabinets must be transported in such a way that they do not suffer shocks.
- A suspension beam must always be used for lifting.
- The dimension "L" must be greater than the dimension "M"
- Only ropes of the appropriate strength and length may be used when lifting by crane!

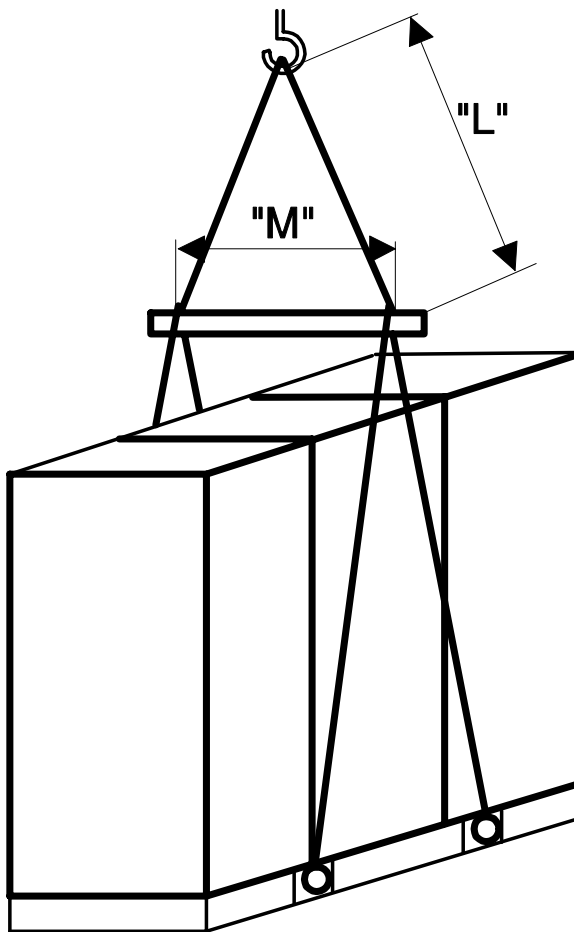


Fig. 4 Transport using lifting posts

The following points are to be observed when transporting by crane using lifting brackets:

- The angle of suspension (angle between the ropes at the crane hook) may not exceed 120°!
- It is not permitted to lift the cabinet directly by the frame!
- The cabinets may only be set down on a level surface!
- The lifting brackets can be dismantled from the cabinets after installation. The bolt holes must be plugged with the supplied caps and sealed with silicone (see section 3.3.7 Sealing).

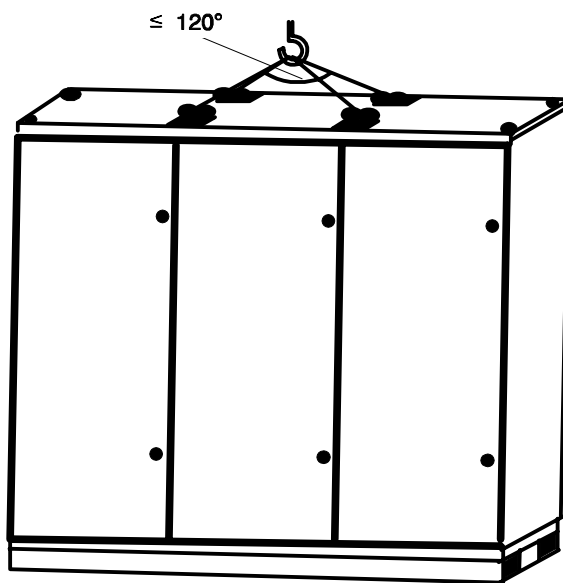


Fig. 5 Transport using lifting brackets

1.5.2 Transport over floors

- The cabinets can be transported over floors using forklift trucks (see [Fig. 6](#)), lifting and rolling devices or, if nothing else is available, on round bars (at least 4 round bars) (see [Fig. 7](#)).
- The wooden cross-beams must be removed when using round bars!
- The cabinets may only be transported in a vertical position!
- Tipping and tilting must be avoided!
- Transport in a horizontal position is only permissible following consultation with the responsible project or sales management at ABB!

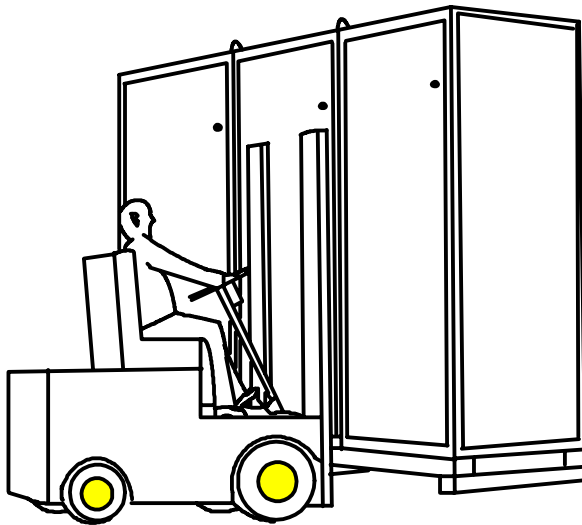


Fig. 6 Transport using a forklift truck

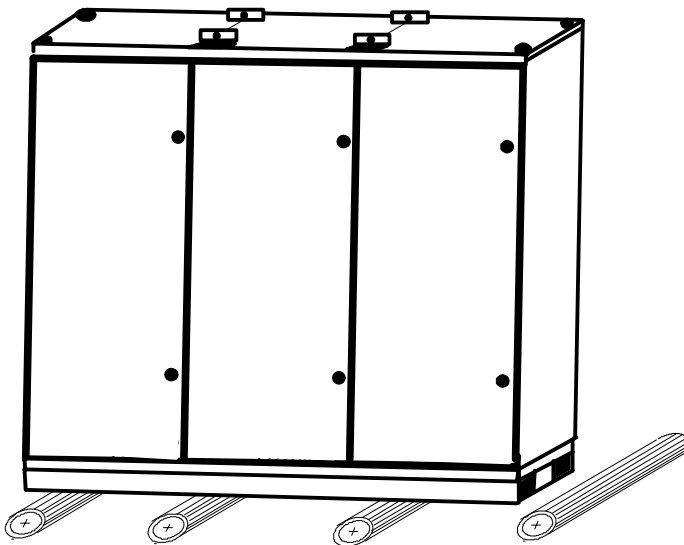


Fig. 7 Transport using round bars

2 Installation planning

To guarantee safe and faultless installation / erection, the following advice must be followed before starting the actual installation work. This advice is divided up according to the forms of delivery:

- Mounting frame
- Equipment / cabinet

2.1 Installation planning for mounting frame

See section 3.2 for detailed planning.

Side view

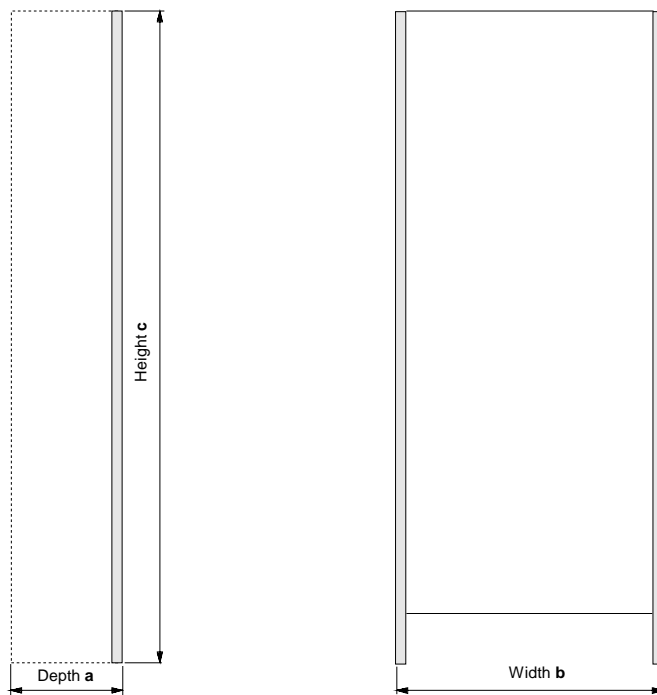


Fig. 8 Free space required for the mounting frame. The dimensions **a,b,c** have to be taken from the enclosed cabinet overview (Drawing ...E01)

2.2 Installation planning for equipment / cabinets

To avoid damage due to moisture and dirt, the following work must be carried out before installing the equipment / cabinets:

- Drill the securing holes according to the component layout plan, then clean the holes and the area of installation. See also section 3.3 "Installation of cabinets / equipment"
- Make any holes needed in the floor, walls or ceiling for cables, leads, pipes and busbars as indicated in the construction drawings
- Restore previous surface condition

It must be ensured that the internal space requirements are complied with! Adequate lighting and access to the place of installation must be ensured. Wide fluctuations in temperature under conditions of high humidity are to be avoided by heating the place of installation. The formation of condensation is to be prevented.

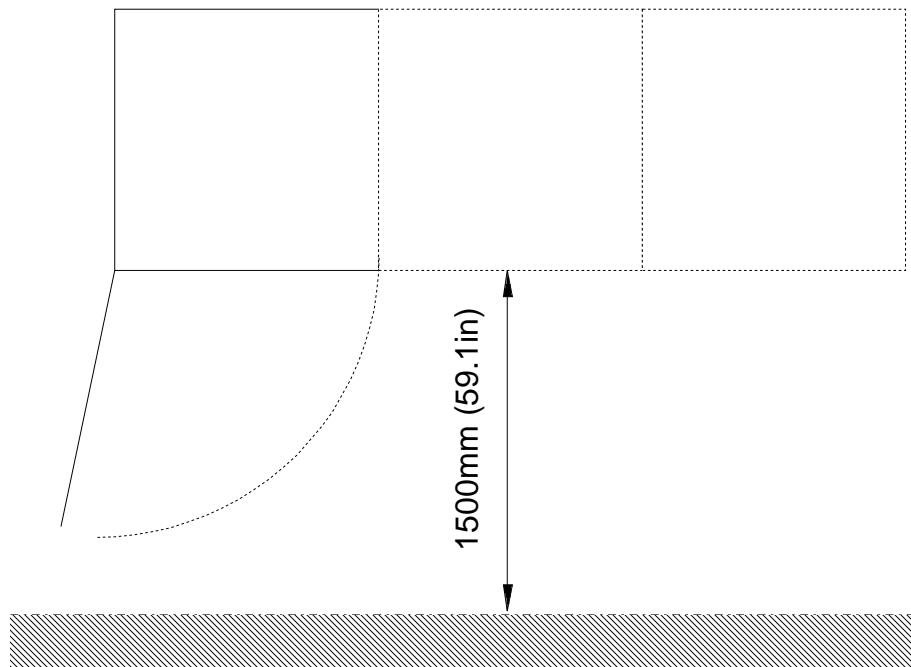


Fig. 9 Required free space around equipment / cabinets

All of the dissipated heat generated by the system (according to manufacturer's data) must be conducted away in the installation space so that no local temperature increases can occur at the air inlet openings.

For this reason, the installation space must be adequately ventilated .

3 Installation

3.1 Electrical connections

When selecting the cables and wires, attention should be paid to the length of the cables and how they are laid. Sensitivity to interference increases with cable length, as do voltage drops.

3.1.1 Connection to busbars

Busbar connections are system-specific and, if required, are defined in the layout plan.

The user must clean the ends of the busbar before connecting them:

Thoroughly clean the contact surfaces using a lint-free cloth. Where the surfaces are very dirty, a cleansing agent (e.g. alcohol) or a soft brush may be used. The surfaces must be absolutely free of dirt and grease. Apply contact grease evenly to the surfaces using a sponge rubber pad. There must only be a thin layer of contact grease on the surfaces. The busbars must then be connected immediately.

Screw-fastening elements must be used for the electrical connection, and must be tightened to the torques given below. However, they should be lubricated with contact grease beforehand.

| Bolt size: | M5 | M6 | M8 | M10 | M12 | M16 | M20 | M24 |
|------------------|------|------|------|-------|------|-------|-------|-------|
| Torque (Nm): | 2.2 | 3.7 | 9.0 | 18.8 | 31.2 | 75.5 | 152.5 | 146.2 |
| Torque (lbf.ft): | 1.62 | 2.73 | 6.64 | 13.86 | 23.0 | 55.68 | 112.5 | 107.8 |

Tab. 1

The connection of Cu cables to Cu busbars is illustrated in the following drawing:

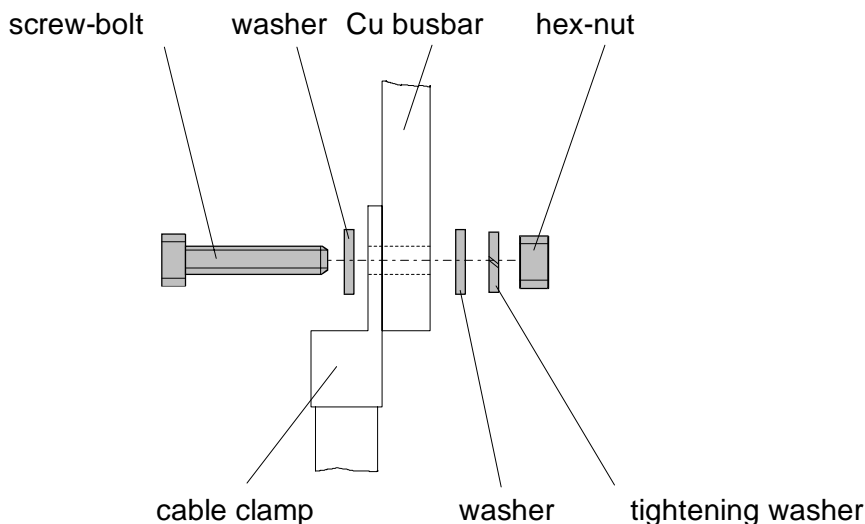


Fig. 10 Basic principle of Cu cable connections

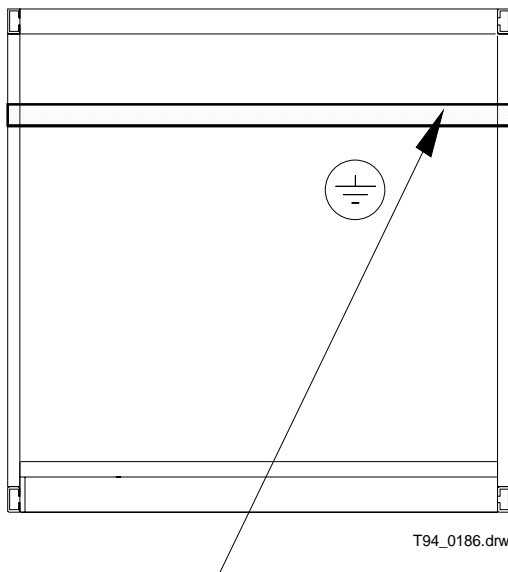
3.1.2 Main PE grounding connection

A main ground busbar (cross section 120 mm² / 0.19 in²) should be installed in the lower section of the cabinet, with the main ground cable (minimum cross section 120 mm² / 0.19 in²) being connected to this. A possible arrangement is shown in Fig. 11. Screw-bolts should be used for the connection and must be tightened using a torque wrench. (for more detailed information, see section 3.1.1 “Connection of busbars”).



The green and yellow conductor may only be used as a protective earth (PE) conductor!

It must not be used as a voltage-carrying conductor by altering the colors at the ends! Nor is it permitted to use it as a connector for screen grounding! The continuous connection of the protective conductor to the inactive metal parts of the building structure in compliance with IEC 439 or DIN VDE 0100 part 540 is to be carried out according to the conditions at the site of installation.



Main ground connection

Fig. 11 Possible arrangement of a main ground busbar

3.2 Installation of the mounting frame

3.2.1 Construction requirements

The simplest way of installing the „Lütze“ mounting frame is to use the RITTAL TS8608.600 (600 mm wide) or RITTAL TS8808.600 (800 mm wide) cabinet system. The mounting frame can be fitted very easily with additional RITTAL 8800.180 mounting rails (see section 3.2.2). If other cabinet systems are used for the installation of the mounting frame, these should comply with the following requirements:

Construction: rigid, transportable

Protection class: min. IP21 or IP31 to IP54 (with filter). The cabinet must be sealed depending on the equipment installed and in accordance with the specified protection class

Cooling: The cabinet must be designed in such a way that the dissipated heat which is generated can be conducted away. Forced cooling (e.g. fan, heat-exchanger) should be used for protection class IP31 or higher.

3.2.2 Installation of the mounting frame in a RITTAL cabinet system

Six RITTAL (8800.180) mounting rails are required for the installation of the mounting frame (see Fig. 12). Installation should be carried out in accordance with Fig. 14

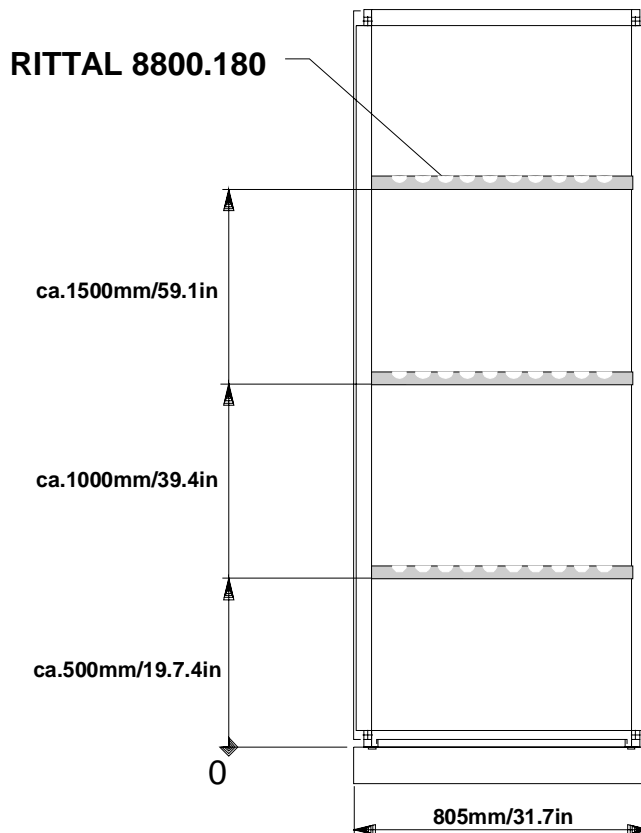
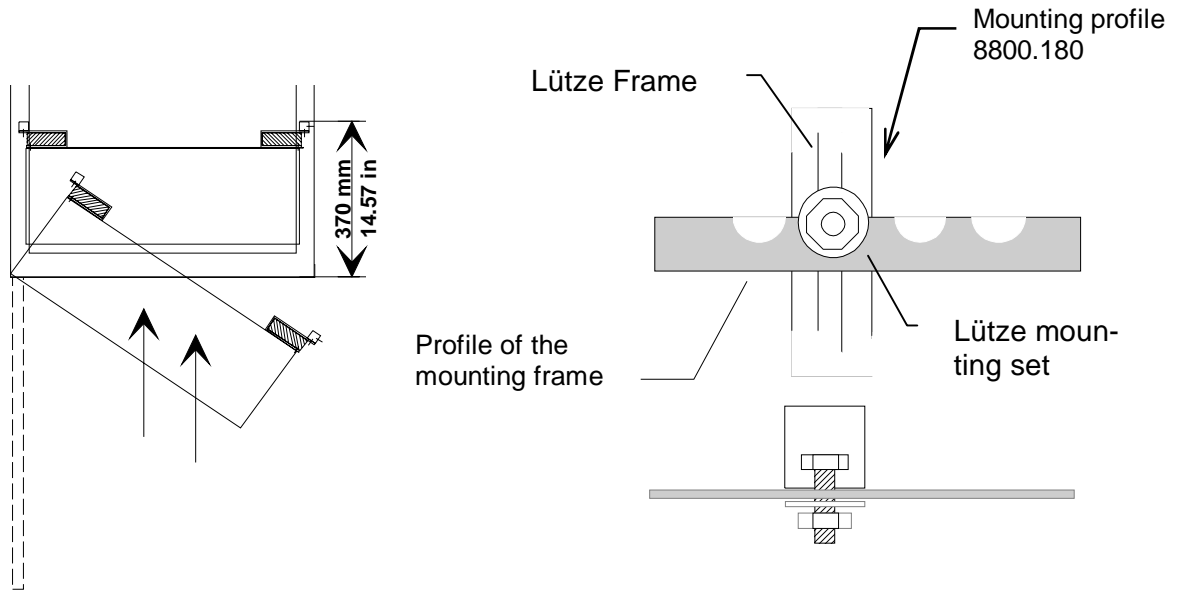


Fig. 13 Arrangement of mounting rails on the right and left-hand sides of the cabinet

Installation of the Lütze frame



Engage frame with Lütze rails

Fix in place using M8x20 bolts, U-washer, nut

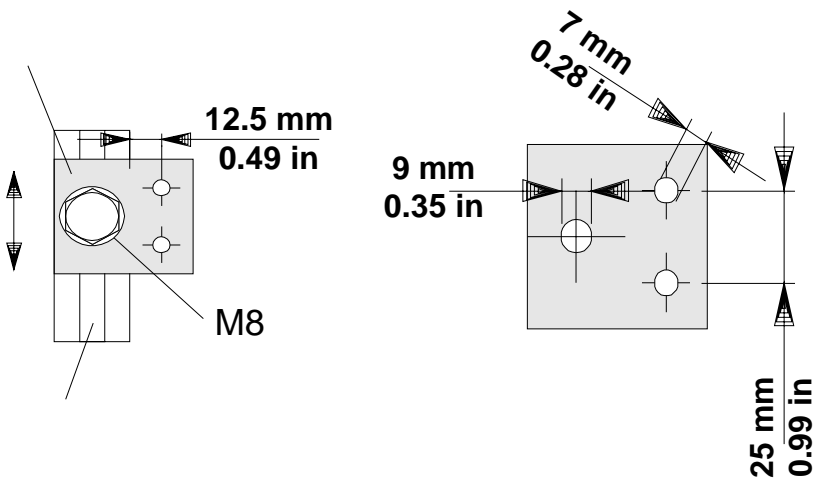
Fig. 14 Installation of the mounting frame in a RITTAL cabinet system

3.2.3 Installation of the mounting frame in another cabinet system

3 mounting plates (see Fig. 15) on each side of the cabinet are required if installing the mounting frame in other cabinet systems.

Adjustable mounting plate

Drilling plan



Profile section of the mounting frame

Fig. 15 Installation of the mounting frame in other cabinet systems

3.2.4 Electrical connections

3.2.4.1 Cable inlets

see section 3.3.8, p.23

3.2.4.2 AC / DC power cables

The cables for the power supply and the power circuits for indirect excitation are connected to the terminal strips -X1 and -X2 according to the electrical circuit diagram. The minimum cross section is defined in the system circuit diagram.

3.2.4.3 Control and signal cables

The control cables to and from the control room are normally connected directly to the terminals of the -U10 / -U11 interface board. The signal cables carrying voltage or current signals are connected to the terminal strip -X3. The minimum cross section is defined in the system circuit diagram.

Cable clamps or cable-mounting strips should be installed in the lower or upper part of the cabinet in order to prevent strain on the cables. The cables can be passed to the terminals through a cable grid fitted on the side wall of the cabinet.

3.2.4.4 Connection to busbars

See section 3.1.1, p. 14

3.2.4.5 Main PE ground connection

The "Lütze frame" is a grounded system. This means that ground connections may be made to all aluminium rails and supports. The special 16 mm² (0.025 in²) ground terminal X1:GND is available for the grounding of the whole frame, and must be connected to the main ground busbar via a 10 ... 16 mm² (0.016...0.025 in²) ground conductor.

See also section 3.1.2, p. 15

3.2.5 Concluding work

- Remove all foreign objects such as tools, packing materials or bits of cable from the cabinet.
- Wipe insulated parts with an anti-static cloth. Do not use any solvents!

3.2.6 Checks

- Check that the mounting frame has been properly installed.
- Check that all covers are correctly fitted.
- Check that the protection class requirements are fulfilled, especially with regard to floor plates and the cable inlets at the top of the cabinet.
- General visual inspection: appearance, completeness, markings, presence of foreign bodies, cleanliness.
- Check that cable connections and wiring are correct and complete, check that cable shields are correctly grounded (via clamping brackets or glands), where this work has been carried out on site.
- Have all protective conductor connections been correctly and completely carried out?
- Close cabinet doors.

3.3 Installation of cabinets / equipment

A "set mounting material", which is supplied with the equipment in a separate cardboard box, is required for the installation or erection of the equipment / cabinet.

This material is shown in curved brackets in the following text when referred to.

3.3.1 General

The work described in section 2.2 must have been carried out before setting up the equipment / cabinet. The following procedure should then be followed:

- | | |
|-------------------------|--------------|
| 1. Alignment | <u>3.3.2</u> |
| 2. Checks | <u>3.3.3</u> |
| 3. Seal joints | <u>3.3.4</u> |
| 4. Anchor to floor | <u>3.3.5</u> |
| 5. Remove lifting bolts | <u>3.3.6</u> |
| 6. Seal | <u>3.3.7</u> |

3.3.2 Alignment

The cabinets are set up according to the layout plan and must be precisely aligned with one another.

It must be ensured that the cabinets stand vertically and plumb!

Doors and covers must not jam or twist. Where the cabinets are divided into sections for transport, the transport units must be properly levelled! (placing mats underneath if necessary).

3.3.3 Checks

After the cabinets have been aligned on the floor, and before being fixed in position, all doors and covers are to be checked for correct function (it must be possible to open / close or remove them without twisting). If problems are encountered, exact alignment must be carried out again as described in section 3.3.2.

3.3.4 Sealing of joints between sections separated for transport

Where units are separated for transport, the joint between these is to be sealed. The sealing material {sealing strip} is applied between the separating wall and the frame or between the frame sections before bolting together. The frame sections must be treated with a suitable cleaning agent and de-greased before being sealed. The joint should then be sealed with {sealer}.

3.3.5 Floor anchoring

After having been aligned in accordance with section 3.3.2, the equipment / cabinets are anchored to the floor foundations. The exact positioning of the floor anchoring points are defined in the specific cubicle layout drawing. The following materials are used for floor anchoring:

{M12 bolt fastener with bolt and mounting}

{MNS mounting bracket}

{M12 bolt fastener with bolt}

3.3.5.1 Floor anchoring with base frame

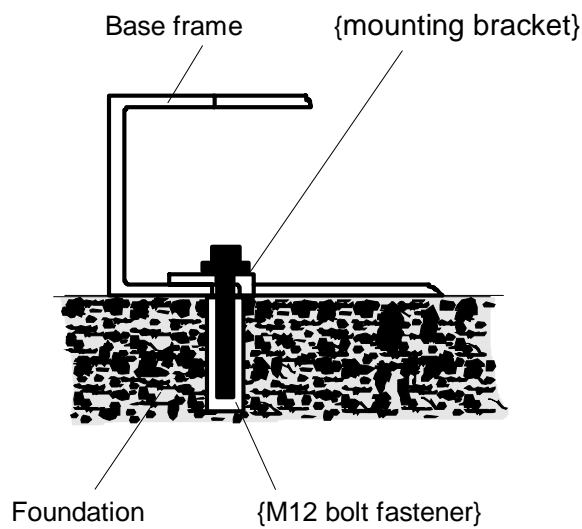


Fig. 16 Floor anchoring with base frame

In the variant with a floor plate, the {mounting bracket} is already fitted in place

3.3.5.2 Floor anchoring with MNS system (without base frame)

If the cabinets are supplied with an MNS system, floor anchoring is carried out as follows:

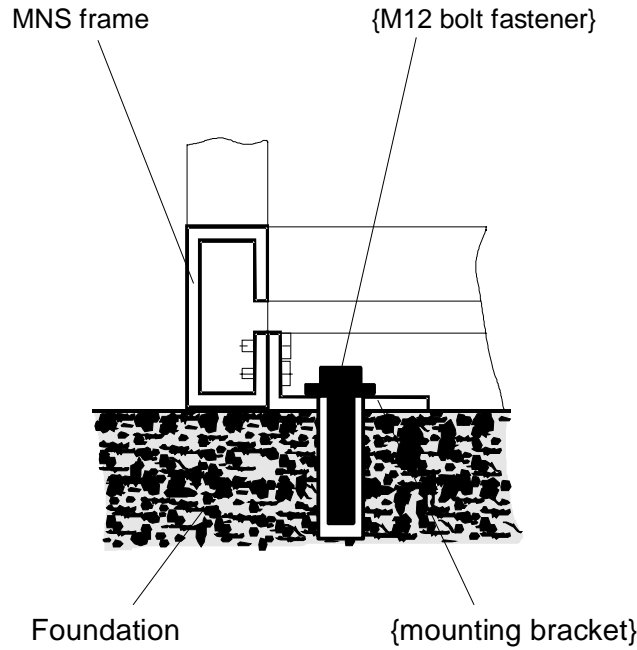


Fig. 17 Floor anchoring with MNS frame (without base frame)

3.3.5.3 Floor anchoring with RITTAL cabinet system

If RITTAL system cabinets are supplied, the floor anchoring should be carried out in accordance with the following drilling plan:

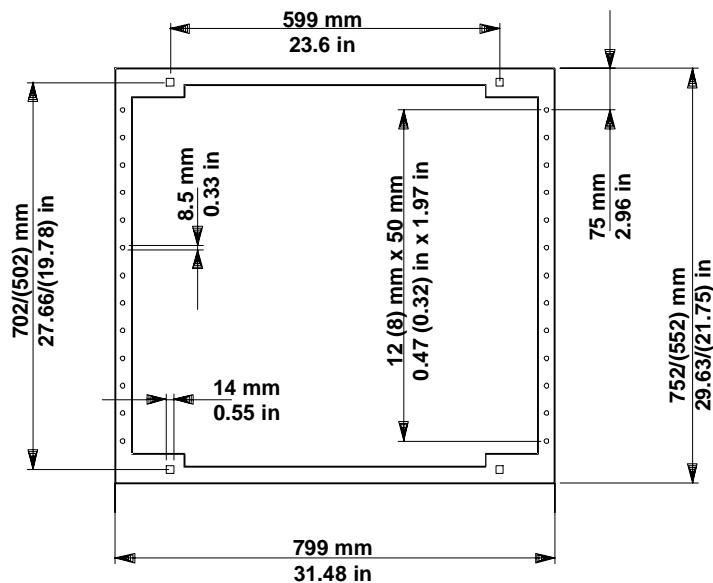


Fig. 18 Drilling plan for RITTAL cabinets

3.3.6 Removing lifting posts

- The lifting posts can be removed once transport and alignment have been completed and the cabinets have been secured to the floor.
- It is recommended that the lifting posts and bolts be stored in a safe place!

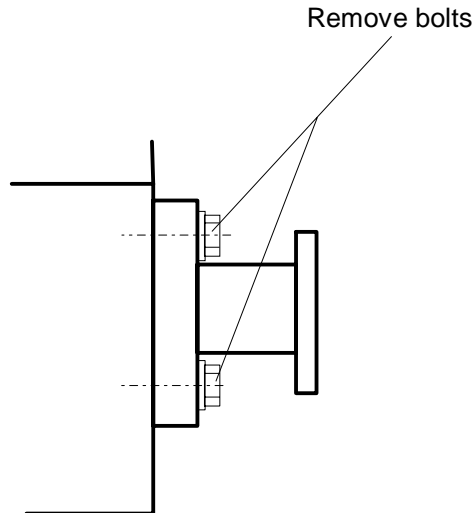


Fig. 19 Lifting posts on base frame

3.3.7 Sealing

Depending on the design and the required protection type (> IP 21 / >IP 31), procedures must be taken to seal the cabinets at the site of installation. The sealing material {sealer / sealing strips} is supplied.

3.3.8 Fitting of cable inlet at bottom of cabinet (with floor plate)

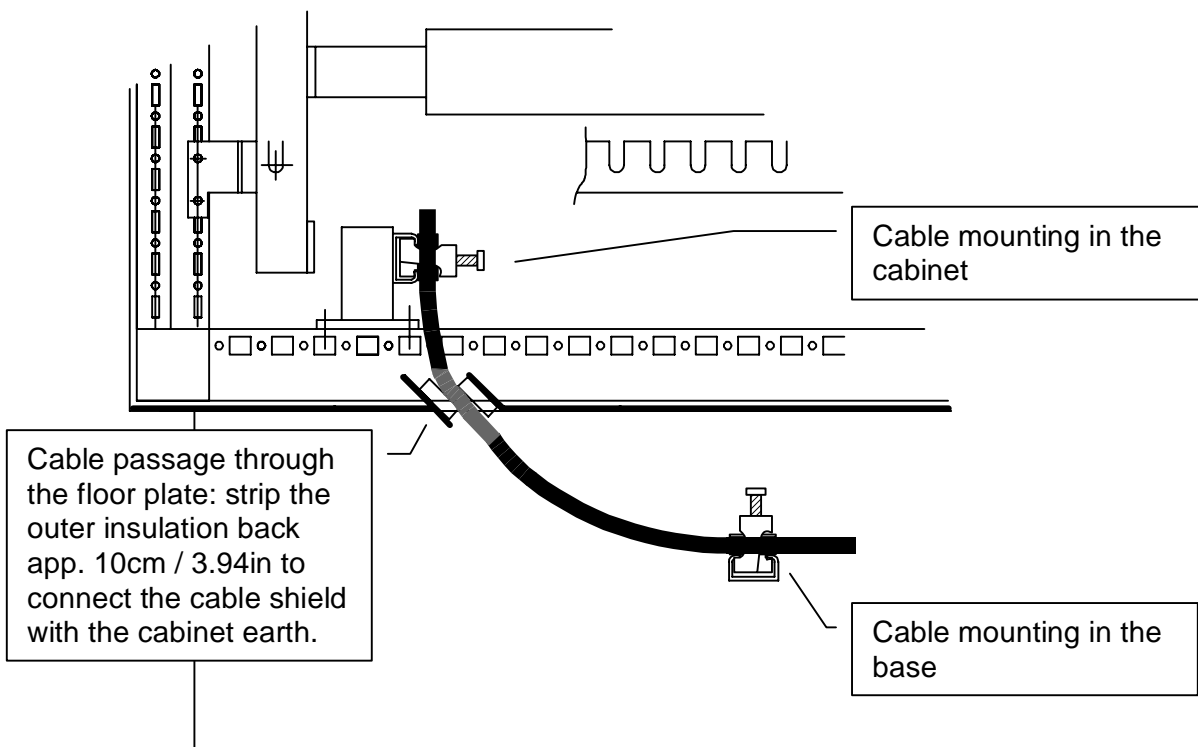


Fig. 20 Fitting of cable inlet at bottom of cabinet

3.3.9 Systems with cable inlet at top of cabinet

The blanking plates are already sealed upon delivery. The holes for the cable glands must be drilled and the glands fitted so that they seal properly. The blanking plate should thereby be removed and drilled in an appropriate place (e.g. workshop).



Note:

On no account may the blanking plate be drilled while fitted to the roof of the cabinet, since drilling waste falling into the cabinet may cause short circuits which can lead to serious damage!

3.3.10 Fitting of sealing plugs

The roof plates must each be plugged with 4 {sealing plugs} and sealed with {sealer}.

3.3.11 Electrical connections

3.3.11.1 AC / DC power cables

The power cables for the power supply are connected to the terminals -X1 and -X2 according to the circuit diagram.

3.3.11.2 Control and signal cables

The control cables to and from the control room are connected according the enclosed terminal list. The cable clamps provide mechanical support for the cables. The EMC earthing is provided when the cables passe the floor plate. Therefor the cables must be striped accordingly (see 3.3.8, p.23).

Should the cable be inserted from the top, the cable shield must be grounded via glands. The inlet plate must be connected to the system ground according to EMC protective earthing.

3.3.11.3 Connection of busbars

See 3.1.1, p. 14

3.3.11.4 Main PE ground connection

The frame of the cabinet is connected to the main ground busbar. All the components are electrically grounded. For this purpose, they are connected to the main ground busbar by separate ground conductors.

See 3.1.2, p. 15

3.3.12 Concluding work

- Remove any transport fixtures such as wooden braces (if present) from the equipment.
- Remove all foreign bodies such as packing materials or bits of cable from the cabinet.
- Wipe insulated parts with an anti-static cloth. Do not use any solvents!

3.3.13 Checks

- Check all busbar connections and frame connections where the cabinets were separated for transport.
- Check floor fixtures.
- Check that the protection class requirements are fulfilled, especially with regard to floor plates and the cable inlet at the top of the cabinet.
- General visual inspection: appearance, completeness, markings, presence of foreign bodies, cleanliness.
- Check that cable connections and wiring are correct and complete, where this work has been carried out on site.
- Are the cable shields correctly grounded where they enter the cabinet (clamping brackets or glands)?
- Have all protective conductor connections been correctly and completely carried out?
- Close doors.

3.3.14 Special instructions

If the installation and wiring work is interrupted, precautions must be taken to protect the equipment against dust, dampness and foreign bodies by:

- closing the cabinet doors.
- covering the cabinets / equipment with plastic sheets.
- heating the site of installation or connecting the cabinet heaters (if installed).

3.3.15 Damage to paintwork

Any damage to paintwork which has occurred during transport and installation must be touched up before commissioning the equipment.

- Only polyurethane paints (DD) may be used for touching up damaged paintwork, since only these are guaranteed to adhere properly to the original coatings.
- Damage in the form of chips and scratches can be touched up using a fine-haired brush
- Large areas of damage on the front of the cabinets may not be touched up. In this case, the whole door must be repainted.
- Separately packed {touch-up paint} is provided with the equipment.
- Where severe mechanical damage has to be corrected, only use filling compounds of air-drying alkyd resin.

3.3.15.1 Preparation of the damaged area

Remove all grease or oil from the areas to be touched up using a cleaning agent (aliphatic) and a lint-free cloth.

3.3.15.2 Application

The {touch-up paint} provided, which is matched in color to the specific equipment, should be used for touching up damage to paintwork.

The paint can be applied using a brush or a sheepskin roller.

3.3.16 Loose mounting material

Additional mounting materials are required for the installation of the equipment or cabinet. This is supplied in a cardboard box with a materials list. The individual items can be ordered from the responsible ABB engineering or sales department, stating the part identification number or order number according to the materials list.