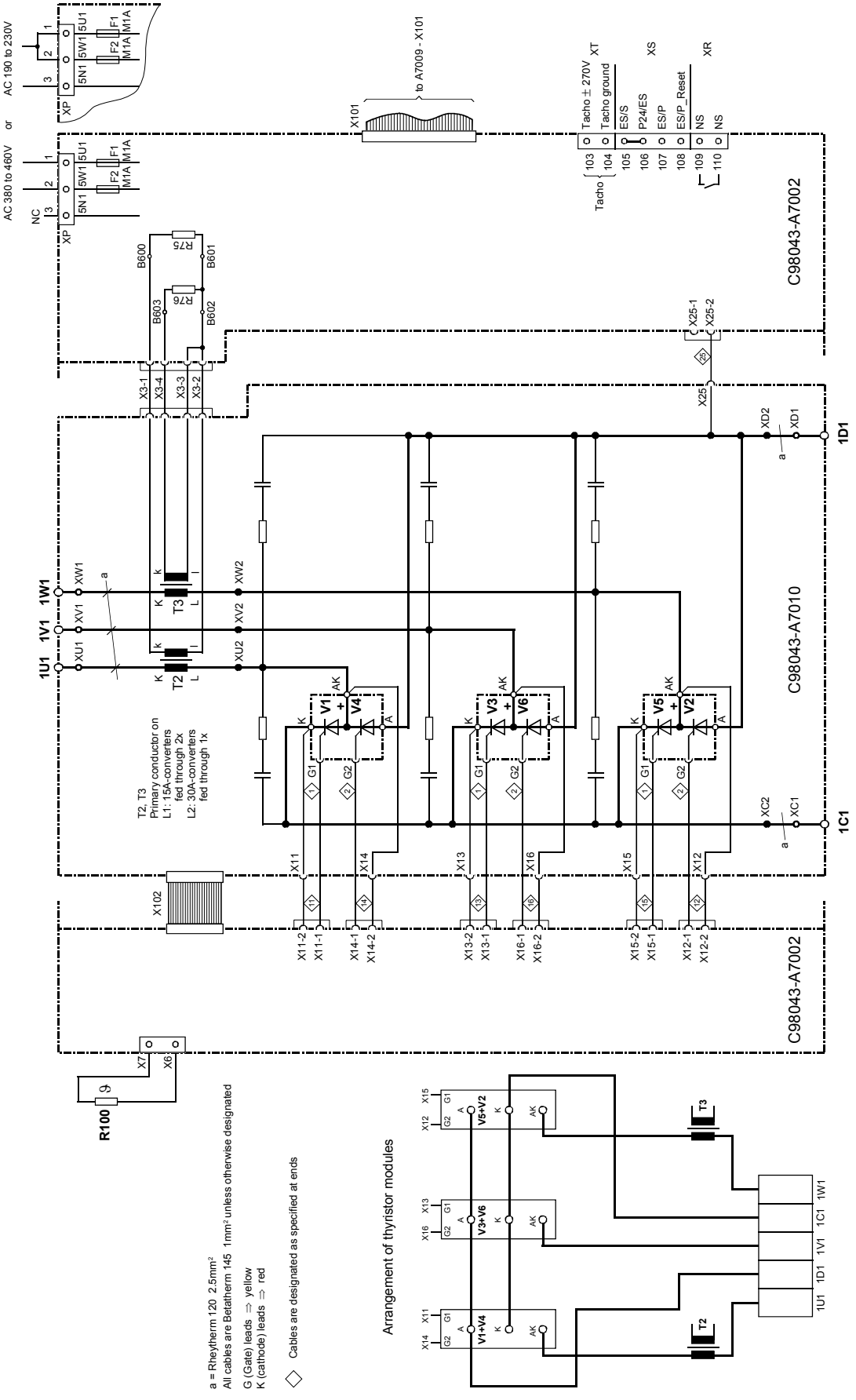
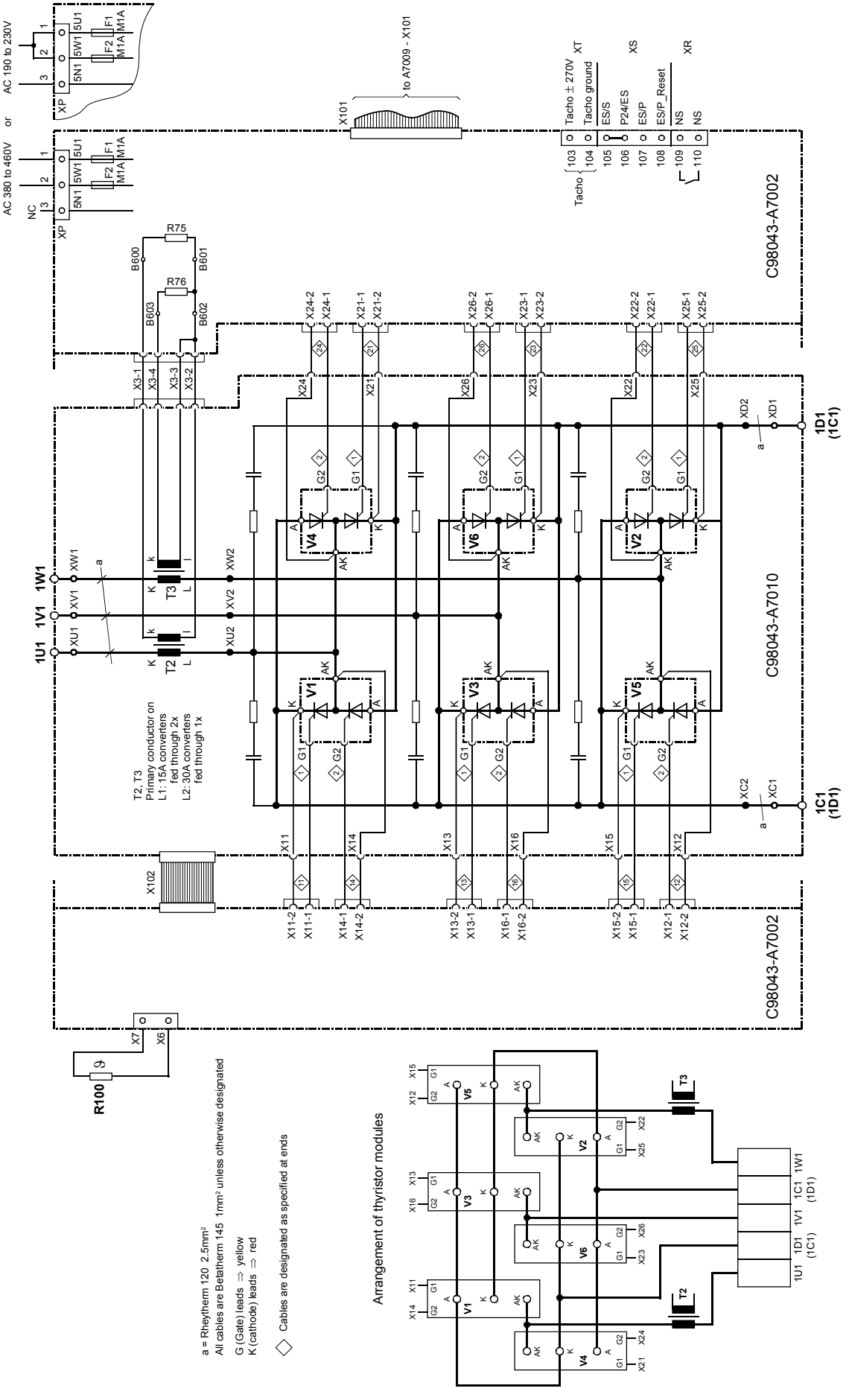
6.4 Power connections

6.4.1 Converters: 30A, 1Q



6.4.11 Converters: 15 to 30A, 4Q



6.6 Fuses and commutating reactors

6.6.1 Commutating reactors

Commutating reactors can be selected from Catalog LV60.
The line impedance including commutating reactors must be equivalent of between 4% and 10% short-circuit voltage. Commutating reactors can be provided by the customer to limit commutating voltage dips in the supply system (subject to local regulations).

6.6.2 Fuses

For technical data, configuring data and dimension drawings, please refer to Catalog DA94.1.

It is essential to use "UL-listed" or "UL-recognized" fuses for protection of devices in accordance with UL standards.

6.6.2.1 Recommended fuses for field circuit

Converter unit Rated DC current	Max. permissible field current	1 Siemens fuse		1 Bussmann fuse FWP 700V ЯU	
A	A	Order No.	A	Order No.	A
15	3	5SD420	16	FWP-5B	5
30	5	5SD420	16	FWP-5B	5
60 to 125	10	5SD420	16	FWP-15B	15
210 to 280	15	5SD440	25	FWP-20B	20
400 to 600	25	5SD440	25	FWP-30B	30
710 to 1200	30	5SD480	30	FWP-35B	35
1500 to 2000	40	3NE1802-0 1)	40	FWP-50B	50
2200 to 3000	85	3NE8021-1 1)	100	FWP-100B	100

1) UL-recognized

6.6.2.2 Fuses for armature circuit

6.6.2.2.1 Converters 1Q: 400V, 575V, 690V, 830V and 950V

Converter Order No.	C / V A / V	3 line fuses Siemens ЯU Order No.	C / V A / V
6RA7018-6DS22	30 / 400	3NE8003-1	35 / 690
6RA7025-6DS22	60 / 400	3NE1817-0	50 / 690
6RA7025-6GS22	60 / 575	3NE1817-0	50 / 690
6RA7028-6DS22	90 / 400	3NE1820-0	80 / 690
6RA7031-6DS22	125 / 400	3NE1021-0	100 / 690
6RA7031-6GS22	125 / 575	3NE1021-0	100 / 690
6RA7075-6DS22	210 / 400	3NE3227	250 / 1000
6RA7075-6GS22	210 / 575	3NE3227	250 / 1000
6RA7078-6DS22	280 / 400	3NE3231	350 / 1000
6RA7081-6DS22	400 / 400	3NE3233	450 / 1000
6RA7081-6GS22	400 / 575	3NE3233	450 / 1000
6RA7085-6DS22	600 / 400	3NE3336	630 / 1000
6RA7085-6GS22	600 / 575	3NE3336	630 / 1000
6RA7087-6DS22	850 / 400	3NE3338-8	800 / 800
6RA7087-6GS22	800 / 575	3NE3338-8	800 / 800
6RA7086-6KS22	720 / 690	3NE3337-8	710 / 900

6.6.2.2.3 Converters 4Q: 400V, 575V, 690V, 830V and 950V

Converter Order No.	C / V	3 line fuses Siemens ЯU		1 DC fuse Siemens ЯU	
		Order No.	I / U	Order No.	C / V
	A / V		A / V		A / V
6RA7013-6DV62	15 / 400	3NE1814-0	20 / 690	3NE1814-0	20 / 690
6RA7018-6DV62	30 / 400	3NE8003-1	35 / 690	3NE4102	40 / 1000
6RA7025-6DV62	60 / 400	3NE1817-0	50 / 690	3NE4120	80 / 1000
6RA7025-6GV62	60 / 575	3NE1817-0	50 / 690	3NE4120	80 / 1000
6RA7028-6DV62	90 / 400	3NE1820-0	80 / 690	3NE4122	125 / 1000
6RA7031-6DV62	125 / 400	3NE1021-0	100 / 690	3NE4124	160 / 1000
6RA7031-6GV62	125 / 575	3NE1021-0	100 / 690	3NE4124	160 / 1000
6RA7075-6DV62	210 / 400	3NE3227	250 / 1000	3NE3227	250 / 1000
6RA7075-6GV62	210 / 575	3NE3227	250 / 1000	3NE3227	250 / 1000
6RA7078-6DV62	280 / 400	3NE3231	350 / 1000	3NE3231	350 / 1000
6RA7081-6DV62	400 / 400	3NE3233	450 / 1000	3NE3233	450 / 1000
6RA7081-6GV62	400 / 575	3NE3233	450 / 1000	3NE3233	450 / 1000
6RA7085-6DV62	600 / 400	3NE3336	630 / 1000	3NE3336	630 / 1000
6RA7085-6GV62	600 / 575	3NE3336	630 / 1000	3NE3336	630 / 1000
6RA7087-6DV62	850 / 400	3NE3338-8	800 / 800	3NE3334-0B [1]	500 / 1000
6RA7087-6GV62	850 / 575	3NE3338-8	800 / 800	3NE3334-0B [1]	500 / 1000
6RA7086-6KV62	760 / 690	3NE3337-8	710 / 900	3NE3334-0B [1]	500 / 1000

1) Two fuses connected in parallel

Converter Order No.	C / V	Branch fuses Siemens ЯU		
		Qty.	Order No.	C / V
	A / V			A / V
6RA7091-6DV62	1200 / 400	6	3NE3338-8	800 / 800
6RA7090-6GV62	1100 / 575	6	3NE3338-8	800 / 800
6RA7090-6KV62	1000 / 690	6	3NE3337-8	710 / 900
6RA7088-6LV62	950 / 830	6	3NE3337-8	710 / 900
6RA7093-4DV62	1600 / 400	6	6RY1702-0BA02	1000 / 660
6RA7093-4GV62	1600 / 575	6	6RY1702-0BA02	1000 / 660
6RA7093-4KV62	1500 / 690	6	6RY1702-0BA03	1000 / 1000
6RA7093-4LV62	1500 / 830	6	6RY1702-0BA03	1000 / 1000
6RA7095-4DV62	2000 / 400	6	6RY1702-0BA01	1250 / 660
6RA7095-4GV62	2000 / 575	6	6RY1702-0BA01	1250 / 660
6RA7095-4KV62	2000 / 690	12	6RY1702-0BA04	630 / 1000
6RA7095-4LV62	1900 / 830	12	6RY1702-0BA04	630 / 1000
6RA7096-4GV62	2200 / 575	6	6RY1702-0BA05	1500 / 660
6RA7096-4MV62	2200 / 950	12	6RY1702-0BA07	800 / 1250
6RA7097-4KV62	2600 / 690	12	6RY1702-0BA08	1000 / 1000
6RA7097-4GV62	2800 / 575	12	6RY1702-0BA08	1000 / 1000
6RA7098-4DV62	3000 / 400	12	6RY1702-0BA08	1000 / 1000

Branch fuses are included in converter, external semiconductor fuses are not needed.

6.6.2.2.4 Converters 4Q: 460V

Converter Order No.	C / V A / V	3 line fuses Siemens ЯU Order No.	C / V A / V	3 line fuses Bussmann ЯU Order No.	C / V A / V	3 line fuses Bussmann ЯU Order No.	C / V A / V
6RA7018-6FV62	30 / 460	3NE1815-0	25 / 690	170M1562	32 / 660	FWH-35B	35 /500
6RA7025-6FV62	60 / 460	3NE1817-0	50 / 690	170M1565	63 / 660	FWH-60B	60 /500
6RA7028-6FV62	90 / 460	3NE1820-0	80 / 690	170M1567	100 / 660	FWH-100B	100 /500
6RA7031-6FV62	125 / 460	3NE1021-0	100 / 690	170M1568	125 / 660	FWH-125B	125 /500
6RA7075-6FV62	210 / 460	3NE3227	250 / 1000	170M3166	250 / 660	FWH-225A	225 /500
6RA7078-6FV62	280 / 460	3NE3231	350 / 1000	170M3167	315 / 660	FWH-275A	275 /500
6RA7082-6FV62	450 / 460	3NE3233	450 / 1000	170M3170	450 / 660	FWH-450A	450 /500
6RA7085-6FV62	600 / 460	3NE3336	630 / 1000	170M4167	700 / 660	FWH-600A	600 /500
6RA7087-6FV62	850 / 460	3NE3338-8	800 / 800	170M5165	900 / 660	FWH-800A	800 /500

Converter Order No.	C / V A / V	1 DC fuse Siemens ЯU Order No.	C / V A / V	1 DC fuse Bussmann ЯU Order No.	C / V A / V
6RA7018-6FV62	30 / 460	3NE4102	40 / 1000	FWP-35B	35 / 660
6RA7025-6FV62	60 / 460	3NE4120	80 / 1000	FWP-70B	70 / 660
6RA7028-6FV62	90 / 460	3NE4122	125 / 1000	FWP-125A	125 / 660
6RA7031-6FV62	125 / 460	3NE4124	160 / 1000	FWP-150A	150 / 660
6RA7075-6FV62	210 / 460	3NE3227	250 / 1000	FWP-250A	250 / 660
6RA7078-6FV62	280 / 460	3NE3231	350 / 1000	FWP-350A	350 / 660
6RA7082-6FV62	450 / 460	3NE3334-0B	500 / 1000	FWP-500A	500 / 660
6RA7085-6FV62	600 / 460	3NE3336	630 / 1000	FWP-700A	700 / 660
6RA7087-6FV62	850 / 460	3NE3334-0B 1)	500 / 1000	FWP-1000A	1000 / 660

FWH-... and FWP-... fuses are <u>not</u> mechanically compatible with the 3NE... or 170M... fuses.

1) Two fuses connected in parallel

Converter Order No.	C / V A / V	Branch fuses Siemens ЯU Qty.	Order No.	C / V A / V
6RA7091-6FV62	1200 / 460	6	3NE3338-8	800 / 800

Branch fuses are included in converter, external semiconductor fuses are not needed.

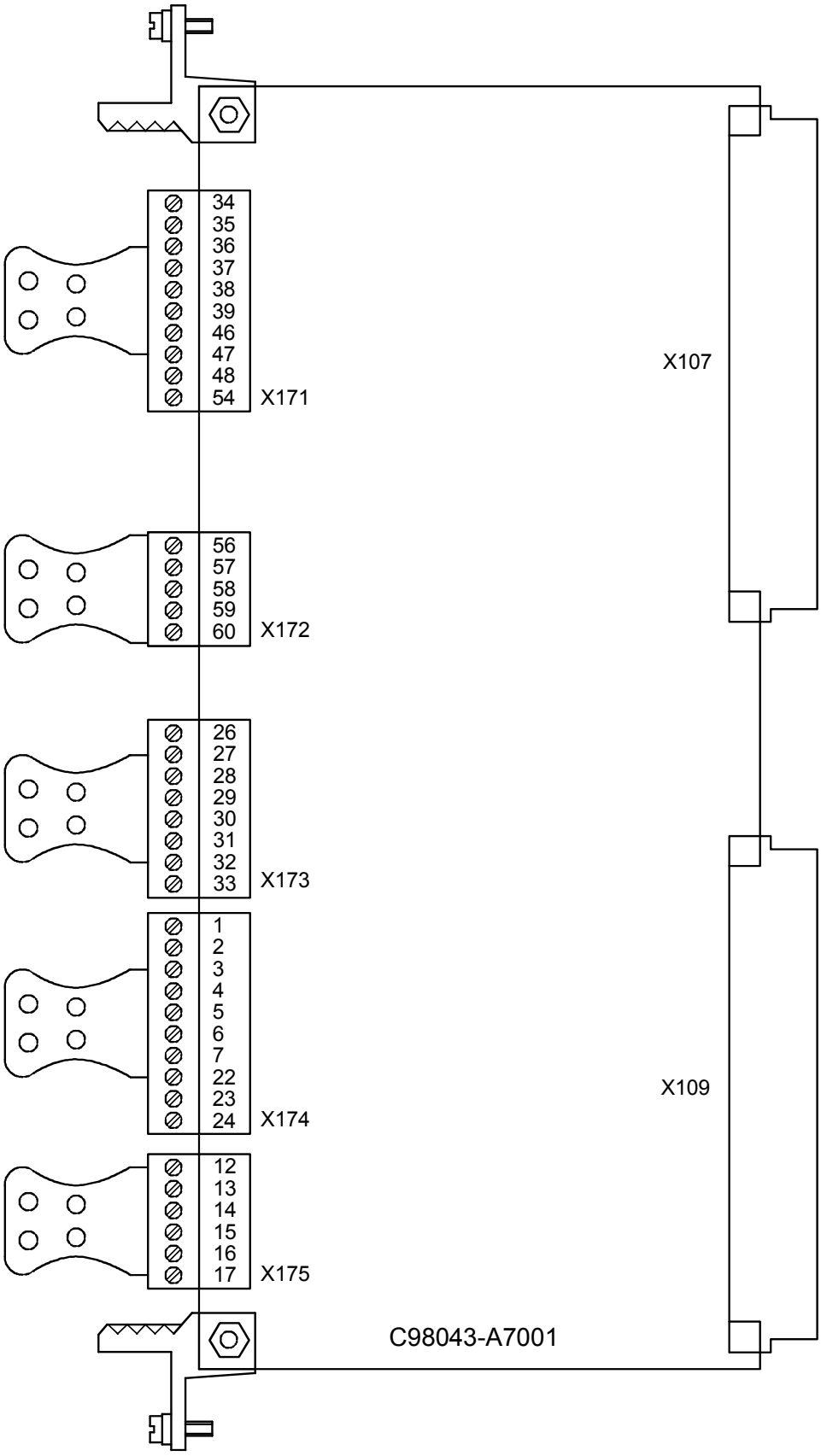
6.6.2.3 F1 and F2 fuses in the power interface

Only UL listed or UL recognized fuses must be used for UL listed converters.

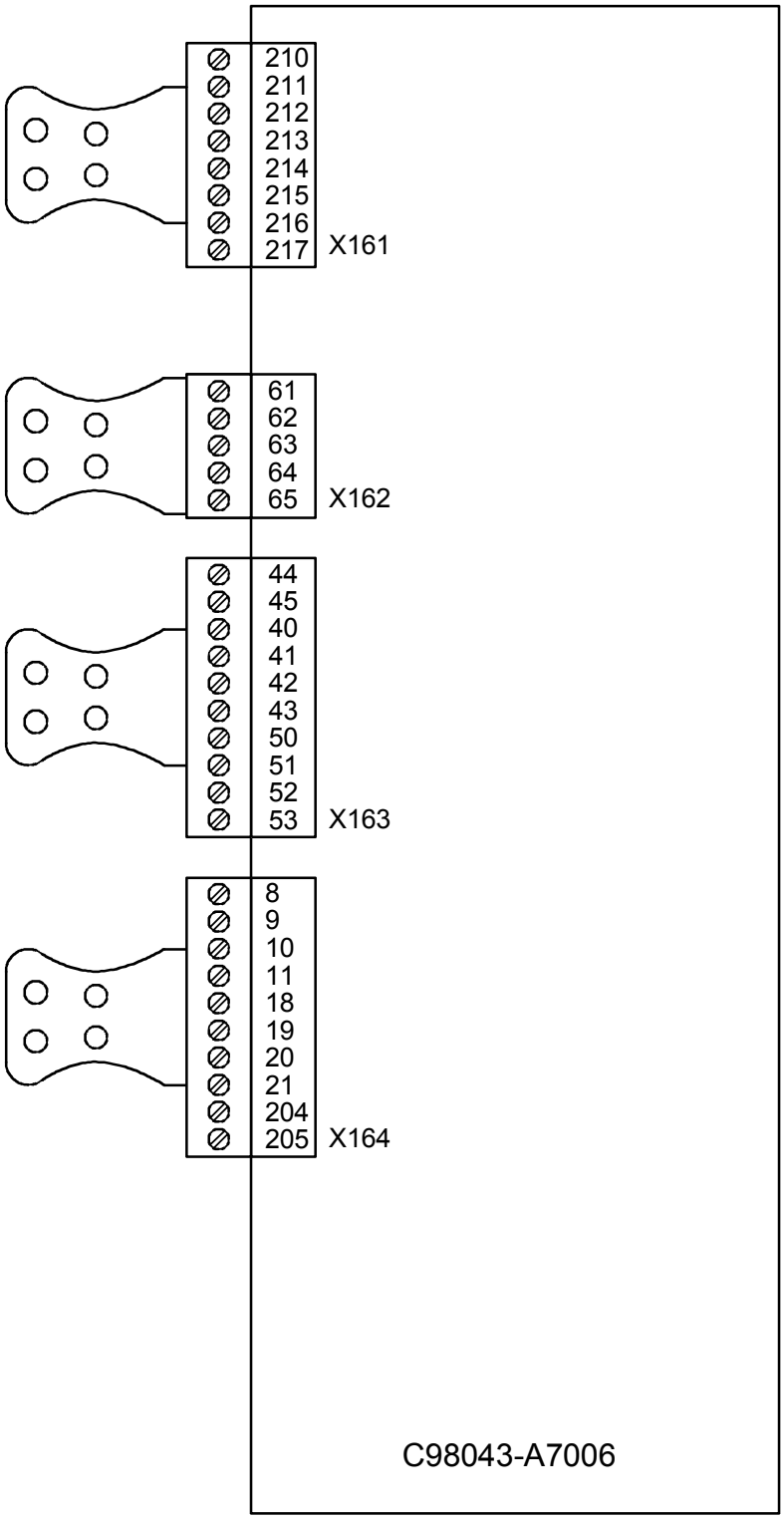
Wickmann 198 1A / 250 V 5 x 20 mm time lag
Wickmann 343 1A / 250 V 6,3 x 32 mm time lag
Schurter FSD 1A / 250 V 5 x 20 mm time lag Ordering Code 0034.3987
Schurter FST 1A / 250 V 5 x 20 mm time lag Ordering Code 0034.3117

6.7 Terminal arrangement

Module C98043-A7001 (CUD1)



Module C98043-A7006 (CUD2)



7 Start-Up

7.1 General safety information for start-up

DANGER

Before commencing with start-up on the converters (90A to 600A), make sure that the transparent terminal cover is mounted in the correct position (see Section 5.1).

CAUTION

Before handling any boards (in particular, the A7001 electronics board), please make sure that your body is electrostatically discharged to protect electronic components against high voltages caused by electrostatic charges. The simplest way of doing this is to touch a conductive, grounded object (e.g. bare metal cabinet component immediately beforehand).

PCBs must not be allowed to come into contact with highly insulating materials (e.g. plastic foil, insulating table tops or clothing made of synthetic fibers).

PCBs may only be set down on electrically conducting surfaces.

WARNING

Hazardous voltages and rotating parts (fans) are present in this electrical equipment during operation. Non-observance of the safety instructions can result in death, severe personal injury or substantial property damage.

Hazardous voltage may be present at the signaling relays in the customer's installation.

The converters must not be connected to a supply with earth-leakage circuit-breaker (VDE 0160, Section 6.5) since, in the event of a fault to frame or ground, the fault current may contain a DC component that will either prevent or hinder a higher-level e.l.c.b. from tripping. In this case, all loads connected to this e.l.c.b. have no protection either.

Only qualified personnel who are thoroughly familiar with all safety notices contained in the operating instructions as well as erection, installation, operating and maintenance instructions should be allowed to work on these devices.

The successful and safe operation of this equipment is dependent on careful transportation, proper storage and installation as well as correct operation and maintenance.

The converter is at a hazardous voltage level even when the line contactor is open. The gating board (board mounted directly to lower part of housing) has many circuits at hazardous voltage levels. Before carrying out any maintenance or repair work, all converter power sources must be disconnected and locked out.

These instructions do not claim to list all of the measures required to ensure safe and reliable operation of the converter. For special applications, additional, supplementary information or instructions might be required. If problems do occur and you feel in any way uncertain, please contact your local Siemens office or representative.

The use of unauthorized parts in the repair of this converter and handling of the equipment by unqualified personnel can give rise to hazardous conditions which may cause death, severe personal injury or substantial property damage. All safety notices contained in this instruction manual and attached to the converter itself must be carefully observed.

Please read the safety information given in Section 1 of this instruction manual.

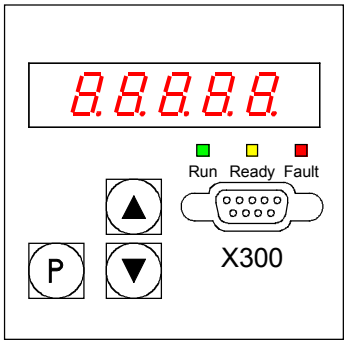
7.2 Operator control panels

The basic converter is equipped with a simple operator panel (PMU) as standard. A user-friendly panel with plaintext display (OP1S) can be connected as an option.

7.2.1 Simple operator control panel (PMU "Parameterization Unit")

The simple operator control panel is mounted in the converter door and consists of a 5-digit, 7-segment display with three status display LEDs and three parameterization keys below.

All adjustments and settings that need to be undertaken for the purpose of start-up can be made on the simple control panel.



- **P** key
  - Switches over between parameter number (parameter mode), parameter value (value mode) and index number (index mode) on indexed parameters.
  - Acknowledges active fault messages.
  - P and RAISE keys to switch a fault message and alarm to the background (see Section 10, Fault Messages and Alarms)
  - P and LOWER key to switch a fault message and alarm from the background back to the foreground display on the PMU (see Section 10, Fault Messages and Alarms)

- **UP** key (▲)
  - Selects a higher parameter number in parameter mode. When the highest number is displayed, the key can be pressed again to return to the other end of the number range (i.e. the highest number is thus adjacent to the lowest number).
  - Increases the selected and displayed parameter value in value mode.
  - Increases the index in index mode (for indexed parameters)
  - Accelerates an adjustment process activated with the DOWN key (if both keys are pressed at the same time).

- **DOWN** key (▼)
  - Selects a lower parameter number in parameter mode. When the lowest number is displayed, the key can be pressed again to return to the other end of the number range (i.e. the lowest number is thus adjacent to the highest number).
  - Decreases the selected and displayed parameter value in value mode.
  - Decreases the index in index mode (for indexed parameters)
  - Accelerates an adjustment process activated with the UP key (if both keys are pressed at the same time).

LED displays

Run green LED
LED illuminated ⇒ in “Torque direction active” state (MI, MII, M0).
(see r000 in Section 11)

Ready yellow LED
LED illuminated ⇒ in “Ready” state (o1 .. o7).
(see r000 in Section 11)

Fault red LED
LED illuminated ⇒ in “Fault signal present” state (o11)
(see r000 in Section 11 and Faults and Alarms (Section 10))
LED flashing ⇒ An alarm is active (see Faults and Alarms in Section 10).

7.2.2 User-friendly operator control panel (OP1S)

The optional, user-friendly, operator control panel with plaintext display (order no.: 6SE7090-0XX84-2FK0) is mounted in the special location provided in the converter door.

This location provides a connection to the serial basic converter interface SST1.

Parameters can be selected directly through input of the parameter number via the keyboard of the OP1S. The following interrelationships apply:

	Displayed number	Number to be keyed in on OP1S
Basic converter parameter	**r**xxx, **P**xxx	(0)xxx
	Uxxx, **n**xxx	**2**xxx
Technology board parameter	**H**xxx, **d**xxx	**1**xxx
	Lxxx, **c**xxx	**3**xxx

If the RAISE or LOWER key on the OP1S is used to select adjacent parameter numbers, then any missing numbers in the range of basic converter parameters are skipped.

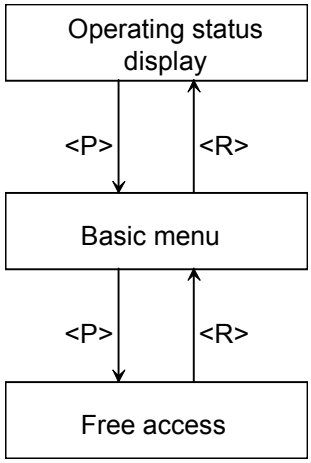
This automatic skipping over missing numbers does not work for technology board parameters. In this case, the numbers of existing parameters must be entered directly.

The OP1S switches to **operational display** a few seconds after initialization.

By pressing the <P> key, you can switch from the operating display to the **Basic Menu** in which you can either select "Free access" to all parameters or a variety of functions. Details of these functions can be found in the function diagram "OP1S operational display" (Section 8, Sheet Z123) and the OP1S operating instructions.

The converter parameters can be set in "**Free access**" status.

You can return to the operating status display by pressing the <R> key (several times if necessary).



Control bits from OP1S operator panel:

(see also function diagram "OP1S operational display" (Section 8, Sheet Z123) and the OP1S operating instructions)

Data are exchanged between the OP1S and SIMOREG 6RA70 converter via the G-SST1 interface (RS485) and USS protocol.

The OP1S operator panel transfers the following control bits in process data word 1 in the USS message:

Key on OP1S	Function *)	Bit in PZD word1 (connector K2001)	Binector
ON key / OFF key (I / 0)	ON / OFF1	Bit 0	B2100
Reset	Acknowledge	Bit 7	B2107
Jog	Jog (inch)	Bit 8	B2108
Reverse	Enable positive direction of rotation	Bit 11	B2111
	Enable negative direction of rotation	Bit 12	B2112
UP key	Increase motorized potentiometer	Bit 13	B2113
DOWN key	Decrease motorized potentiometer	Bit 14	B2114

*) Suggested functions. Since binectors can be freely wired up to any selector switch, the control signals from the OP1S can be used for any type of control task in the SIMOREG 6RA70.

Connection of control signals from the OP1S for the suggested functions:

Functions can be implemented via the OP1S only if the following conditions are fulfilled:
1) Bit-by-bit input of control bits in control word 1 (P648 = 9), see also Section 8, Function Diagrams, Sheet G180
2) OP1S in "Operational display" status

ON / OFF1:
Parameterization of switch-on/shutdown via OP1S by setting
P654 = 2100
Please also note AND operation with "Switch-on/Shutdown" from terminal 37 (see also Function Diagrams, Sheet G130 in Section 8 and Section "Switch-on/Shutdown (ON / OFF) terminal 37" in Section 9)

Acknowledge:
Parameterization of fault message acknowledgements via OP1S by setting
P665, P666 or P667 = 2107
Faults can always be acknowledged by pressing the <P> key on the PMU.

Inching:
Parameterization of inching via OP1S by setting
P668 or P669 = 2108
Selection of source of inching setpoint via the corresponding index of P436 (see "Inching setpoint" function diagram)

Direction of rotation enable:
Parameterization of direction of rotation enabling via OP1S by setting
P671 = 2111 (positive direction of rotation)
P672 = 2112 (negative direction of rotation)

Motorized potentiometer:
Parameterization of motorized potentiometer via OP1S by setting
P673 = 2113 (higher)
P674 = 2114 (lower)
P644 = 240 (main setpoint from motorized potentiometer)

7.3 Parameterization procedure

Parameterization is the process of changing setting values (parameters) via the operator panel, activating converter functions or displaying measured values.

Parameters for the basic converter are called P, r, U or n parameters. Parameters for an optional supplementary board are called H, d, L or c parameters.

The basic unit parameters are displayed first on the PMU, followed by the technology board parameters (if such a board is installed). It is important not to confuse the parameters of the optional S00 technology software of the basic unit with the parameters of an optional supplementary board (T100, T300 or T400).

Depending on how parameter P052 is set, only some parameter numbers (see Section 11, Parameter List) are displayed.

7.3.1 Parameter types

Display parameters are used to display current quantities such as the main setpoint, armature voltage, setpoint/actual value difference of speed controller, etc. The values of display parameters are read-only values and cannot be changed.

Setting parameters are used to both display and change quantities such as the rated motor current, thermal motor time constant, speed controller P gain, etc.

Indexed parameters are used to both display and change several parameter values which are all assigned to the same parameter number.

7.3.2 Parameterization on simple operator control panel

After the electronics supply voltage has been switched on, the PMU is either in the operational display state and indicating the current operating status of the SIMOREG 6RA70 (e.g. o7.0), or in the fault/alarm display state and indicating a fault or alarm (e.g. F021).

Operational states are described under parameter r000 in Section 11 and the fault and alarm messages in Section 10.

1. To reach the parameter number level from the operational display state (e.g. o7.0), press the P key and then the <Up> or <Down> key to select individual parameter numbers.
2. To reach the parameter index level (for indexed parameters) from the parameter number level, press P and then the <Up> or <Down> key to select individual indices.
   If you press P when a non-indexed parameter is displayed, you go directly to the parameter value level.
3. To reach the parameter value level from the parameter index level (for indexed parameters), press P.
4. On the parameter value level, you can change the setting of a parameter value by pressing the <Up> or <Down> key.

NOTE

Parameters can be altered only if the following conditions are fulfilled:

- The appropriate access authorization is set in key parameter P051, e.g. “40” (see Section 11, “Parameter List”).
- The converter is the correct operational state. Parameters with characteristic “offline” cannot be changed when the converter is in the “Run” (online) state. To change parameters with this characteristic, switch the converter to the ≥o1.0 status (“Ready”).
- The values of display parameters can never be changed (read only).

5. Manual shifting

If the 5 existing digits on the 7-segment display are not sufficient to display a parameter value, the display first shows just 5 digits (see Fig. 7.1). To indicate that digits are concealed to the right or left of this “window”, the right-hand or left-hand digit flashes. By pressing the <P>+<Down> or <P>+<Up> key, you can shift the window over the remaining digits of the parameter value.
As an orientation guide, the position of the right-hand digit within the overall parameter value is displayed briefly during manual shifting.

Example: Parameter value “208.173“
"208.17" is displayed when the parameter is selected. When the P and LOWER keys are pressed, "1" appears briefly followed by “08.173“, i.e. the right-hand digit 3 is the 1st position in the parameter value.
When the P and RAISE keys are pressed, "2" appears briefly followed by “208.17“, i.e. the right-hand digit 7 is the 2nd position in the parameter value.

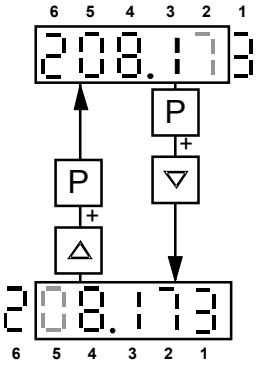


Fig. 7.1 Shifting the PMU display for parameter values with more than 5 digits

6. Press the P key to return to the parameter number level from the parameter value level.

Tables 7.1 and 7.2 below show an overview of displays which may appear on the PMU:

		Parameter number e. g.	Index e. g.	Parameter value e. g.
Display parameters	**Basic unit**	r000 or n000	001	0 7.0
	Technology	d000 or c000		
Setting parameters	**Basic unit**	P051 or U051	001	-2.08
	Technology	H002 or L002		

Table7.1 Display of visualization and setting parameters on the PMU

	Actual value	Parameter value not (currently) possible	Alarm	Fault
Display	-2.08	- - - - _ _ _ _	A022	F006

Table 7.2 Status displays on the PMU

NOTE

Parameters are described in the Parameter List in Section 11 and faults and alarms in Section 10.

7.4 Reset to default value and adjust offset

Restoring parameters values to defaults (works settings) and performing an internal converter offset adjustment.

The "Restore factory setting" function must be executed after every software update if the converter software has been updated from version 1.0 or 1.1.

With converter SW version 1.2 and later, it is no longer necessary to execute "Restore factory settings" after a software update because the parameter settings prior to the update remain valid.

The “Restore to default” function can be executed if a defined basic setting is to be established, e.g. in order to carry out a complete new start-up operation.

NOTICE

When the “Restore to default” function is activated, all parameters set for a specific installation are overwritten (deleted). We therefore recommend that all old settings be read out beforehand with **Drive Monitor** and stored on a PC or programmer.

“Restore to default” must be followed by a completely new start-up operation or else the converter will not be “ready” with respect to safety.

Execution of function:

1. Set parameter **P051 = 21**
2. Transfer parameter values to the non-volatile memory.
   The parameter values are stored in non-volatile storage (EEPROM) so that they will still be available when the converter is switched off. This operation takes at least 5 s (but may also last several minutes). The number of the parameter currently being processed is displayed on the PMU during the process. The electronics power supply must remain connected while this operation is in progress.
3. Offset adjustments
   Parameter P825.ii is set (takes approx. 10 s).

The offset adjustment can also be activated as an individual function by means of parameter **P051 = 22**.

7.5 Start-up procedure

WARNING

The converter is at a hazardous voltage level even when the line contactor is open. The gating board (board mounted directly to lower part of housing) has many circuits at hazardous voltage levels.

Non-observance of the safety instructions given in this manual can result in death, severe personal injury or substantial property damage.

1 Access authorization

P051 . . . Key parameter
- 0 Parameter cannot be changed
- 40 Parameter can be changed

P052 . . . Selection of parameters to be displayed
- 0 Only parameters that are not set to default are visible
- 3 All parameters are visible

P927 . . . Enter an odd number if parameters are to be entered via CB (PROFIBUS)

2 Adjustment of converter rated currents

NOTICE

On North American manufactured Base Drive assemblies (Type 6RA70xx-2xxxx) the US rating must be set in Parameter P067.

The **rated converter armature DC current** must be adapted by the setting in parameter P076.001 (in %) or parameter P067, if:

$$\frac{\textit{Max. armature current}}{\textit{Rated armature DC current}} < 0{,}5$$

The **rated converter field DC current** must be adjusted by the setting in parameter P076.002 (in %) if:

$$\frac{\textit{Max. field current}}{\textit{Rated converter field DC current}} < 0{,}5$$

3 Adjustment to actual converter supply voltage

P078.001 . . . Rated input voltage converter armature (in volts)
P078.002 . . . Rated input voltage converter field (in volts)

4 Input of motor data

In the parameters below, the motor data must be entered as specified on the motor rating plate.

P100 . . . Rated armature current (in amps)
P101 . . . Rated armature voltage (in volts)
P102 . . . Rated field current (in amps)
P104 . . . Speed n_1 (in rpm) see also Section 9.16
P105 . . . Armature current I_1 (in amperes) see also Section 9.16
P106 . . . Speed n_2 (in rpm) see also Section 9.16
P107 . . . Armature current I_2 (in amperes) see also Section 9.16
P108 . . . Maximum operating speed n_3 (in rpm) see also Section 9.16
P109 . . . 1 = speed-dependent current limitation active see also Section 9.16
P114 . . . Thermal time constant of motor (in minutes) see also Section 9.14
(if necessary: activate fault signal F037 with P820!)

5 Actual speed sensing data

5.1 Operation with analog tacho

P083 = 1: The actual speed is supplied from the “Main actual value” channel (K0013) (terminals XT.103, XT.104)

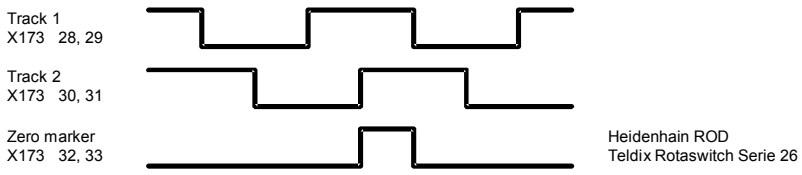
P741 Tacho voltage at maximum speed (– 270,00V to +270,00V)

5.2 Operation with pulse encoder

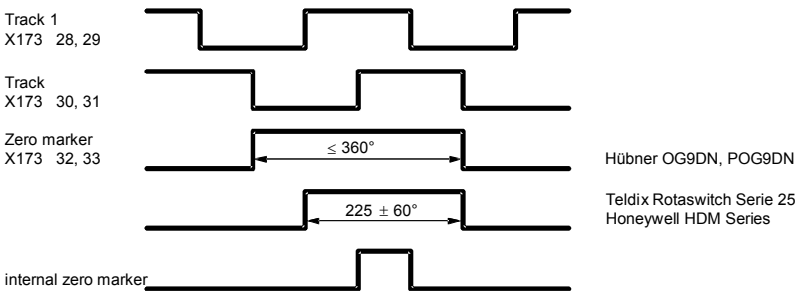
P083 = 2: The actual speed is supplied by the pulse encoder (K0040)

P140 Selecting a pulse encoder type (pulse encoder types see below)
0 No encoder/"Speed sensing with pulse encoder" function not selected
1 Pulse encoder type 1
2 Pulse encoder type 1a
3 Pulse encoder type 2
4 Pulse encoder type 3

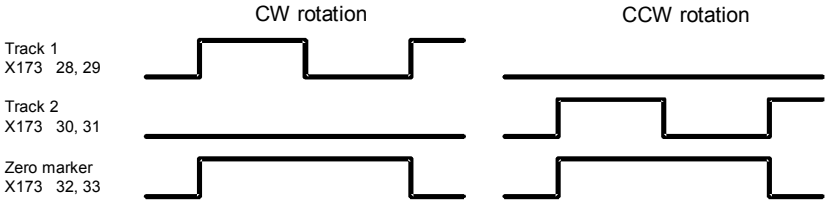
1. Pulse encoder type 1
Encoder with two pulse tracks mutually displaced by 90° (with/without zero marker)



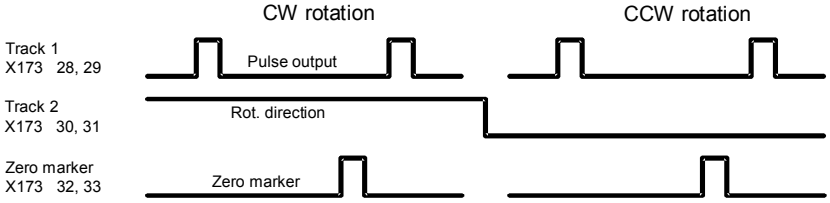
2. Pulse encoder type 1a
   Encoder with two pulse tracks mutually displaced by 90° (with/without zero marker). The zero marker is converted internally to a signal in the same way as on encoder type 1.



3. Pulse encoder type 2
   Encoder with one pulse track per direction of rotation (with/without zero marker).



4. Pulse encoder type 3
   Encoder with one pulse track and one output for direction of rotation (with/without zero marker).



P141 Number of pulses of pulse encoder (in pulses/rev)

P142 Matching to pulse encoder signal voltage
0 Pulse encoder outputs 5 V signals
1 Pulse encoder outputs 15V signals

Matching of internal operating points to signal voltage of incoming pulse encoder signals.

NOTICE

Resetting parameter P142 to the alternative setting does not switch over the supply voltage for the pulse encoder (terminals X173.26 and 27).
Terminal X173.26 always supplies +15V. An external voltage supply must be provided for pulse encoders requiring a 5V supply.

P143 Setting the maximum speed for pulse encoder operation (in pulses/rev)
The speed set in this parameter corresponds to an actual speed (K0040) of 100%.

5.3 Operation without tacho (EMF control)

P083 = 3: The actual speed is supplied from the “Actual EMF” channel (K0287), but weighted with P115.

P115 EMF at maximum speed
(1.00 to 140.00% of rated converter supply voltage (r078.001)).

5.4 Freely wired actual value

P083 = 4: The actual value input is defined with P609.

P609 Number of connector which is connected to controller actual value input.

6 Field data

6.1 Field control

P082 = 0: Internal field is not used
(e.g. with permanent-field motors)

P082 = 1: The field is switched together with the line contactor
(field pulses are enabled/disabled when line contactor closes/opens)

P082 = 2: Automatic connection of standstill field set via P257 after a delay parameterized via P258, after operating status o7 or higher has been reached

P082 = 3: Field current permanently connected

6.2 Field weakening

P081 = 0: No field weakening as a function of speed or EMF

P081 = 1: Field weakening operation as a function of internal EMF control so that, in the field weakening range, i.e. at speeds above rated motor speed (= “threshold speed”), the motor EMF is maintained constantly at setpoint
EMFset (K289) = P101 – P100 * P110.

7 Selection of basic technological functions

7.1 Current limits

P171 Motor current limit in torque direction I (in% of P100)

P172 Motor current limit in torque direction II (in% of P100)

7.2 Torque limits

P180 Torque limit 1 in torque direction I
(in % of rated motor torque)

P181 Torque limit 1 in torque direction II
(in % of rated motor torque)

7.3 **Ramp-function generator**

P303 Acceleration time 1 (in seconds)
P304 Deceleration time 1 (in seconds)
P305 Initial rounding 1 (in seconds)
P306 Final rounding 1 (in seconds)

8 Execution of optimization runs

8.1 The drive must be in operating state o7.0 or o7.1 (enter SHUTDOWN!).

8.2 Select one of the following optimization runs in key parameter P051:

P051 = 25 Optimization run for precontrol and current controller for armature and field
P051 = 26 Speed controller optimization run
can be preceded by selection of the degree of dynamic response of the speed control loop with P236, where lower values produce a softer controller setting.
P051 = 27 Optimization run for field weakening
P051 = 28 Optimization run for compensation of friction moment and moment of inertia
P051 = 29 Speed controller optimization run for drives with oscillating mechanical system.

8.3 The SIMOREG converter switches to operating state o7.4 for several seconds and then to o7.0 or o7.1 and waits for the input of SWITCH-ON and OPERATING ENABLE..

Enter the commands SWITCH-ON and OPERATING ENABLE.

The flashing of the decimal point in the operational status display on the PMU (simple operator control panel) indicates that an optimization run will be performed after the switch-on command.

If the switch-on command is not given within 30 s, this waiting status is terminated and fault message F052 displayed.

8.4 As soon as the converter reaches operating status <o1.0 (RUN), the optimization run is executed.
An activity display appears on the PMU, consisting of two 2-digit numbers, separated by a bar that moves up and down. These two numbers indicate (for SIEMENS personnel) the current status of the optimization run.

P051 = 25 Optimization run for precontrol and current controller for armature and field
(process lasts approximately 40s)
The current controller optimization run may be executed without a mechanical load coupled to the motor; it may be necessary to lock the rotor.
The following parameters are set automatically: P110, P111, P112, P155, P156, P255, P256, P826.

CAUTION

Permanent-field motors (and motors with an extremely high residual flux) must be mechanically locked during this optimization run.

CAUTION

In order to avoid rotation in the case of separately excited motors with a very high field circuit time constant, the motor field current must be zero before starting this optimization run. The value 1 (11, 21) must therefore be set at P082 instead of 3 (13, 23) for the duration of this optimization run. The standstill field P257 is to be set to 0.0 percent if P082 = 2 (12, 22).

WARNING

The set current limits are not effective during the current controller optimization run. 75% of the rated motor armature current flows for approximately 0.7s. Furthermore, individual current spikes of approximately 120% of the motor rated armature current are generated.

P051 = 26 **Speed controller optimization run** (process lasts approximately 6s)
The degree of dynamic response of the speed control loop can be selected with P236, where lower values produce a softer control loop. P236 must be set before the speed controller is optimized, and affects the settings of P225, P226, and P228.
For the purpose of speed controller optimization, the ultimate mechanical load should be connected to the motor where possible, since the parameter settings are determined by the measured moment of inertia.
The following parameters are set automatically: P225, P226 and P228.

Note:
The speed controller optimization run takes only the filtering of the actual speed controller value parameterized in P200 into account and, if P083=1, filtering of the main actual value parameterized in P745.
When P200 < 20ms, P225 (gain) is limited to a value of 30.00.
The speed controller optimization run sets P228 (speed setpoint filter) to the same value as P226 (speed controller integration time) (for the purpose of achieving an optimum control response to abrupt setpoint changes).

NOTICE

In the case of separately excited motors with a very high field circuit time constant, a motor field current approximately equal to the rated field current of the motor according to P102 should be flowing before this optimization run starts. The value 3 (13, 23) must therefore be set at P082 instead of 1 (11, 21), 2 (12, 22) or 4 (14, 24) for the duration of this optimization run.

WARNING

During the speed controller optimization run, the motor is accelerated at a maximum of 45% of its rated armature current. The motor may reach speeds of up to approximately 20% of maximum speed.

If field weakening is selected (P081 = 1), if closed-loop torque control (P170=1) or torque limiting (P169=1) is selected or if a variable field current setpoint is applied:

P051 = 27 **Optimization run for field weakening** (process lasts approx. 1min)
This optimization run may also be started without a mechanical load.
The following parameters are set automatically: P117 to P139, P275 and P276.

Note:
In order to determine the magnetization characteristic, the field current setpoint is reduced during the optimization run from 100% of the motor rated field current as set in P102 down to a minimum of 8%. The field current setpoint is limited to a minimum according to P103 by parameterizing P103 to values < 50% of P102 for the duration of the run. This might be necessary in the case of uncompensated motors with a very high armature reaction.

The magnetizing characteristic is approximated linearly to 0, starting from the measuring point, at a minimum field current setpoint.

To execute this optimization run, the minimum field current (P103) must be parameterized to less than 50% of the rated motor field current (P102).

WARNING

During this optimization run, the drive accelerates to approximately 80% of rated motor speed (the armature voltage corresponds to maximum 80% of the rated motor armature voltage (P101)).

P051 = 28 **Optimization run for compensation of friction moment and moment of inertia (if desired)** (process lasts approx. 40s)

The following parameters are set automatically: P520 to P530, P540

WARNING

The drive accelerates up to maximum speed during this optimization run.

On completion of this run, the friction and inertia moment compensation function must be activated manually by setting P223=1.

When the operating mode is switched from current control to torque control with P170, the optimization run for friction and inertia moment compensation must be repeated.

Note:
The speed controller may not be parameterized as a pure P controller or as a controller with droop when this optimization run is executed.

P051 = 29 **Speed controller optimization run on drives with oscillating mechanical components** (takes up to 10 minutes)
The following parameters are set automatically: P225, P226 and P228.

The frequency response of the controlled system for frequencies of 1 to 100 Hz are recorded during this optimization run.

The drive is first accelerated up to a base speed (P565, FS=20%). A sinusoidal speed setpoint with low amplitude (P566, FS=1%) is then injected. The frequency of this supplementary setpoint is changed in steps of 1 Hz from 1 Hz to 100 Hz. An average is calculated from a programmable number of current peaks (P567, WE=300) for each frequency.
[The value set in P567 is significant in determining the time taken to perform the run. With a setting of 300, the run can take about 3 to 4 minutes.]

The optimum speed controller setting for the controlled system is calculated on the basis of the frequency response measured for the system.

WARNING

This optimization run must not be carried out if the motor is coupled to a mechanical load which is capable of moving the torque-free motor (e.g. a vertical load).

8.5 At the end of the optimization run, P051 is displayed on the operator panel and the drive switches to operating state o7.2.

NOTICE

In the case of drives with a limited travel path, the optimization run for field weakening (P051=27) may not be interrupted by the SHUTDOWN command until the 1st field weakening measuring point has been plotted. Likewise, the optimization run for the friction moment and moment of inertia compensation function (P051=28) may not be interrupted by SHUTDOWN until the measuring point at 10% of maximum speed has been determined. Premature interruption in both cases will lead to activation of fault message F052. When either of these optimization runs is restarted (P051=27 or P051=28), it will be continued at a more advanced position. In this way, the respective run can be completed in several stages, even if the travel path is limited.

Note:
The respective optimization run is executed completely after a restart if a) a fault message is activated during the optimization run, b) if the electronics supply is disconnected before the relevant optimization run is restarted, c) if another function dataset than the one before is selected or d) if another optimization run is started in-between.

The parameters of the function data set selected in each case are optimized.

While optimization runs are being executed, the function data set selection must not be changed or else a fault message will be activated.

NOTE

Optimization runs should be executed in the order listed above (precontrol and current controller, speed controller, field weakening control, friction moment and moment of inertial compensation).

The determined parameters are dependent on the motor temperature. Values set automatically when the motor is cold can be used as effective defaults.

For highly dynamic drives, the optimization run P051=25 should be repeated after the drive has been operated under load (i.e. when motor is warm).

9 **Checking and possible fine adjustment of maximum speed**

After the optimization runs have been executed, the maximum speed must be checked and it's setting corrected if necessary.
If it is necessary to change the maximum speed setting by more than about 10%, the control response of the speed control loop must be checked. It may be necessary to repeat the speed controller optimization run or re-optimize the controller manually.

The optimization runs for field weakening and friction motor and moment of inertial compensation must be repeated every time the maximum speed setting is altered.

10 **Checking the drive settings**

The optimization runs do not provide optimum results for every application. The controller settings must therefore be checked by suitable means (oscilloscope, DriveMonitor, Trace etc.). In some cases, manual re-optimization will be necessary.

11 Manual (post-)optimization (if necessary)

Precontrol and current controller for armature and field

Instructions on how to manually set parameters for the precontrol function can be found in Section 7.2 “Manual optimization”.

Speed controller

P200 Actual speed filtering
P225 Speed controller P gain
P226 Speed controller integration time
P227 Speed controller droop
P228 Speed setpoint filtering

Note:
P228 is set to the same value as P226 (speed controller integration time) during the speed controller optimization run (P051=26) (for the purpose of achieving an optimum control response to abrupt setpoint changes). When the ramp-function generator is used, it may be better to parameterize a lower speed setpoint filtering value (P228).

Setting of empirical values or optimization using setpoint control boxes according to generally applicable optimization guidelines.

EMF controller

P275 EMF controller P gain
P276 EMF controller integration time

Setting of empirical values or optimization using setpoint control boxes according to generally applicable optimization guidelines.

12 Setting of supplementary functions

e.g. activating monitoring functions

NOTE

In the factory setting, the following fault signals are deactivated with parameters P820.01 to P820.06:

F007 (overvoltage)
F018 (short circuit at the binary outputs)
F031 (controller monitoring speed controller)
F035 (drive blocked)
F036 (no armature current can flow)
F037 (i^2t monitoring of motor)

Activate the monitoring functions required in your applications by replacing the fault number in question with the value 0.

e.g. activating the free function blocks

NOTE

Freely assignable function blocks are enabled in parameter U977.
For enabling instructions, please refer to Section 11, Parameter List, description of parameters U977 and n978.

13 Documentation of setting values

- Read out parameters with DriveMonitor (see Section 15 “DriveMonitor”)

  or

- Document parameters
  If P052=0, only parameters that are not set to the default setting are displayed on the operator control panel.

7.6 Manual optimization (if required)

7.6.1 Manual setting of armature resistance R_A (P110) and armature inductance L_A (P111)

- **Setting of armature circuit parameters according to motor list**

  Disadvantage: The data is very inaccurate and/or the actual values deviate significantly.

  The feeder resistances are not taken into account in the armature circuit resistance.
  Additional smoothing reactors and feeder resistances are not taken into account in the armature circuit inductance.

- **Rough estimation of armature circuit parameters from motor and supply data**

  Armature circuit resistance P110

$$R_A\,[\Omega] = \frac{\text{Rated motor armature voltage [V] (P101)}}{10 * \text{Rated motor armature current [A] (P100)}}$$

  The basis for this formula is that 10% of the rated armature voltage drops across armature circuit resistor R_A at rated armature current.

  Armature circuit inductance P111

$$L_A\,[\text{mH}] = \frac{1.4 * \text{Rated converter supply voltage of armature power section [V] (P071)}}{\text{Rated motor armature current [A] (P100)}}$$

  The basis for this formula is the empirical value: The transition from discontinuous to continuous current is at approx. 30% of the rated motor armature current.

- **Calculation of armature circuit parameters based on current/voltage measurement**
  - Select current-controlled operation: **P084=2**
  - Set parameter **P153=0** (precontrol deactivated)
  - The field must be switched off by setting **P082=0** and, in the case of excessively high residual flux, the rotor of the DC motor locked so that it cannot rotate.
  - Set the overspeed protection threshold **P354=5%**
  - Enter a main setpoint of 0
  - If ”ENABLE OPERATION” is applied and the “SWITCH ON” command entered, an armature current of approximately 0% now flows.

Calculation of armature circuit resistance P110 from measured armature current and armature voltage values

- Increase the main setpoint (displayed at r001) slowly until the actual armature current value (r019 in % of rated converter armature current) reaches approximately 70% of the rated motor armature current.
- Read out r019 (actual armature current value) and convert to amps (using P100)
- Read out r038 (actual armature voltage in volts)
- Calculate the armature circuit resistance:

$$R_A\,[W] = \frac{r038}{r019\,(\text{converted to amps})}$$

- Set the armature circuit resistance in parameter P110

Calculation of armature circuit inductance P111 from measured armature current at transition from discontinuous to continuous current

- Make an oscilloscope trace of the armature current (e.g. at terminal 12)
  Increase the main setpoint (displayed at r001) slowly starting from 0 until the armature current reaches the transition from discontinuous to continuous current.
- Measure armature current at transition (at standstill EMF=0) $I_{LG,\,EMF=0}$ or read out the value of r019 and convert to amps using P100.
- Measure the phase-to-phase voltage of the armature power section U_{supply} or read out the value of r015.
- Calculate the armature circuit inductance using the following formula:

$$L_A\,[mH] = \frac{0.4 * U_{supply}\ [V]}{I_{LG,EMF}\ [A]}$$

- Set the armature circuit inductance in parameter P111.

7.6.2 Manual setting of field circuit resistance R_F (P112)

- **Rough estimation of field circuit resistance R_F (P112) from motor rated field data**

$$R_F = \frac{\text{Rated motor field voltage}}{\text{Rated motor field current (P102)}}$$

- **Adapt the field circuit resistance R_F (P112) using a field current setpoint/actual value comparison**
  - Set parameter **P112=0** to produce a 180° field precontrol output, and thus an actual field current value = 0
  - Set parameter **P082=3** to ensure that the field remains permanently energized, even when the line contactor has dropped out
  - Set parameters **P254=0** and **P264=0,** i.e. only field precontrol active and field current controller disabled
  - Set parameter **P102** to the rated field current
  - **Increase** parameter **P112** until the actual field current (r035 converted to amps be means of r073.002) is equal to the required setpoint (P102).
  - Reset parameter **P082** to the plant operating value.

7.7 Starting up optional supplementary boards

For board mounting instructions, see Section 5.3.2 , Mounting Optional Supplementary Boards. This section also contains details on the number of supplementary boards that can be installed and in which slots they may be inserted.

The basic converter automatically detects all installed supplementary boards during power-up.

All communications-related settings must be made by means of parameters. The function diagrams in Section 8 show a general overview of the parameters provided for this purpose.

If two boards of the same type (e.g. two EB1s) are installed in a converter, the slots in which they are installed determine the parameter settings. The board in the slot with the lower slot letter is the 1st board (e.g. the 1st EB1) of this particular type and the board with the higher letter the 2nd board (e.g. 2nd EB1).
The 1st board is parameterized via index 1 and the 2nd board via index 2 of the corresponding parameter (e.g. to define the signal type of the analog inputs of boards of type EB1, parameter U755.001 is used for the 1st EB1 and parameter U755.002 for the 2nd EB1).

7.7.1 Procedure for starting up technology boards (T100, T300, T400):

NOTE

Freely configurable technology boards T300 and T400 are guaranteed to operate correctly (board run up and data exchange with the SIMOREG 6RA70). The user, however, must bear responsibility for ensuring that the system is properly configured.

1 Disconnect the power supply and insert the board in location 2.

2 Power up the system again to gain access to the parameters of the technology board (d and H parameters, as well as c and L parameters if programmed).

The process data are interconnected at the basic converter end by means of the appropriate connectors and binectors (see Section 8, function diagram Z110)
For meaning of bits of control and status words, please see Section 8, Sheets G180 to G183.

If a communication board is used in addition to a technology board, then data are exchanged with the basic converter via the technology board. The basic converter cannot directly access the data of the communication board. The connections of the transfer data are then determined by the configuration or parameter settings of the technology board.

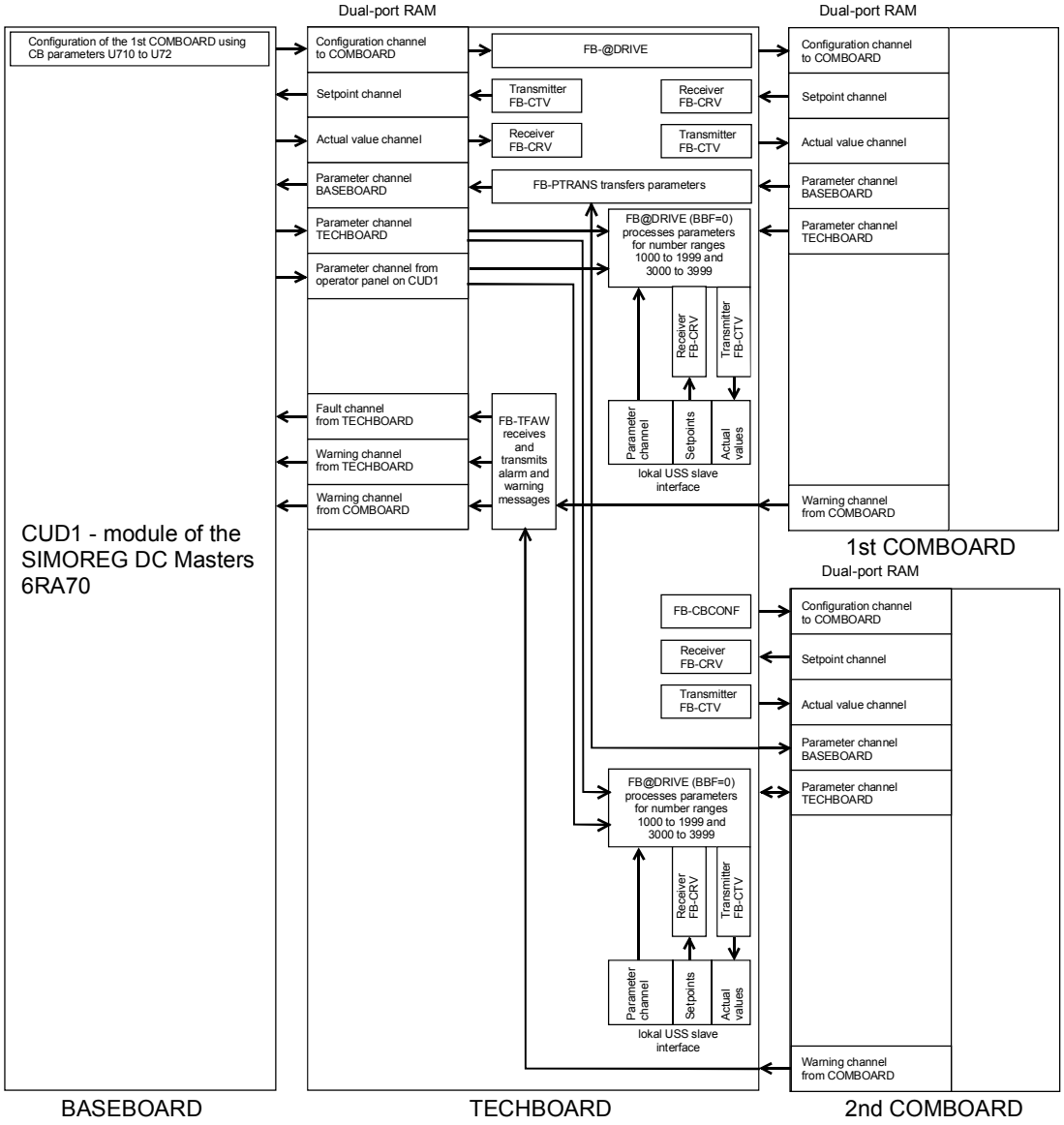
Module T100 comprising software submodule MS100 already contains several technology functions and arithmetic, control, and logic modules, which are freely configurable using parameters. This software can be expanded with customized components, if required.

As module T300 has already been replaced by T400, T300 should only be used in special circumstances.

Only one communication module (CBC, CBD, CBP2, SCB1) is permitted in slot G in addition to the technology modules T100 and T300 in slot 2.

Module T400 is already available with standard configurations for frequent applications. They permit the use of several functions (e.g. inputs/outputs, serial interfaces, link to a communications module) without any additional configuration.

As from configuration software D7-SYS V4.0 R07/98, it is possible to configure not only one, but two communications modules (CBC, CBD, CBP2) for module T400. These modules are then located on an ADB in slots G (1. CB) and F (2. CB).
In this case, the 2nd CB is not configured with parameters of the basic device, but the CB parameters must be configured as modifiable parameters of the T400.
Possible communications paths are shown in the figure below. For details of how to configure a T400, please consult the relevant documentation (e.g. SIMADYN D – Configuring Instructions T400, 6DD1903-0EA0 etc.).



The SIMOREG DC-MASTER 6RA70 does not permit direct evaluation of the signals of a pulse generator connected to the terminals of the CUD1 by the T400.

7.7.2 Sequence of operations for starting up PROFIBUS boards (CBP2):

1 Switch off the power supply and insert the board or adapter with board. For board mounting instructions, see Section 5.3.2 , Mounting Optional Supplementary Boards.

2 The following are important communication parameters. Index 1 of each parameter is set for the 1st communication board (1st CB) and index 2 for the 2nd communication board (2nd CB):

- U712 PPO type, definition of the number of words in the parameter and process data section of the telegram (required only if the PPO type cannot be set via PROFIBUS-DP master)
- U722 Telegram failure time for process data (0 = deactivated)
  The DP master configuring data determine whether the slave (CBP2) must monitor telegram traffic with the master. If this monitoring function is activated, the DP master passes a time value (watchdog time) to the slave when the link is set up. If no data are exchanged within this period, the slave terminates the process data exchange with the SIMOREG converter. The latter can monitor the process data as a function of U722 and activate fault message F082.
- P918 Bus address
- P927 Parameterization enable (need only be set if parameters are to be assigned via PROFIBUS)

-The process data of the 1st or 2nd communication board are connected by means of the appropriate connectors and binectors (see Section 8, function diagrams Z110 and Z111) For meaning of bits of control and status words, please see Section 8, Sheets G180 to G183.

3 Turn the electronics supply voltage off and on again or set U710.001 or U710.002 to "0" to transfer the values of parameters U712, U722 and P918 to the supplementary board.

WARNING

This initialization process will interrupt the communication of any supplementary board that has already been started up.

WARNING

Note the setting of parameter U722. In the factory setting of U722 (monitoring deactivated) the drive continues to run with the last received setpoints in case of a PROFIBUS failure and can only be stopped by an OFF signal from the terminal. For details, see Section 11, Parameter list.

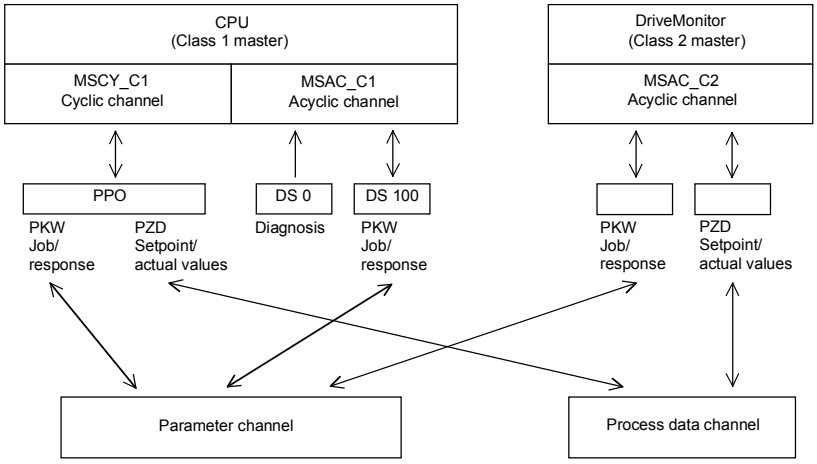
The CBP2 (Communication Board PROFIBUS) serves to link drives and higher-level automation systems via the PROFIBUS-DP. For the purpose of PROFIBUS, it is necessary to distinguish between master and slave converters.

Masters control the data traffic via the bus and are also referred to as **active nodes**. There are two classes of master:
DP masters of class 1 (DPM1) are central stations (e.g. SIMATIC S5, SIMATIC S7 or SIMADYN D) which exchange data with slaves in predefined message cycles.
DPM1s support both a **cyclic channel** (transmission of process data and parameter data) and an **acyclic channel** (transmission of parameter data and diagnostic data).
DP masters of class 2 (DPM2) are programming, configuring or operator control/visualization devices (e.g. DriveMonitor) which are used in operation to configure,

start up or monitor the installation.
DPM2s support only an **acyclic channel** for transferring parameter data.

The contents of the data frames transferred via these channels are identical to the structure of the parameter section (PKW) as defined by the USS specification.

The following diagram shows the services and channels supported by a CBP2:



Slaves (e.g. CBP2) may only respond to received messages and are referred to as **passive nodes**.

PROFIBUS (**Pro**cess **Fi**eld Bus) combines high baud rates (to RS485 standard) with simple, low-cost installation. The PROFIBUS baud rate can be selected within a range of 9.6 kbaud to 12 Mbaud and is set for all devices connected to the bus when the bus system is started up.
The bus is accessed according to the token-passing method, i.e. permission to transmit for a defined time window is granted to the active stations (masters) in a "logical ring". The master can communicate with other masters, or with slaves in a subordinate master-slave process, within this time window.
PROFIBUS-**DP** (**D**istributed **P**eripherals) predominantly utilizes the master-slave method and data is exchanged cyclically with the drives in most cases.

The user data structure for the **cyclic channel MSCY_C1** (see picture above) is referred to as a Parameter Process(data) Object (**PPO**) in the PROFIBUS profile for variable-speed drives. This channel is also frequently referred to as the **STANDARD** channel.
The user data structure is divided into two different sections which can be transferred in each telegram:

PZD section
The process data (PZD) section contains control words, setpoints, status words and actual values.

PKW section
The parameter section (PKW - Parameter ID Value) is used to read and write parameter values.

When the bus system is started up, the type of PPO used by the PROFIBUS master to address the drive is selected. The type of PPO selected depends on what functions the drive has to perform in the automation network.

Process data are always transferred and processed as priority data in the drive.
Process data are "wired up" by means of connectors of the basic unit (drive) or via technology board parameters, if these are configured.

Parameter data allow all parameters of the drive to be accessed, allowing parameter values, diagnostic quantities, fault messages, etc. to be called by a higher-level system without impairing the performance of the PZD transmission.

A total of five PPO types are defined:

	PKW section				PZD section									
	PKE	IND	PWE		PZD1 STW 1 ZSW 1	PZD2 HSW HIW	PZD3	PZD4	PZD5	PZD6	PZD7	PZD8	PZD9	PZD 10
	1st word	2nd word	3rd word	4th word	1st word	2nd word	3rd word	4th word	5th word	6th word	7th word	8th word	9th word	10th word
PPO1														
PPO2														
PPO3														
PPO4														
PPO5														

PKW:	Parameter ID value	IND:	Index	ZSW	Status word
PZD:	Process data	PWE:	Parameter value	HSW:	Main setpoint
PKE:	Parameter identifier	STW:	Control word	ISW:	Main actual value

The **acyclic channel MSCY_C2** (see diagram above) is used exclusively for the start-up and servicing of DriveMonitor.

7.7.2.1 Mechanisms for processing parameters via the PROFIBUS:

The PKW mechanism (with PPO types 1, 2 and 5 and for the two acyclic channels MSAC_C1 and MSAC_C2) can be used to read and write parameters. A parameter request job is sent to the drive for this purpose. When the job has been executed, the drive sends back a response. Until it receives this response, the master must not issue any new requests, i.e. any job with different contents, but must repeat the old job.

The parameter section in the telegram always contains at least 4 words:

Parameter identifier PKE	Index IND	Parameter value 1 PWE1 (H word)	Paramter value 2 PWE2 (L word)

Details about the telegram structure can be found in Section 7.7.9, "Structure of request/response telegrams“, and in the PROFIBUS profile "PROFIBUS Profile, Drive technology" of the user's organization PROFIBUS International (http://www.profibus.com).

The **parameter identifier PKE** contains the number of the relevant parameter and an identifier which determines the action to be taken (e.g. "read value").

The **index IND** contains the number of the relevant index value (equals 0 in the case of nonindexed parameters). The IND structure differs depending on the communication mode:

- Definition in the PPOs (structure of IND with cyclical communication via PPOs)
- Definition for acyclical channels MSAC_C1 and MSAC_C2 (structure of IND with acyclical communication)

The array subindex (referred to simply as "subindex" in the PROFIBUS profile) is an 8-bit value which is transferred in the **high-order** byte (bits 8 to 15) of the index (IND) **when data are transferred cyclically via PPOs**. The low-order byte (bits 0 to 7) is not defined in the DVA profile. The low-order byte of the index word is used in the PPO of CBP2 to select the correct number range (bit7 = Page Select bit) in the case of parameter numbers of > 1999.

In the case of **acyclical data traffic** (MSAC_C1, MSAC_C2) the number of the index is transferred in the **low-order** byte (bits 0 to 7). Bit 15 in the high-order byte is used as the Page Select bit. This assignment complies with the USS specification.

Index value 255 (request applies to all index values) is meaningful only for acyclical transmission via MSAC_C1. The maximum data block length is 206 bytes with this transmission mode.

The **parameter value PWE** is always transferred as double word (32-bit value) PWE1 and PWE2. The high-order word is entered as PWE1 and the low-order word as PWE2. In the case of 16-bit values, PWE1 must be set to 0 by the master.

Example (acyclical data traffic):

Read parameter P101.004 (for details, see Section 7.7.9, "Structure of request/response telegrams“):

Request identifier PKE = 0x6065 (request parameter value (array) P101),
Index IND = 0004h = 4d
Parameter value PWE1 = PWE2 = 0

SIMOREG response:

Response identifier PKE = 0x4065,
Index IND = 0004h = 4d
Value of P101.004 = 0190h = 400d (PWE1 = 0, because it is not a double word parameter)

Rules for job/response processing:

A job or a response can only ever refer to one parameter.

The master must send the job repeatedly until it receives an appropriate response from the slave. The master recognizes the response to the job it has sent by analyzing the response identifier, the parameter number, the parameter index and the parameter value.

The complete job must be sent in one telegram. The same applies to the response.

The actual values in repeats of response telegrams are always up-to-date values.

If no information needs to be fetched via the PKW interface (but only PZD) in cyclic operation, then a "No job" job must be issued.

PROFIBUS devices have a variety of difference performance features. In order to ensure that all master systems can correctly address each supplementary board, the characteristic features of each board are stored in a separate device master file (GSD).
You need file <siem8045.gsd> for CBP2.
The appropriate file can be chosen in the selection menu for the SIMOVERT MASTER DRIVES files in later versions of the configuring tool.
If a device master file is not available in the menu, it can be collected from an Internet site. The Internet address is http://www4.ad.siemens.de/view/cs/en/4647098.
Product Support/PROFIBUS GSD files/Drives/ . Have all entries displayed using the search function and click on the search results.

SIMOVERT/SIMOREG/SIMADYN CBP
File: siem8045.gsd

The communication boards can only be operated on a non-Siemens master as a DP standard slave, the corresponding GSD file containing all necessary information for this mode.

Detailed information about communication via PROFIBUS can be found in Section 8.2 of the compendium for SIMOVERT MASTER DRIVES Motion Control (order no. 6SE7080-0QX50). The description in this document is fully applicable in every respect, except that the specified parameter numbers differ from those used on the SIMOREG DC-MASTER 6RA70.

7.7.2.2 Diagnostic tools:

LED displays of CBP2 (flashing LEDs mean normal operation):

Red LED	Status of CBP2
Yellow LED	Communication between SIMOREG and CBP2
Green LED	Communication between CBP2 and PROFIBUS

As a start-up support tool, the PROFIBUS board supplies data which can be displayed in n732.001 to n732.032 (1st CB) or n732.033 to n732.064 (2nd CB).
The values of the indices are as follows:

Index	Meaning for CBP2
001/033	CBP_Status Bit0: "CBP Init", CBP is being initialized or waiting to be initialized by the basic unit (not set in normal operation) Bit1: "CBP Online", CBP is selected by basic unit (set in normal operation) Bit2: "CBP Offline", CBP not selected by basic unit (not set in normal operation) Bit3: Illegal bus address (P918) (not set in normal operation) Bit4: Diagnostic mode activated (U711 <> 0) (not set in normal operation) Bit8: Incorrect identifier bytes transferred (incorrect configuring message from PROFIBUS Master) (not set in normal operation) Bit9: Incorrect PPO type (incorrect configuring message from PROFIBUS Master) (not set in normal operation) Bit10: Correct configuring data received from PROFIBUS_DP Master (set in normal operation) Bit12: Fatal error detected by DPS Manager software (not set in normal operation) Bit13: Program in endless loop in main.c (loop can only be exited by a Reset) Bit15: Program in communications online loop (loop can only be exited through re-initialization by basic unit)
002/034	SPC3_Status Bit0: Offline/Passive Idle (0=SPC3 is operating in normal mode (offline) 1=SPC3 is operating in Passive Idle) Bit2: Diag flag (0=diagnostic buffer has been picked up by master 1= diagnostic buffer has not been picked up by master) Bit3: RAM Access Violation, memory access >1.5kB (0=no address violation, 1=for addresses > 1536 bytes, 1024 is subtracted from address and access made to the new address) Bit4+5: DP state (00=Wait_Prm, 01=Wait_Cfg, 10=Data_Ex, 11=not possible) Bit6+7: WD state (00=Baud search, 01=Baud_Control, 10=DP_Control, 11=not possible) Bit8-11: Baud rate (0000=12MBd, 0001=6MBd, 0010=3MBd, 0011=1,5MBd, 0100=500kBd, 0101=187.5kBd, 0110=93.75kBd, 0111=45.45kBd, 1000=19.2kBd, 1001=9.6kBd) Bit12-15: SPC3-Release (0000=Release 0)
003/035	SPC3_Global_Controls Bits remain set until the next DP global command Bit1: 1=Clear_Data message received Bit2: 1=Unfreeze message received Bit3: 1=Freeze message received Bit4: 1=Unsync message received Bit5: 1=Sync message received
004/036	L byte: No. of received error-free messages (DP Standard only) H byte: Reserved
005/037	L byte: "Timeout" counter H byte: Reserved
006/038	L byte: "Clear Data" counter H byte: Reserved
007/039	L byte: "Heartbeat counter error" counter H byte: Reserved
008/040	L byte: No. bytes for special diagnosis H byte: Reserved
009/041	L byte: Mirroring of slot identifier 2 H byte: Mirroring of slot identifier 3
010/042	L byte: Mirroring of P918 (CB bus addr.) H byte: Reserved
011/043	L byte: "Re-config. by CUD" counter H byte: "Initialization runs" counter
012/044	L byte: Error ID DPS manager error H byte: Reserved
013/045	L byte: PPO type found H byte: Reserved
014/046	L byte: Mirroring of "DWord specifier ref"

Index	Meaning for CBP2
015/047	H byte: Mirroring of "DWord specifier act"
016/048	L byte: DPV1:DS_Write, pos. ack. counter H byte: Reserved
017/049	L byte: DPV1:DS_Write, neg. ack. counter H byte: Reserved
018/050	L byte: DPV1:DS_Read, pos. ack. counter H byte: Reserved
019/051	L byte: DPV1:DS_Read, neg. ack. counter H byte: Reserved
020/052	L byte: DP/T:GET DB99 pos. ack. counter H byte: DP/T:PUT DB99 pos. ack. counter
021/053	L byte: DP/T:GET DB100 ps. ack. counter H byte: DP/T:PUT DB100 ps. ack. counter
022/054	L byte: DP/T:GET DB101 ps. ack. counter H byte: DP/T:PUT DB101 ps. ack. counter
023/055	L byte: DP/T service neg. acknow. counter H byte: DP/T:Application association pos. acknow. counter
024/056	Reserved
025/057	Date of creation: Day, month
026/058	Date of creation: Year
027/059	Software version (Vx.yz, display x)
028/060	Software version (Vx.yz, display yz)
029/061	Software version: Flash-EPROM checks.
030/062	Reserved
031/063	Reserved
032/064	Reserved

Fault and alarm messages:

For details about fault messages, see Section 10.

Fault F080
An error occurred as board CBP2 was being initialized, e.g. incorrect value of a CB parameter, incorrect bus address or defective module.

Fault F081
The heartbeat counter (counter on CBP2) which is monitored by SIMOREG for "signs of life" from the board has not changed for at least 800 ms.

Fault F082
Failure of PZD telegrams or a fault in the transmission channel.

Alarm A081 (1st CB) or **alarm A089** (2nd CB)
The identifier byte combinations transmitted by the DP master in the configuration telegram do not match the permitted identifier byte combinations (configuring error on DP master)
Effect: No link can be established with the DP master, reconfiguration necessary.

Alarm A082 (1st CB) or **alarm A090** (2nd CB)
No valid PPO type can be determined from the configuration telegram from the DP master.
Effect: No link can be established with the DP master, reconfiguration necessary.

Alarm A083 (1st CB) or **alarm A091** (2nd CB)
No user data, or only invalid data, are being received from the DP master.
Effect:The process data are not transferred to the basic unit. When the telegram failure

monitoring function is active (U722 set to value other than 0), this disturbance generates fault message F082 with fault value 10.

Alarm A084 (1st CB) or **alarm A092** (2nd CB)
The exchange of data between the communication board and DP master has been interrupted (e.g. cable break, bus connector removed or DP master switched off).
Effect: When the telegram failure monitoring function is active (U722 set to value other than 0), this disturbance generates fault message F082 with fault value 10.

Alarm A085 (1st CB) or **alarm A093** (2nd CB)
Error in the DPS software of the communication board.
Effect: Fault message F081 is generated.

Alarm A086 (1st CB) or **alarm A094** (2nd CB)
Failure of heartbeat counter detected by SIMOREG DC-MASTER.
Effect: Interruption in communication with PROFIBUS.

Alarm A087 (1st CB) or **alarm A095** (2nd CB)
DP slave software has detected serious fault, fault number in diagnostic parameter n732.08.
Effect:Total communication failure (secondary fault F082).

Alarm A088 (1st CB) or **alarm A096** (2nd CB)
At least 1 configurable internode transmitter is not yet active or has failed again (for details, see diagnostic parameter n732).
Effect:If a transmitter is not yet active, the associated setpoints are set to "0" as an alternative. If an internode transmitter fails again, transmission of the setpoints to the SIMOREG may be interrupted depending on the setting of U715 (with secondary fault F082).

7.7.3 Sequence of operations for starting up CAN bus boards (CBC):

1 With the power supply switched off, insert the board with adapter board (ADB) into the slot. For board mounting instructions, see Section 5.3.2 , Mounting Optional Supplementary Boards.

2 The following are important communication parameters. Index 1 of each parameter is set for the 1st communication board (1st CB) and index 2 for the 2nd communication board (2nd CB): Exception: In parameter U721, i001 to i005 are applicable to the 1st CB and i006 to i010 to the 2nd CB (indices 3 to 5 and 8 to 10 are reserved).
The meaning of the parameters also differs depending on the setting of U721, i.e. CAN-Layer 2 (U721=0) and CANopen (U721=1):

	CAN-Layer 2	CANopen
U711	Basic identifier for PKW Request/PKW Response	1st Receive-PDO
U712	Basic identifier for PZD Receive	2nd Receive-PDO
U713	Basic identifier for PZD Send	3rd Receive-PDO
U714	Number of PZD for PZD Send	4th Receive-PDO
U715	Updating rate for PZD Send	1st Transmit-PDO
U716	Basic identifier for PZD Receive-Broadcast	2nd Transmit-PDO
U717	Basic identifier for PZD Receive-Multicast	3rd Transmit-PDO
U718	Basic identifier for PZD Receive-Internode	4th Transmit-PDO
U719	Basic identifier for PKW Request-Broadcast	Response to Life Time Event
U720	Baud rate when U721.002 or U721.007 = 0: 0=10kbit/s, 1=20kbit/s, 2=50kbit/s, 3=100kbit/s, 4=125kbit/s, 5=250kbit/s, 6=500kbit/s, 7=Reserved, 8=1Mbit/s	Baud rate when U721.002 or U721.007 = 0: 0=10kbit/s, 1=20kbit/s, 2=50kbit/s, 3=100kbit/s, 4=125kbit/s, 5=250kbit/s, 6=500kbit/s, 7=Reserved, 8=1Mbit/s
U721.01 or U721.06	**0** = Functionality according to Layer 2 of ISO-OSI-7 Layer Model	**1** = Functionality according to Layer 7 of ISO-OSI-7 Layer Model (CANopen)
U721.02 or U721.07	Bus timing (this should not be changed)	Bus timing (this should not be changed)
U722	Telegram failure time (0 = deactivated)	Telegram failure time (0 = deactivated)
P918	Bus address (node ID)	Bus address (node ID)
P927	Parameterizing enable (required only in cases where parameter values must be altered via the CAN Bus)	Parameterizing enable (required only in cases where parameter values must be altered via the CAN Bus)

The process data of the 1st or 2nd communication board are connected by means of the appropriate connectors and binectors (see Section 8, function diagrams Z110 and Z111) For meaning of bits of control and status words, please see Section 8, Sheets G180 to G183.

3 Turn the electronics supply voltage off and on again or set U710.001 or U710.002 to "0" to transfer the values of parameters U711 to U721 and P918 to the supplementary board. Note: The initialization process may interrupt the communication link to a supplementary board which is already operational.

WARNING

This initialization process will interrupt the communication of any supplementary board that has already been started up.

The CAN (**C**ontroller **A**rea **N**etwork) fieldbus is being used increasingly for industrial applications in spite of its limited network length (max. 40 m with a data transmission rate of 1 Mbaud).

Data are transferred by means of telegrams. Each data message, the so-called **COBs** (**C**ommunication **Ob**jects), has its own individual **identifier** and contains a maximum of 8 bytes of user data. The CBC board uses the Standard Message Format with **11-bit identifier**. Simultaneous use by other nodes of Extended Message Format with 29-bit identifiers is tolerated, but messages with this format are not evaluated.
Nodes on the bus determine from the identifier which telegrams apply to them. The COBs to be sent and received by each node must be defined before data transmission commences.
The identifiers also determine bus accessing priority. Low identifiers gain faster access to the bus, i.e. they have higher priority then high identifiers.

Errored telegrams can be reliably detected by means of a number of interactive error detection mechanisms. A transmission is automatically repeated when errors are detected.

The figure below shows a diagram of the CAN architecture model that is oriented toward the ISO-OSI-7 layer reference model. The CBC supports the functionalities provided by layers 2 and 7 of this model.

Functionality according to layer 2
The user data from the user software (as COBs on byte level) must be transferred directly to layer 2 (see also the examples of PZD and PKW data exchange given further down).

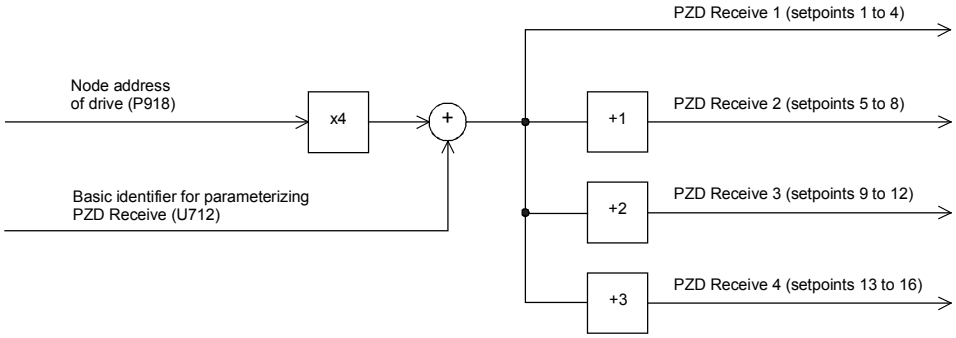
Functionality according to layer 7 (CANopen)
Process data are exchanged rapidly by means of so-called PDOs (**P**rocess **D**ata **O**bjects) analogous to the transmission method used for layer 2.
Parameter data are exchanged by means of so-called SDOs (**S**ervice **D**ata **O**bjects).

<table>
<tr><td colspan="3"></td><td>CAN protocol</td><td>Device net</td></tr>
<tr><td rowspan="2">Application</td><td></td><td>Device profile</td><td></td><td rowspan="3">Device net specification includes:
- Device profile
– Communication profile
– Application layer</td></tr>
<tr><td></td><td>Communication profile</td><td>CIA
DS 301</td></tr>
<tr><td rowspan="5">Communication</td><td>Layer 7</td><td>Application layer</td><td>CIA CAL
DS 201 .. 205, 207
CANopen
CAL</td></tr>
<tr><td>Layer 3-6</td><td></td><td colspan="2"></td></tr>
<tr><td>Layer 2</td><td>Data link layer</td><td colspan="2">ISO-DIS 11898</td></tr>
<tr><td rowspan="2">Layer 1</td><td>Physical layer, electrical</td><td colspan="2"></td></tr>
<tr><td>Physical layer, mechanical</td><td>CIA DS 102-1</td><td>Device Net ODVA</td></tr>
</table>

7.7.3.1 Description of CBC with CAN Layer 2

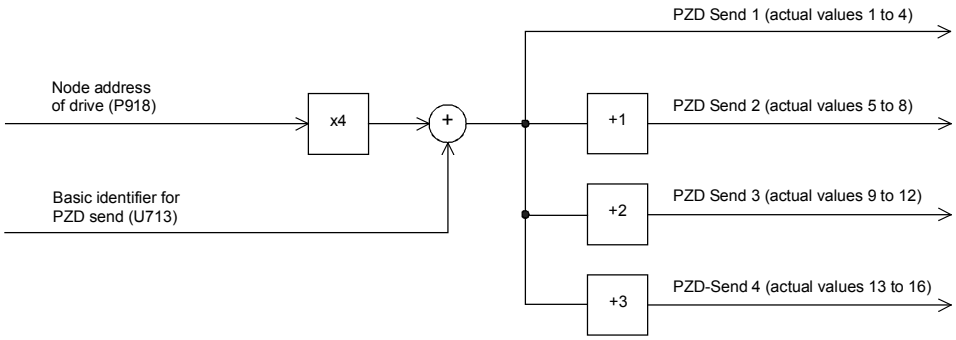
User data are exchanged between the CAN master and the CAN boards on the drives, i.e. the slaves. User data are categorized as either process data (control and status information, setpoints and actual values) or data which relate to parameters.
Process data (**PZD**s) are time-critical and therefore processed faster by the drive (every 3.3 ms at system frequency of 50 Hz) than the non-time-critical **PKW data** (parameter identifier value), which is processed by the drive every 20 ms.
All settings required to operate the communication board are made in drive parameters (see Section 8, function diagrams Z110 and Z111).

Process data (PZD) are categorized as either data received by the drive (control words and setpoints: **PZD Receive**) or data transmitted by the drive (status words and actual values: **PZD Send**). A maximum of 16 PZDs can be transferred in either direction; these are divided into COBs with 4 data words each by the communication board. In other words, 4 COBs are required to transfer 4 PZD words, with each COB requiring its own separate identifier. Identifiers are assigned in the CB parameters as shown in the following diagram:



Example of PZD Receive:

P918 = 1 U712 = 96	This settings assigns identifier 100 to the first 4 receive PZDs, identifier 101 to the second 4 receive PZDs, etc.



Example of PZD Send:

P918 = 1 U713 = 196	This setting assigns identifier 200 to the first 4 send PZDs, identifier 201 to the second 4 send PZDs, etc.

How received data are utilized by the drive or which data are to be sent by the drive is determined by connectors (see Section 8, function diagrams Z110 and Z111).

3 different modes of COB transmission can be selected in CB parameter 5 (U715):

U715 = 0	Actual values are transmitted only on request (Remote Transmission Requests)
U715 = 1 to 65534	Actual values are transmitted after the set time [ms] or on request (Remote Transmission Requests)
U715 = 65535	Actual values are transmitted if the values have changed (event) or on request (Remote Transmission Requests). This option should only be used in cases where values seldom change so as to prevent excessive bus loading.

Structure of a telegram for PZD data exchange:

The telegram consists of the following data words:

Identifier ID	Process data word 1 PZD1	Process data word 2 PZD2	Process data word 3 PZD3	Process data word 4 PZD4

ID is the CAN identifier that is defined for the COB in question by parameterization.

PZDx are process data words

Example of a PZD setpoint telegram:

Using the receive identifier of the above example

Receive identifier	100_d	0064_h	
1. Setpoint	40063_d	$9C7F_h$	control word 1
2. Setpoint	8192_d	2000_h	speed setpoint 50%
3. Setpoint	123_d	$007B_h$	
4. Setpoint	0_d	0_h	

Using the CAN BusAnalyser++ from Steinbeis, the setpoint data appear as follows (data field length = 8 bytes, low and high bytes are shown swapped round):

Identifier	Data field			
64 00	7F 9C	00 20	7B 00	00 00
ID	PZD1	PZD2	PZD3	PZD4

The following functions are also available, each allowing a maximum of 16 process data to be transferred:

PZD Receive Broadcast
This function is used to send setpoints and control words from the master **to all slaves** on the bus simultaneously. With this option, an identical identifier must be set on all slaves utilizing the function. This common identifier is set in CB parameter 6 (U716). The first 4 PZDs are transferred with the value set in U716 and the second 4 PZDs with the value in U716+1, etc.

PZD Receive Multicast
This function is used to send setpoints and control words from the master to a **group of slaves** on the bus simultaneously. With this option, all slaves within the group using the function must be set to an identical identifier. This group identifier is set in CB parameter 7 (U717). The first 4 PZDs are transferred with the value set in U717 and the second 4 PZDs with the value in U717+1, etc.

PZD Receive Internode
This function is used to **receive** setpoints and control words **from another slave**, allowing PZDs to be exchanged between drives without intervention by a CAN master. For this purpose, the identifier of PZD Receive Internode on the receiving slave must be set to the identifier of PZD Send on the transmitting slave. This identifier is set in CB parameter 8 (U718). The first 4 PZDs are transferred with the value set in U718 and the second 4 PZDs with the value in U718+1, etc.

Notes regarding PZD transmission:

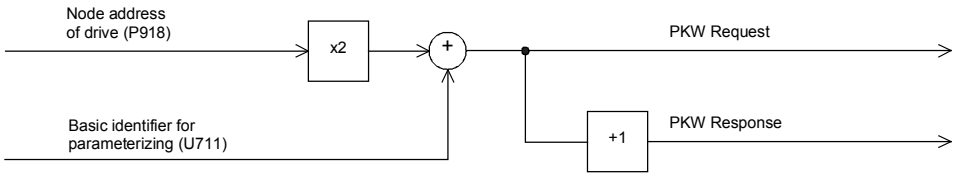
Control word 1 must always be transferred as the first PZD word for setpoints. If control word 2 is needed, then it must be transferred as the fourth PZD word.

Bit 10 (control by PLC) must always be set in control word 1 or else the drives will not accept setpoints and control words.

The consistency of process data can only be guaranteed within a COB. If more than 4 data words are needed, these must be divided among several COBs. Since drives accept the data asynchronously, the data transferred in several COBs may not always be accepted and processed in the same processing cycle.
For this reason, interrelated data should be transferred within the same COB. If this is not possible, data consistency can be assured by means of control word bit 10 (control by PLC), i.e. by setting the bit to "off" in the first COB to temporarily prevent the drive from accepting the data from the communications board. The remaining data are then transmitted. Finally, a COB containing a control word bit 10 set to "on" is transmitted. Since a drive can accept up to 16 PZDs simultaneously from the communication board, data consistency is assured.

Since a variety of different functions can be used to transfer PZDs simultaneously, data are overlayed in the drive. For example, the first PZD from PZD Receive and PZD Receive Broadcast are always interpreted as the same control word 1. For this reason, care should be taken to ensure that data are transferred in meaningful combinations.

Two CAN identifiers are required for the purpose of processing parameters, i.e. one CAN identifier for PKW Request (parameter request job to drive) and one CAN identifier for PKW Response (parameter response by drive). These assignments are made in CB parameters as shown in the following diagram:



Example of PKW data exchange:

P918 = 1 This setting assigns identifier 300 to the parameter job (request)
U711 = 298 and identifier 301 to the parameter response.

Structure of a telegram for PKW data exchange:

The telegram consists of the following data words:

Identifier ID	Parameter identifier PKE	Parameter index IND	Parameter value 1 PWE1	Parameter value 2 PWE2

ID is the CAN identifier that is defined for the COB in question by parameterization.

PKE contains the request or response ID and the parameter number

Request or response ID		Parameter number PNU

Bit 0 to bit 10 contain the number of the parameter concerned. Bit 12 to bit 15 contain the request or response ID.

The index **IND** contains the value 0 for unindexed parameters, for indexed parameters it contains the corresponding index value. Bit15 also has a special function as the page select bit for parameter numbers greater than 1999.
The index value 255 means that the request concerns all indices of the parameter in question. For a change request, the parameter values must then be passed on for all indices of the parameter. Because a COB can only contain up to 4 data words (8 bytes) of net data, use of this request is only possible for parameters with (up to) 2 indices. In the other direction, the drive supplies all index values in the response telegram to a read request.

Details about the telegram structure can be found in Section 7.7.9, "Structure of request/response telegrams“.

Example of a PKW request:

Changing the parameter value of the indexed parameter P301.02 (in the RAM) to -95.00%.

The example telegram therefore contains the following values:

Request identifier	300_d	$012C_h$	For use of the IDs of the example above
Request code	7_d	7_h	"Change parameter value (array word)"
Parameter number	301_d	$012D_h$	=> PKE = $712D_h$
Index	2_d	0002_h	
Parameter value	9500_d	$DAE4_h$	

Using the CAN BusAnalyser++ from Steinbeis, the transmit data appear as follows (data field length = 8 bytes, low and high bytes are shown swapped round):

Identifier	Data field			
2C 01	2D 71	02 00	E4 DA	00 00
ID	PKE	IND	PWE1	

The following transfer function is also available:

PKW Request Broadcast
A parameter job (request) is processed simultaneously by all slaves on the bus. The node address is not used to generate the CAN identifier because this must be set identically on all slaves utilizing the PKW Request Broadcast function. This common identifier is set in CB parameter 9 (U719). The corresponding parameter response is made with the CAN identifier for PKW Response described above.

Notes regarding PKW transmission:

The length of the job and the response is always 4 words. Jobs which apply to all indices of a parameter (e.g. "Request all indices") are not possible.

As a general rule, the low-order byte (in words) or the low-order word (in double words) is transferred first. SIMOREG 6RA70 does not use double word parameters itself, these jobs can only be executed where access is available to technology board parameters (e.g. T400).

The CBC does not respond to a parameter request job until the drive data are available. This normally takes 20 ms. The response times will be longer only if change (write) jobs including storage of the value in the EEPROM are received from other sources (e.g. serial basic converter interface), resulting in a delay in job execution.

In certain system states (e.g. initialization states), parameter processing is greatly delayed or does not take place at all.

The master may not issue a new parameter request job until any current parameter job has been acknowledged.

7.7.3.2 Description of CBC with CANopen

7.7.3.2.1 Introduction to CANopen

CANopen is a standardized application for distributed, industrial automation systems based on CAN and the CAL communication standard. CANopen is a standard of CAN in Automation (CiA) and was in widespread use shortly after it became available.

CANopen can be regarded in Europe as the definitive standard for the implementation of industrial CAN-based system solutions.

CANopen is based on a so-called "communication profile" which specifies the underlying communication mechanisms and their definition [CiA DS-301].

The main types of device deployed for automating industrial systems, such as digital and analog input/output modules [CiA DS-401], drives [CiA DS-402], control panels [CiA DS-403], controllers [CiA DS-404], PLCs [CiA DS-405] or encoders [CiA DS-406], are described in so-called "device profiles". These profiles define the functionality of standard equipment of the relevant type.

A central component of the CANopen standard is the definition of device functionality using an "Object Directory" (OD). This object directory is subdivided into two sections, one which contains general information about the device, such as identification, manufacturer's name, etc. and the communication parameters, and the other describing the scope of device functions. An entry ("object") in the object directory is identified by means of a 16-bit index and an 8-bit subindex.

The "application objects" of a device, such as input and output signals, device parameters, device functions or network variables, are made accessible in standardized form via the network by means of the entries in the object directory.

Similar to other field bus systems, CANopen employs two basic data transmission mechanisms: The rapid exchange of short process data via so-called "process data objects" (**PDO**s) and the accessing of entries in the object directory via so-called "service data objects“ (**SDO**s). Process data objects are generally transferred either event-oriented, cyclically or on request as broadcast objects without an additional protocol overhead. SDOs are used mainly to transmit parameters during the device configuring process and generally for the transmission of longer data areas.

A total of 8 bytes of data can be transferred in a PDO. The assignment between application objects and a PDO (transfer object) can be set by means of a structure definition ("PDO mapping") stored in the OD and is thus adaptable to the individual operating requirements of a device.

SDOs are transmitted as a confirmed data transfer with two CAN objects in each case between two network nodes. The relevant object directory entry is addressed through the specification of index and subindex. Messages of unrestricted length can be transferred in principle. The transmission of SDO messages involves an additional overhead.

Standardized, event-oriented, high priority alarm messages ("**Emergency Messages**“) are available for signaling device malfunctions.

The functionality required for the preparation and coordinated starting of a distributed automation system corresponds to the mechanisms defined under CAL Network Management (NMT); this also applies to the "**Node Guarding**" principle underpinning the cyclical node monitoring function.

Identifiers can be entered directly into the data structures of the object directory to assign CAN message identifiers to PDOs and SDOs; predefined identifiers can be used for simple system structures.

7.7.3.2.2 Functionality of CBC with CANopen

The CBC with CANopen supports only minimal boot-up as defined in communication profile CiaA DS-301 (Application Layer and Communication Profile).

Up to four Receive PDOs and four Transmit PDOs are available. Parameters U711 to U714 can be programmed to select the mapping and communication properties of the Receive PDOs and parameters U715 to U718 to set the mapping and communication properties of the Transmit PDOs.

Dynamic mapping, i.e. changing the assignment between the objects from the object directory and a PDO in operation, is not supported by the CBC. Transmission type and identifier of the communication objects (PDO, SDO, SYNC, EMCY and Node Guarding Object) can, however, be set via SDOs in operation. These settings override the settings of the CP parameters and are erased when the supply voltage is switched off.

One server SDO is available.

Another available communication object is the **SYNC object**. Using a synchronization message, the CAN master can synchronize the transmission and reception of PDOs for the whole network ("synchronous PDOs").

The EMCY object (**Emergency Object**) is implemented. This telegram is used to signal all faults and alarms generated in the SIMOREG system via the CAN Bus.

The network functionality is monitored via the **Node Guarding Telegram** with which the master addresses the slaves cyclically. Each slave must individually respond to this telegram within a parameterizable time frame.

If the master does not receive a response to its request, the communication link to the slave must be malfunctioning in some way (e.g. cable break, bus connector removed, etc.).

If the slave does not receive a Node Guarding Telegram from the master within a particular time period (**Life Time Event**), it can assume that there is error in the communication link. The reaction of the slave to this event can be parameterized in parameter U719.

Canopen modes **Velocity Mode** (speed control) and **Profile Torque Mode** (torque control), both in accordance with CiA DS-401 (Device Profile for Drives and Motion Control), and the manufacturer-specific **Current Mode** (current control) are implemented.

7.7.3.2.3 Requirements for operating the CBC with CANopen

To be able to operate the CBC with CANopen, the following two conditions must be fulfilled:

- SIMOREG firmware, V1.9 and later
- CBC firmware, V2.2 and later

To be able to operate the individual CANopen profiles, certain parameter settings must be made in the SIMOREG.

7.7.3.3 Diagnostic tools:

LED displays on the CBC (flashing LEDs indicate normal operation):

Red LED	Status of CBC
Yellow LED	Communication between SIMOREG and CBC
Green LED	Communication between CBC and CAN Bus

LED			Status
red	yellow	green	
flashing	flashing	flashing	Normal operation
flashing	off	on	CBC waiting for commencement of initialization by SIMOREG
flashing	on	off	CBC waiting for end of initialization by SIMOREG
flashing	flashing	off	No PZD data exchange via CAN Bus
flashing	on	on	CBC defective

Diagnostic parameter n732:

Indices i001 to i032 apply to a CBC as the first communication board; indices i033 to i064 apply to a CBC as the second communication board.

	Value	Meaning
n732.001 or n732.033	0	No fault Fault F080/fault value 5 is displayed under fault conditions:
		<u>Fault values for CAN layer 2:</u>
	1	Incorrect address on CAN Bus (P918 / slave address)
	2	Incorrect CAN identifier with PKW Request (U711)
	5	Incorrect CAN identifier with PKW Request-Broadcast (U719)
	7	Incorrect CAN identifier with PZD Receive (U712)
	13	Incorrect CAN identifier with PZD Transmit (U713)
	14	PZD transmit length = 0 (U714)
	15	PZD transmit length > 16 , i.e. too long (U714)
	20	Incorrect CAN identifier with PZD Receive-Broadcast (U716)
	21	Incorrect CAN identifier with PZD Receive-Multicast (U717)
	22	Incorrect CAN identifier with PZD Receive-Internode (U718)
	23	Invalid baud rate (U720)
	35	Incorrect CAN protocol type (U721)
	36	PKW Request-Broadcast (U719) without PKW Request (U711)
	48	Overlap between CAN identifier PKW and PKW Broadcast
	49	Overlap between CAN identifier PKW and PZD Receive
	50	Overlap between CAN identifier PKW and PZD Transmit
	51	Overlap between CAN identifier PKW and PZD Receive-Broadcast
	52	Overlap between CAN identifier PKW and PZD Receive-Multicast
	53	Overlap between CAN identifier PKW and PZD Receive-Internode
	54	Overlap between CAN identifier PKW Broadcast and PZD Receive
	55	Overlap between CAN identifier PKW Broadcast and PZD Transmit
	56	Overlap between CAN identifier PKW Broadcast and PZD Receive-Broadcast
	57	Overlap between CAN identifier PKW Broadcast and PZD Receive-Multicast
	58	Overlap between CAN identifier PKW Broadcast and PZD Receive-Internode
	59	Overlap between CAN identifier PZD Receive and PZD Transmit
	60	Overlap between CAN identifier PZD Receive and PZD Receive-Broadcast
	61	Overlap between CAN identifier PZD Receive and PZD Receive-Multicast
	62	Overlap between CAN identifier PZD Receive and PZD Receive-Internode
	63	Overlap between CAN identifier PZD Transmit and PZD Receive-Broadcast
	64	Overlap between CAN identifier PZD Transmit and PZD Receive-Multicast
	65	Overlap between CAN identifier PZD Transmit and PZD Receive Internode
	66	Overlap between CAN identifier PZD Receive-Broadcast and PZD Receive-Multicast
	67	Overlap between CAN identifier PZD Receive-Broadcast and PZD Receive-Internode
	68	Overlap between CAN identifier PZD Receive-Multicast and PZD Receive-Internode
		<u>Fault values for CANopen:</u>
	1	Incorrect bus address (P918)
	23	Invalid baud rate (U720)
	35	Incorrect CAN protocol type (U721)
	257	Invalid mapping of 1st Receive PDO (U711)
	258	Invalid transmission type of 1st Receive PDO (U711)
	273	Invalid mapping of 1st Transmit PDO (U715)
	274	Invalid transmission type of 1st Transmit PDO (U715)
	513	Invalid mapping of 2nd Receive PDO (U712)
	514	Invalid transmission type of 2nd Receive PDO (U712)
	529	Invalid mapping of 2nd Transmit PDO (U716)
	530	Invalid transmission type of 2nd Transmit PDO (U716)
	769	Invalid mapping of 3rd Receive PDO (U713)
	770	Invalid transmission type of 3rd Receive PDO (U713)
	785	Invalid mapping of 3rd Transmit PDO (U717)
	786	Invalid transmission type of 3rd Transmit PDO (U717)
	1025	Invalid mapping of 4th Receive PDO (U714)
	1026	Invalid transmission type of 4th Receive PDO (U714)
	1041	Invalid mapping of 4th Transmit PDO (U718)
	1042	Invalid transmission type of 4th Transmit PDO (U718)
	1092	Invalid Life Time Event or incorrect basic unit parameterized (U719)
n732.002 or n732.034		Number of correctly received PZD CAN telegrams since Power ON Irrelevant for CANopen
n732.003 or n732.035		Number of PZD telegrams lost since Power ON Telegrams will be lost if the CAN Bus master sends PZD telegrams faster than they can be processed by the slave. Irrelevant for CANopen

	Value	Meaning
n732.004 or n732.036		Counter of Bus Off states since Power ON (alarm A084)
n732.005 or n732.037		Counter of Error Warning states since Power ON (alarm A083)
n732.006 or n732.038		Status of the CAN controller
n732.007 or n732.039		Number of errors occurring during reception of PCD frames
n732.008 or n732.040		Type of error occurring during reception of PCD frames
n732.009 or n732.041		Value of error occurring during reception of PCD frames
n732.010 or n732.042		Number of correctly transmitted PZD CAN telegrams since Power ON Irrelevant for CANopen
n732.011 or n732.043		Number of errors during transmission of PZD telegrams PZD telegrams cannot be transmitted when the bus is overloaded Irrelevant for CANopen
n732.012 or n732.044		Type of error occurring during transmission of PCD frames
n732.013 or n732.045		Value of error occurring during transmission of PCD frames
n732.014 or n732.046		Number of correctly processed PKW requests and responses since Power ON Irrelevant for CANopen
n732.015 or n732.047		Number of PKW request processing errors, e.g. owing to bus overload or missing responses from CUD1 (see below for error type) Irrelevant for CANopen
n732.016 or n732.048	0 9 11 12	Type of PKW request processing error: No error Error transmitting the PKW response (while waiting for a free channel) Timeout waiting for the PKW response from the CUD1 Timeout waiting for a free channel (bus overload) Irrelevant for CANopen
n732.017 or n732.049		Value of error occurring while processing PKW requests
n732.018 or n732.050		Number of lost PKW requests Irrelevant for CANopen
n732.026 or n732.058		Software version of CBC (e.g. "12“ = version 1.2, see also r060)
n732.027 or n732.059		Software identifier (extended software version identifier, see also r065)
n732.028 or n732.060		Date of generation of CBC software Day (H byte) and month (L byte)
n732.029 or n732.061		Date of generation of CBC software Year

Fault and alarm messages:

Detailed information about fault messages can be found in Section 10.

Fault F080
An error occurred during initialization of the CBC board, e.g. incorrect setting of a CB parameter, incorrect bus address or defective board.

Fault F081
The heartbeat counter (counter on CBC) which is monitored by SIMOREG for "signs of life" from the board has not changed for at least 800 ms.

Fault F082
Failure of PZD telegrams or a fault in the transmission channel

Alarm A083 (Error Warning)
Errored telegrams are being received or sent and the error counter on the supplementary board has exceeded the alarm limit.
Errored telegrams are ignored. The data most recently transferred remain valid. If the errored telegrams contain process data, fault message F082 with fault value 10 may be activated as a function of the telegram failure time set in U722. No fault message is generated for PKW data.

Alarm A084 (Bus Off)
Errored telegrams are being received or sent and the error counter on the supplementary board has exceeded the fault limit.
Errored telegrams are ignored. The data most recently transferred remain valid. If the errored telegrams contain process data, fault message F082 with fault value 10 may be activated as a function of the telegram failure time set in U722. No fault message is generated for PKW data.

7.7.4 Procedure for starting up the SIMOLINK board (SLB):

1 Disconnect the power supply and insert adapter board (ADB) containing SLB in a location. Please remember to insert a board in location 2 before you use location 3. .

2 The SLBs must be connected up using fiber optics in such a manner as to avoid long distances between two units (max. 40m with plastic fiber optics and max. 300 m with glass fiber optics). Please also note that the transmitter (in center of SLB) on one unit is connected to the receiver (at corner of SLB) on the next unit. These connections must be made on all units until they are linked in a closed circuit.

3 The following are important communication parameters. Index 1 of each parameter is set for the 1st SIMOLINK board (1st SLB) and index 2 for the 2nd SIMOLINK board (2nd SLB) (the use of a 2nd SLB is planned for future software versions):

- U740 Node address (address 0 identifies the dispatcher)
  Node addresses must be assigned consecutively unless a SIMOLINK master is being used.
- U741 Telegram failure time (0 = deactivated)
- U742 Transmitter power
  The output of the fiber optic transmitter module can be set on each active bus node.
- U744 Reserved for SLB selection (leave at 0 setting)
- U745 Number of channels (telegrams) used per node
  The SLB with dispatcher function assigns the same number of channels to all nodes
- U746 Traffic cycle time

In contrast to converters of the SIMOVERT series, the line-synchronous SIMOREG converter cannot be synchronized with the cycle time of the SIMOLINK bus in order to minimize the data interchange time.
The user data in the telegrams are exchanged cyclically (6x per mains period, i.e. every 3.3 ms at 50 HZ) between the SIMOREG converter and the SLB, irrespective of the cycle time on the bus (U746). A shorter cycle time still means, however, that the data are transferred more quickly after they have been made available by the converter or more up-to-date information for the converter.

U745 and U746 together determine the number of addressable nodes (this can be checked with diagnostic parameter n748.4 in the converter with the dispatcher board).

No. of addressable nodes = $$\left(\frac{U746[us]+3{,}18us}{6{,}36us}-2\right)*\frac{1}{U745}$$

The number of nodes serves only to check whether data can be exchanged with the values set in U745 and U746. These parameters must otherwise be corrected.

A maximum of 201 nodes (dispatcher and 200 transceivers) can be connected to the SIMOLINK bus. Node addresses 201 to 255 are reserved for special telegrams and others. Consequently, with 8 channels per node, a bus cycle can be a maximum of 6.4 ms in duration.

4 Process data are connected to the SIMOLINK board through assignment of the corresponding connectors and/or binectors to telegram addresses and channel numbers (see Section 8, Sheet Z122).

Example:

U749.01 = 0.2	means that the values of node 0 / channel 2 are read as word1 (K7001) and word2 (K7002)
U740.01 = 1 U751.01 = 32 U751.02 = 33	means that node 1 in channel 0 transmits status word 1 (K0032) as word1 and status word 2 (K0033) as word2

Changes to the settings of the receive data parameters do not take effect until the electronics power supply is switched on again.

WARNING

Changing parameters U740, U745, U746 and U749 causes re-initialization, resulting in an interruption in communication with all drives linked to the SIMOLINK bus.

SIMOLINK (**S**iemens **M**otion **L**ink) is a digital, serial data transmission protocol which uses fiber optics as a transmission medium. The SIMOLINK drive link has been developed to allow a fast, cyclic exchange of process data (control information, setpoints, status information and actual values) via a closed ring bus.
Parameter data cannot be transferred via SIMOLINK.

SIMOLINK consists of the following components:

SIMOLINK **Master**
Active bus node as interface to higher-level automation systems (e.g. SIMATIC M7 or SIMADYN)

SIMOLINK Board (**SLB**)
Active bus node as interface for drives on SIMOLINK

SIMOLINK **Switch**
Passive bus node with switching function between two SIMOLINK ring busses. The separating filter and concentrator are identical in terms of hardware, but perform different functions. Separating filters are used to reverse the signal flow, e.g. in order to link the nodes on one ring bus to another ring bus after the failure of their master. Concentrators allow ring segments to be star-connected to form a complete ring.

Fiber optic cables
Transmission medium between the SIMOLINK nodes. Glass or plastic fiber optic cables can be used. The permissible maximum distances between adjacent nodes in the ring differs depending on the type of fiber optic used (plastic: max 40m, glass: max. 300m).

SIMOLINK is a closed fiber optic ring. One of the nodes on the bus has a **dispatcher** function (SIMOLINK master or SLB parameterized as the dispatcher). This dispatcher node is identified by **node address 0** and controls communication on the bus. Using SYNC telegrams, it supplies the common system clock cycle for all nodes and sends telegrams in ascending sequence of telegram addresses and channel numbers in the task table. The **task table** contains all telegrams which are transmitted cyclically in normal data interchange.

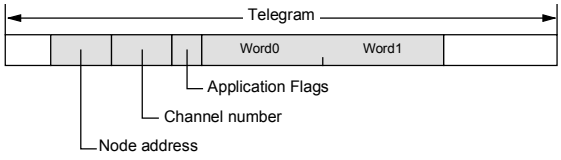
When an SLB is employed as the dispatcher, the task table is configured solely on the basis of drive parameters. The following restrictions apply as compared to the use of a SIMOLINK master as the dispatcher:

Flexible address lists with gaps in address sequence are not allowed on the bus. Addresses are assigned consecutively to the nodes, starting with address 0.
The number of telegrams (channels) used per node is identical for all nodes.
It is not possible to use application-specific special data.

All other active bus nodes apart from the dispatcher are **transceivers**. These simply forward telegrams (with updated contents in some cases) along the bus.

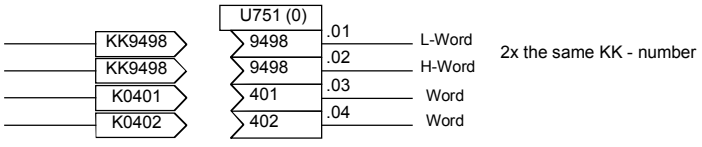
Active bus nodes receive and/or send telegrams (SIMOLINK master, dispatcher, transceivers).
Passive bus nodes simply forward received telegrams along the bus without changing their contents (separating filters, concentrators).

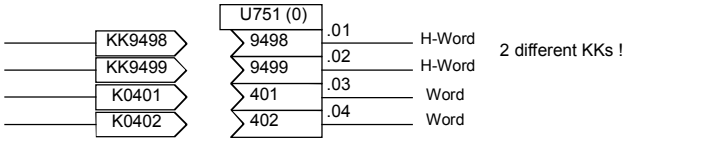
A separate address is assigned to each active bus node; the dispatcher is always assigned node address 0.
A maximum of 8 telegrams can be transferred per active node. The number of telegrams used per node is a parameterizable quantity.
Telegrams are identified by the node address and distinguished by their channel number of between 0 and 7, with 2 data words transferred as user data in each telegram. The first channel number starts with 0 and is counted in ascending sequence.



The assignment between connector values to be transferred and individual telegrams and channels is also parameterized (see Section 8, Sheet Z122).

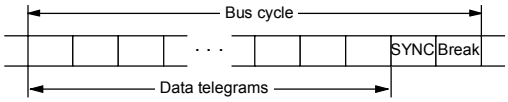
Transmission of double-word connectors:
The values of double-word connectors can be transmitted in the first four channels (selected with U749.01 to U749.04 in the receive direction or with U751.01 to U751.08 in the transmission direction). In the receive direction, the values of any two adjacent connectors (K) are combined to form a double-word connector (KK) (e.g. K7001 and K7002 to KK7031). These double-word connectors can be connected to other function blocks in the usual way. For details of how to connect with double-word connectors, see Section 9.1, subsection, " The following rules apply to the selection of double-word connectors ".
In the transmission direction, a double-word connector is applied by entering the same double-word connector at two contiguous indices of selection parameter U751.
Examples:





Apart from these data, a SIMOLINK master can also send **special telegrams** with application-specific data (addresses 201 to 204 and channel number 0). An SLB as dispatcher does not support these special telegrams.
If a transceiver stops receiving telegrams due to an interruption, it automatically transmits special telegram "Time Out“.

The transmission rate is **11 Mbits/s**. The data telegrams are transmitted in direct succession, followed by a SYNC telegram and a pause telegram, within one bus cycle. Transferring the data telegrams without pauses ensures a higher data throughput. At a data transmission rate of 11 Mbit/s, the transmission time for one telegram is 6.36µs.



The assignment of telegrams to nodes is determined by the type of SIMOLINK application, i.e. peer-to-peer functionality or master-slave functionality.
When an SLB is configured as the dispatcher, only the peer-to-peer functionality is available.

Peer-to-peer functionality
In this mode, there is no defined logical master for distributing information. The drives have **equal status** in logical terms and exchange data with one another via the ring bus. One node (SLB) specifies the bus cycle in its dispatcher role to keep the transmission alive. All nodes receive and/or send user data. Dispatcher and transceivers can read any telegram, but may only write information in the telegrams specifically assigned to them (node address = address in telegram).

Master-slave functionality
A **logical master** (e.g. SIMATIC) supplies all nodes with information on the one hand and, on the other, specifies the bus clock cycle (dispatcher function). All other nodes behave as described above under peer-to-peer functionality, i.e. they receive and/or send user data, but are only permitted to read or write telegrams containing their address.
In contrast to peer-to-peer functionality, the restrictions described above (no gaps in address sequence, uniform number of used channels, no special data) do not apply. The master has its own 8 channels for transferring data, but can also use telegrams with the address and channel numbers of the transceivers for its data transmissions.

NOTE

An external 24V power supply to the SIMOLINK modules ensures that communication with the other bus nodes continues if a device fails.
However, this power supply does not prevent the short interruption in communication when the device is switched on again when establishing communication is forced.

7.7.5 Procedure for starting up expansion boards (EB1 and EB2)

1. Remove connector X480 from the EB1 board for safety reasons. A short circuit could otherwise occur should the signal direction of the bidirectional binary inputs/outputs be incorrectly parameterized (see also point 3).
   This risk of short circuits does not exist on EB2 boards.

2. The analog inputs on the EB1 can be used either as current or voltage inputs, the mode being selected by setting **jumpers** (X486, X487, X488) appropriately (see Function Diagrams, Section 8). The same applies to EB2 (X498); on this board, the analog output can also be configured as a current or voltage source (X499).

3. Parameterize the desired functions for the inputs and outputs (see Function Diagrams, Section 8).
   If you wish to operate a bidirectional binary input/output on an EB1 as an input, please note that the output circuit must be deactivated in the corresponding parameter (e.g. U769.01=0). A short circuit will otherwise occur if the signal levels of the external input and output signals are opposed.
   Switch off the device.

4. With the power supply disconnected, insert the adapter board with expansion board in a location. Please remember to insert a board in location 2 before you use location 3.

5. EB1 boards only: Plug connector X480 back into board.

Expansion boards EB1 and EB2 expand the range of terminals on the basic converter. A total of 2 EB1 boards and 2 EB2 boards may be installed in one SIMOREG DC-MASTER 6RA70. The EB1 and/or EB2 are plugged into adapter (carrier) boards (ADB). 2 boards may be mounted on each ADB.

The EB1 provides the following expansion terminals:

- 3 binary inputs
- 4 bidirectional binary inputs/outputs
- 1 analog input for differential signal (current or voltage input)
- 2 analog inputs (single ended), can also be used as binary inputs
- 2 analog outputs
- 1 connector for external 24 V voltage supply to binary outputs

The EB2 provides the following expansion terminals:

- 2 binary inputs
- 1 connector for external 24 V voltage supply to binary outputs
- 1 relay output with changeover contacts
- 3 relay outputs with NO contacts
- 1 analog input for differential signal (current or voltage input)
- 1 analog output (current or voltage output)

For further details, see Section 8, function diagrams for expansion boards EB1 and EB2.

7.7.6 Procedure for starting up the pulse encoder board (SBP)

1 Set the switches (for encoder supply and bus terminating resistors) on the SBP board:
If one pulse encoder is connected to one SBP board, then the three switches for bus terminating resistors must be switched to ON.
If one pulse encoder is connected to several SBP boards, then the three switches for bus terminating resistors must be switched to ON only on the last SBP.
The fourth switch connects and disconnects the supply voltage for the encoder.
(Caution: Switch open means supply voltage connected)

2 Disconnect power supply and insert adapter with board into location. Please remember to insert a board in location 2 before you use location 3.

3 Connect the terminals on strips X400, X401 on the pulse encoder board to the appropriate terminals on the encoder (for circuit example, refer to operating instructions for pulse encoder board). If you connect unipolar signals, a ground connection for all signals to terminal 75 (CTRL-) is sufficient. For very long lines or high interference irradiation, we recommend jumpering terminals 69, 71, and 75 (A-, B-, and CTRL-) and connecting to encoder ground. The zero track of the pulse encoder is not evaluated by SIMOREG and need not therefore be connected.
The terminals designated coarse pulse1, coarse pulse2 and fine pulse2 can be used as digital inputs for any function (see Function Diagrams in Section 8)

4 Please make the following settings:

- U790 Voltage level of inputs

  0: HTL unipolar
  1: TTL unipolar
  2: HTL differential input
  3: TTL/RS422 differential input

- U791 Level of encoder supply

  0: 5V voltage supply
  1: 15V voltage supply

- U792 Pulse encoder resolution

- U793 Type of pulse encoder

  0: Encoder with A/B track (two tracks displaced by 90 degrees)
  1: Encoder with separate forward and reverse track

- U794 Reference speed

(For further details, see Section 11, description of parameters U790- U794)

The pulse encoder board SBP (**S**ensor **B**oard **P**ulse) supports commercially available pulse encoders with pulse frequencies up to 410kHz. The voltage level of the encoder signals can be parameterized. TTL or HTL level pulses, bipolar or unipolar, can be used.

A voltage supply for 5V and 15V encoders is provided on the board.

Evaluation of a temperature sensor is not supported on SIMOREG DC-MASTER 6RA70 converters.

7.7.7 Sequence of operations for starting up DeviceNet boards (CBD):

1 With the power supply switched off, insert the board or adapter board with board in the slot. Please note that slot 2 (on right) must always be occupied before slot 3 (in center) can be used.

2 Wire up the DeviceNet using appropriate cabling (see below for details of cables).

3 The following parameters are relevant with respect to communications. Index 1 of the relevant parameter applies to the 1st communication board (1st CBx) and index 2 to the 2nd communication board (2nd CBx):

- U711 CB parameter1
  Definition of number of words in the process data area that the SIMOREG sends as a response to a request by the master (produced data). The following options can be selected:
  U711 = 170 ... 4 PZD (status word and actual values)
  U711 = 171 ... 8 PZD (status word and actual values)
  U711 = 172 ... 16 PZD (status word and actual values)

- -U712 CB parameter2
  Definition of number of words in the process data area that SIMOREG expects to receive after a request from the master (consumed data). The following options can be selected:
  U712 = 120 ... 4 PZD (control word and setpoints)
  U712 = 121 ... 8 PZD (control word and setpoints)
  U712 = 122 ... 16 PZD (control word and setpoints)

  U711 and U712 can be parameterized independently of one another. The first 4 PZD words (produced data) are always sent after a request from the master.

- -U720 CB parameter10
  Definition of the DeviceNet transmission rate. The following options can be selected:
  U720 = 0 ..... 125kbaud
  U720 = 1 ..... 250kbaud
  U720 = 2 ..... 500kbaud

- U722 CB/TB telegram failure time
  Definition of the time period within which at least 1 telegram with PZDs must be exchanged before a fault message is generated.
  This parameter should be set to "0" first (monitoring function deactivated). Once the network is operating correctly, a time value can be set within which PZDs are normally exchanged.

- P918 Bus address
  Definition of DeviceNet MAC ID for the CBD in the 0 to 63 range.

- P927 Parameterizing enable (necessary only if parameter values need to be altered via DeviceNet)

- The process data of the 1st or 2nd communication board are wired up by means of the appropriate connectors or binectors (see Section 8, function diagrams Z110 and Z111). For meaning of the control and status word bits, see Section 8, Sheets G180 to G183.

4 Switch the electronics power supply off and on again or set U710.001 or U710.002 to "0" to transfer the values of parameters U712, U720, U722 and P918 to the supplementary board.

WARNING

This initialization process will interrupt the communication of any supplementary board that has already been started up.

The CBD board supports "DeviceNet Explicit Messages“ for the transfer of process data, as well as "DeviceNet I/O Messages“ for the transmission of parameter data. The meaning of the data within an I/O message is determined by the corresponding "Connection ID".

The CBD supports the "Predefined Master/Slave Connection Set“ defined in the DeviceNet Specification. Both "poll" and "bit strobe I/O messages“ are supported.

The CBD adheres to the "DeviceNet Device Profile for Communication Adapter“ (Device Type 12). This profile has been selected to allow the DeviceNetMaster to utilize all the options and extended functions provided by the SIMOREG.

DeviceNet messages can be divided roughly into 3 groups:

- DeviceNet configuration data, e.g. channel assignment, timeouts and I/O messages, for which explicit messages are used
- Process data, e.g. control/status word and setpoints/actual values, for which I/O messages are used
- Parameter data, for which manufacturer-specific PKW objects and explicit messages are used, to read or modify drive parameter settings

The drive is controlled by process data. The number of process data words is determined either by the value of particular CB parameters (U711 and U712) after booting, or dynamically by the DeviceNet.

The master uses a manufacturer-specific PKW object to read or modify drive parameters via DeviceNet, utilizing the explicit messaging channel. The user thus has access via DeviceNet to all SIMOREG parameters and any installed technology board (e.g. detailed diagnostic information and fault messages).

DeviceNet specifies a shielded cable with 2 individually screened two-wire conductors for signal transmission and power supply. 2 types of different cross-sections may be used, i.e. "Thin Cable“ and "Thick Cable“.
Thick cables are used in networks of >100m in length and thin cables for spur lines and networks of <100m.
The following cable types are recommended for use as DeviceNet bus cables:

Thin cable:Belden 3084A
Thick cable:Belden 3082A, 3083A or 3085A

Pin assignment and color coding are defined as follows:

Pin	Function	Color of wire in DeviceNet cable
X438.1	V-	Black (power supply ground)
X438.2	CAN-	Blue
X438.3	Shield	
X438.4	CAN+	White
X438.5	V+	Red (+24V supply +/- 1%)

Recommended bus connector:Phoenix Combicon MSTB 2.5/5-ST-5.08-AU

Transmission rates and bus cable lengths:

Transmission rate	Max. cable length (thick cable)	Spur line length (thin cable)	
		Maximum	Cumulative
125kbaud	500m	6m	156m
250kbaud	250m	6m	78m
500kbaud	100m	6m	39m

To ensure proper functioning, both ends of the bus cable must be terminated by a terminating resistor (121Ω metal film resistor, +/- 1%, 0.25W).

The DeviceNet cable screen should be earthed at ONE point (e.g. at the power supply). Earthing the screen at several locations can produce ground loops and cause malfunctions.

Telegrams transmitted via DeviceNet have the same useful data structure as those used in **CAN Bus** communication.

A CAN telegram comprises the protocol header, CAN identifier, up to 8 bytes of useful data and the protocol trailer.

The methods applied for DeviceNet transmissions allow useful data of any length to be transferred. Data which are longer than 8 bytes can be transmitted in fragmented form (in several consecutive telegrams).

PZD object (process data)

Both control words and setpoints as well as status words and actual values (process data) are transmitted by means of DeviceNet I/O message connections. The number of process data to be transferred (4, 8 or 16) depends on which DeviceNet I/O assembly instance has been selected. The quantity of process data transmitted by the drive can differ from the quantity received.

Options for defining the number of PZD:

- "Consumed Connection Path“ with "Poll I/O" (direction: Master -> drive)
  U712 = 120 ... 4 PZD (control word and setpoints)
  U712 = 121 ... 8 PZD (control word and setpoints)
  U712 = 122 ... 16 PZD (control word and setpoints)
- "Produced Connection Path“ with "Poll I/O“ (direction: Drive -> master)
  U711 = 170 ... 4 PZD (status word and actual values)
  U711 = 171 ... 8 PZD (status word and actual values)
  U711 = 172 ... 16 PZD (status word and actual values)
- "Produced Connection Path“ with "Bit Strobe I/O“
  U711 = 170 ... 4 PZD (status word and actual values); cannot be changed

The meaning of each process data word is determined by the assignment of connectors parameterized in the drive (see function diagrams in Section 8, particularly "Data exchange with 1st and 2nd CB"). Process data can be exchanged between the SIMOREG and CBD 6x per line period, i.e. every 3.3ms at 50Hz, but is dependent on the data exchange mode via DeviceNet. For further details, see also "Information about PZD transmission" in Section 7, "Sequence of operations for starting up CAN Bus boards“.

Information about PZD transmission:

The low-order byte or word is always transferred before the high-order byte or word.

Control word 1 must always be sent as the first PZD word. If control word 2 is also used, this must always be sent as the 4th PZD word.

Bit10 in control word 1 ("control requested“) must always be set or else no new setpoints will be accepted from the drive.

The second PZD word should normally contain the main setpoint.

The consistency of a block of data words is guaranteed within a DeviceNet I/O message connection even in cases where more than 4 PZD words are used and the transmission data is distributed among several telegrams. The data are not transferred from the CBD to the drive until all data words have been received.

PKW object (parameter data)

The manufacturer-specific PKW object (class 100) is used to read and modify parameters of the drive or a technology board by means of the DeviceNet master (PKW = parameter identifier value). Explicit messaging mode is used for this purpose.

Only two instances are implemented for the PKW object: Instance 0 permits access to class attributes and instance 1 (always set to "1") access to all parameter numbers (see DeviceNet objects below).

Apart from the protocol header and trailer specific to DeviceNet, the structure of a telegram is follows:

Parameter identifier PKE	Parameter index IND	Parameter value1 PWE1	Parameter value2 PWE2

For details about this telegram area, see also Section 7.7.9, Structure of request/response telegrams. The useful data area of PROFIBUS, CAN Bus and DeviceNet telegrams is structured identically.

DeviceNet GET Single

This object is used to read parameter values and 9 bytes in length.

Byte	DeviceNet identification		
1	[FRAG] [XID] [SRC/DST MAC ID]		
2	[R/R] [Service]	0x0E	[Get_Attribute_Single]
3	Class	100	[PKW object] manufacturer-specific
4	Instance	1	[Instance number] always set to 1
5	Attribute	1	[Attribute number] always set to 1
6	PKE		Parameter ID, L byte
7			Parameter ID, H byte
8	IND		Parameter index, L byte
9			Parameter index, H byte

DeviceNet SET Single

This object is used to modify parameter values and 14 bytes in length

Byte	DeviceNet identification		
1	[FRAG] [XID] [SRC/DST MAC ID]		
2	[Fragmentation Protocol]		
3	[R/R] [Service]	0x10	[Set_Attribute_Single]
4	Class	100	[PKW object] manufacturer-specific
5	Instance	1	[Instance number] always set to 1
6	Attribute	1	[Attribute number] always set to 1
7	PKE		Parameter ID, L byte
8			Parameter ID, H byte
9	IND		Parameter index, L byte
10			Parameter index, H byte
11	PWE1		Parameter value, L word, L byte
12			Parameter value, L word, H byte
13	PWE2		Parameter value, H word, L byte
14			Parameter value, H word, H byte

DeviceNet Response

This object is used to respond to requests of the above type and 8 bytes in length.

Byte	DeviceNet identification		
1	[FRAG] [XID] [SRC/DST MAC ID]		
2	[R/R] [Service]	0x8E 0x90	[Get/Set_Attribute_Single]
3	PKE		Parameter ID, L byte
4			Parameter ID, H byte
5	PWE1		Parameter value, L word, L byte
6			Parameter value, L word, H byte
7	PWE2		Parameter value, H word, L byte
8			Parameter value, H word, H byte

Examples

Read parameter P101.004 using GET Single (for details in the shaded data area, see also Section 7, Starting up PROFIBUS boards):

Byte	DeviceNet identification		
1	[FRAG] [XID] [SRC/DST MAC ID]		
2	[R/R] [Service]	0x0E	[Get_Attribute_Single]
3	Class	100	[PKW object] manufacturer-specific
4	Instance	1	[Instance number] always set to 1
5	Attribute	1	[Attribute number] always set to 1
6	PKE	0x65	Parameter ID, L byte
7		0x60	Parameter ID, H byte
8	IND	4	Parameter index, L byte
9		0	Parameter index, H byte

Request identifier = 0x6065 (request parameter value (array) P101), Index = 0004h = 4d

Response by SIMOREG:

Byte	DeviceNet identification		
1	[FRAG] [XID] [SRC/DST MAC ID]		
2	[R/R] [Service]	0x8E	[Get_Attribute_Single]
3	PKE	0x65	Parameter ID, L byte
4		0x40	Parameter ID, H byte
5	PWE1	0x90	Parameter value, L word, L byte
6		0x01	Parameter value, L word, H byte
7	PWE2	0x00	Parameter value, H word, L byte
8		0x00	Parameter value, H word, H byte

Response identifier = 0x4065, value of P101.004 = 0190h = 400d (PWE2 remains unused because it is not a double word parameter)

Modify parameter U099.001 using SET Single (for details in the shaded data area, see also Section 7, Starting up PROFIBUS boards):

Byte	DeviceNet identification		
1	[FRAG] [XID] [SRC/DST MAC ID]		
2	[Fragmentation Protocol]		
3	[R/R] [Service]	0x10	[Set_Attribute_Single]
4	Class	100	[PKW object] manufacturer-specific
5	Instance	1	[Instance number] always set to 1
6	Attribute	1	[Attribute number] always set to 1
7	PKE	0x63	Parameter ID, L byte
8		0x70	Parameter ID, H byte
9	IND	0x01	Parameter Index, L byte
10		0x80	Parameter Index, H byte
11	PWE1	0xC8	Parameter value, L word, L byte
12		0x00	Parameter value, L word, H byte
13	PWE2	0x00	Parameter value, H word, L byte
14		0x00	Parameter value, H word, H byte

Request identifier = 7063h (modify parameter value (array) U099), index = 0001h = 1d (bit 15 is also set in the H byte in order to address the parameter number range from 2000 to 4000), value = 00C8h = 200d

Response by SIMOREG:

Byte	DeviceNet identification		
1	[FRAG] [XID] [SRC/DST MAC ID]		
2	[R/R] [Service]	0x90	[Set_Attribute_Single]
3	PKE	0x63	Parameter ID, L byte
4		0x40	Parameter ID, H byte
5	PWE1	0xC8	Parameter value, L word, L byte
6		0x00	Parameter value, L word, H byte
7	PWE2	0x00	Parameter value, H word, L byte
8		0x00	Parameter value, H word, H byte

Response identifier = 0x4063, value of U099.001 = 00C8h = 200d (PWE2 remains unused because SIMOREG 6RA70 has no double word parameters)

Information about PKW transmission:

The length of a request from the master is two words (for GET Single) or 4 words (SET Single). The length of a SIMOREG response is always 3 words.

The low-order byte or word is always sent before the high-order byte or word.

The master may generate a new PKW request only after it has received a response from the slave to the previous request.

The master identifies the response to the transmitted request by
evaluating the response identifier
evaluating the parameter number
evaluating the parameter value (if further identification is needed)

The CBD slave does not respond to a parameter request until it has received the relevant data from the drive. The time delay depends on the type of request, but is at least 20 ms. During the initialization phase after Power ON or a re-initialization operation due to a change in a CB parameter setting, requests may not be processed at all, in which case the ensuing delay could be as much as 40 s.

7.7.7.1 Diagnostic tools:

LED displays on the CBD (steadily flashing LEDs indicate normal operation):

Red	Status of CBD (software working correctly)
Yellow	Communication between SIMOREG and CBD
Green	PZD data exchange between CBD and DeviceNet

LED			Status
red	yellow	green	
flashing	flashing	flashing	Normal operation
flashing	off	on	CBD waiting for commencement of initialization by SIMOREG
flashing	on	off	CBD waiting for end of initialization by SIMOREG
flashing	flashing	off	No PZD data exchange via DeviceNet
flashing	on	on	CBD defective

Diagnostic parameter n732:

Indices i001 to i032 apply to a CBD as the first communication board, while indices i033 to i064 apply to a CBD as the second communication board.

<table>
<tr><th></th><th>Value</th><th>Meaning</th></tr>
<tr><td>n732.001
or
n732.033</td><td>0

1
2
3
17</td><td>Ok
Fault F080/fault value 5 is displayed under fault conditions:
DeviceNet MAC ID (P918 / slave address) incorrect
DeviceNet polled I/O produced connection path (U711) incorrect
DeviceNet polled I/O produced consumed path (U712) incorrect
Baud rate (U720) incorrect</td></tr>
<tr><td>n732.002
or
n732.034</td><td></td><td rowspan="3">The displayed decimal values must be converted to hexadecimal values. In hexadecimal notation, every digit of the 16-bit data word has a meaning:

<table><tr><td>Thousands place</td><td>Bit11 Bit10 Bit9 Bit8</td><td>Tens place</td><td>Units place</td></tr></table>
<table><tr><td>Thousands place:
(Idle Indicator)
0 = device not idle; A poll or bit strobe request with length other than 0 was last received
1 = device idle; A poll or bit strobe request with length equal to 0 was last received</td><td>Hundreds place:
(Channel Allocation)
The meaning of individual bits is as follows
Bit8: 1 = Explicit Channel allocated
Bit9: 1 = I/O Poll Channel allocated
Bit10: 1 = I/O Bit Strobe Channel allocated
Bit11: 1 = Reserved</td><td>Tens place:
Reserved</td><td>Units place:
(network status)
0 = CBD not online (Dup_MAC_ID test not yet complete)
1 = CBD online, but not assigned to a master
2 = CBD online and assigned to the master
3 = data cannot be exchanged via bus (multiple MAC IDs or Bus Off)</td></tr></table></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>n732.003
or
n732.035</td><td></td><td>Number of correctly received telegrams since Power ON. The value contains all Group2 DeviceNet messages including those that are not addressed to this CBD.</td></tr>
<tr><td>n732.008
or
n732.040</td><td></td><td>Number of correctly received PZD telegrams since Power ON</td></tr>
<tr><td>n732.009
or
n732.041</td><td></td><td>Number of Bus Off states since Power ON (alarm A084)</td></tr>
<tr><td>n732.019
or
n732.051</td><td></td><td>Number of correctly transmitted telegrams since Power ON</td></tr>
<tr><td>n732.026
or
n732.058</td><td></td><td>Software version of CBDs
(e.g. "12“ = Version 1.2, see also r060)</td></tr>
</table>

	Value	Meaning
n732.027 or n732.059		Software identifier (extended software version identifier, see also r065)
n732.028 or n732.060		Date of generation of CBD software (day and month) (e.g. "2508“ = 25th August)
n732.029 or n732.061		Date of generation of CBD software (year)

Fault and alarm messages:

For details about fault messages, see Section 10.

Fault F080
An error occurred as board CBD was being initialized, e.g. incorrect value of a CB parameter, incorrect bus address or defective board.

Fault F081
The heartbeat counter (counter on CBD) which is monitored by SIMOREG for "signs of life" from the board has not changed for at least 800 ms.

Fault F082
Failure of PZD telegrams or a fault in the transmission channel.

Alarm A081
Idle condition alarm; a PZD telegram of length = 0 has been received either in the "poll" or "bit strobe I/O message channel". The alarm is reset when a PZD telegram of normal length is received.
Faulty CAN messages of this type are ignored. The last transmitted data remain valid.

Alarm A083 (error alarm)
Telegrams containing errors are being received or transmitted and the error counter on the supplementary board has exceeded the alarm limit.
The faulty telegrams are ignored. The last transmitted data remain valid. If the faulty telegrams contain process data, fault message F082 with fault value 10 may be generated as a function of the telegram failure time set in U722.

Alarm A084
Faulty DeviceNet CAN telegrams have been received or transmitted, causing the internal error counter to overrun.
Faulty CAN messages of this type are ignored. The last transmitted data remain valid.

7.7.8 Sequence of operations for starting up the serial I/O board (SCB1):

1 With the power supply disconnected, insert the SCB1 board into slot 2 (or, if you have installed a technology board, into slot 3).

2 Set bus address on SCI using DIP-Fix switch S1 (each SCI slave requires its own address number):

	Slave 1	Slave 2
Address number	1	2
Switch setting S1	open	closed

3 Mount the interface board(s) on the rail, make the connection to the 24 V power supply and the fiber optic connection between SCB1 and SCI.

4 The SCB1 board is used in conjunction with the SIMOREG DC-MASTER only as the master for SCI slaves.
Depending on the type of SCI slaves used and the functions required, the following parameters are relevant with respect to board operation (for details, see function diagrams in Section 7, and parameter list in Section 11):

- U690 Configuration of analog inputs of SCI1
  The type of input signal for each input is parameterized via the indices.
- U691 Smoothing time constant of analog inputs of SCI1
  Filtering of the input signal for each input is parameterized via the indices.
- U692 Zero calibration of analog inputs of SCI1
  The input signal for each input is zero calibrated via the indices.
- U693 Actual value output via analog outputs of SCI1
  A connector number is selected via the indices to define the output quantity at each output.
- U694 Gain of analog outputs of SCI1
  The gain for each output is parameterized via the indices.
- U695 Zero calibration of analog outputs of SCI1
  The output signal for each output is zero calibrated via the indices.
- U698 Binector selection for binary outputs of SCI1
  Selection of binectors whose states are output via the binary outputs of the SCIs.
- Display parameters n697 (diagnostic information) and n699 (display of input/output data) facilitate troubleshooting during start-up.

5 Switch the electronics power supply off and on again or set U710.001 or U710.002 to "0" to transfer the values of parameters U690 to U698 to the supplementary board.
Note: This initialization process will interrupt the communication of any supplementary board that has already been started up.

Option board **SCB1** (**S**erial **C**ommunication **B**oard **1**) is used to link the SIMOREG DC-MASTER 6RA70 to board **SCI1** or **SCI2** (**S**erial **C**ommunication **I**nterface) using a fiber optic connection (recommendation: Siemens plastic fiber optic cable, CA-1V2YP980/1000,200A or Siemens glass-fiber cable, CLY-1V01S200/230,10A). These boards can be used if the CUD2 terminal expansion module is not large enough or safe electrical isolation via fiber optics is an absolute necessity. This board only allows the SCB1 master to exchange data with the SCI slaves. Data cannot be exchanged between the SCI slaves themselves.

A maximum of 2 SCIs, of either the same or different types, can be connected to the SCB1.

SCI1 or SCI2 are terminal expansion boards which are mounted on a rail outside the SIMOREG DC-MASTER and supplied with 24 V DC voltage (-17% +25%, 1A) from an external source.

The interface boards extend the converter by the following additional inputs/outputs:

SCI1	SCI2
10 binary inputs	16 binary inputs
8 binary outputs	12 binary outputs
3 analog inputs	
3 analog outputs	

Reception of SCI data by the SCB1 or transmission to the SCIs is synchronized, i.e. the data of two slaves is received simultaneously or transmitted simultaneously.

Details about the functions and connections of inputs and outputs are shown in the function diagrams in Section 8.

CAUTION

SCI boards have no external enclosure to protect them against direct contact or ingress of pollutants. To protect them against damage, they must be installed in a housing or in the control cabinet of a higher-level system.

The maximum permissible length of fiber optic cables is 10m.

An input filter must be fitted for the external power supply of the interface boards.

Ground SCI at X80 using a short lead.

Analog inputs on SCI1: Only the voltage input or the current input may be used for each channel.

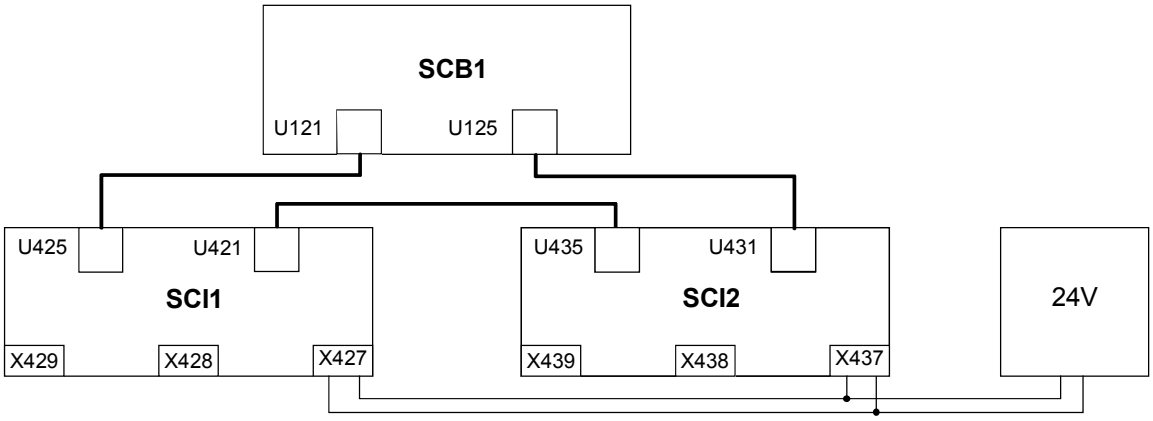
Analog outputs on SCI1: Only the voltage input or the current input may be used for each channel. The outputs are short-circuit-proof.

The binary driver outputs are short-circuit-proof. Relays may only be connected to these outputs in conjunction with an external power supply.

The binary relay outputs are not designed for protective separation.

To protect them against static discharge, the boards may only be placed on conductive surfaces.

Recommended circuit for connecting SCB1 to SCI1 and SCI2 using fiber optic cables:



WARNING

If the 24 V voltage supply for an SCI slave fails which data are being exchanged between the SCB1 and an SCI, then the "1" signal applied at a binary input is sent to the SCB1 or SIMOREG as an "0" shortly before the power finally fails.
In contrast, the "1" remains applied in the SIMOREG in the event of an interruption in the fiber optic connection.

If an external voltage (logical "1") has already been applied to a binary input when the electronics supply voltage is switched on, this status will not be registered until the external voltage is disconnected and reconnected again.

7.7.8.1 Diagnostic tools:

LED display on SCB1:

LED on	Reset state
LED flashing	Normal operation
LED off	Error

LED display on SCI1 or SCI2 slave:

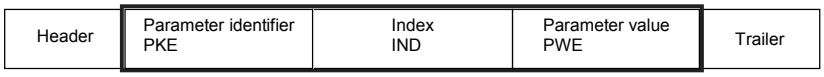
LED on	Reset state	
LED flashing	12Hz frequency	No telegram traffic (e.g. fiber optic cable not connected)
	5Hz frequency	Faulty telegram traffic (e.g. fiber optic ring interrupted or other slave has no supply voltage)
	0.5Hz frequency	Normal operation
LED off	Error	

Details about fault or alarm messages which may occur in relation to SCB1 or SCI (F070 to F079 and A049 and A050) can be found in Section 10.

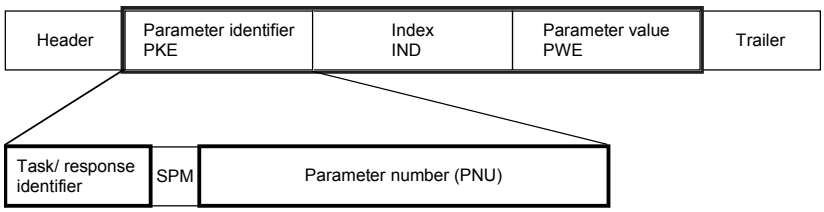
7.7.9 Structure of request/response telegrams

There is no basic difference between the useful data area in the request and response telegrams for PROFIBUS and CAN Bus. There are differences, for example, in the protocol frame and in the sequence in which H and L bytes are transmitted. The structures shown here are those of a SIMOREG DC-MASTER n735, for example. The structure of the protocol frame and the transmission sequence of bytes are therefore described where necessary in the sections containing the start-up description for the appropriate board.

Each request and each response basically comprises three areas apart from the telegram frame with header and trailer:



The **parameter identifier** (PKE) contains a request or response identifier (i.e. type of request or response) and the number of the addressed parameter. The spontaneous signaling bit SPM (bit11) is not used on the SIMOREG DC-MASTER.



Bits 0 to 10 contain the number of the parameter specified in the request.

Owing to the length restriction of the bit field (11 bits), a **parameter number** (PNU) higher than 1999 must be converted to another code for use in the parameter identifier; the **Page Select Bit** in the index is used for this purpose:

Parameter area	Displayed number	Input on OP1S	PNU in parameter identifier	Page Select Bit (index bit 15)
Basic unit	**P**xxx, **r**xxx	0 - 999	0 - 999	0
	Uxxx, **n**xxx	2000 - 2999	0 - 999	1
Technology board	**H**xxx, **d**xxx	1000 - 1999	1000 - 1999	0
	Lxxx, **c**xxx	3000 - 3999	1000 - 1999	1

In the case of a request, for example, which specifies parameter U280 (2280), therefore, PNU = 280 must be entered in the parameter identifier and bit 15 set in the index.

Bits 12 to 15 contain the **request identifier** or the associated **response identifier** as shown in the following list:

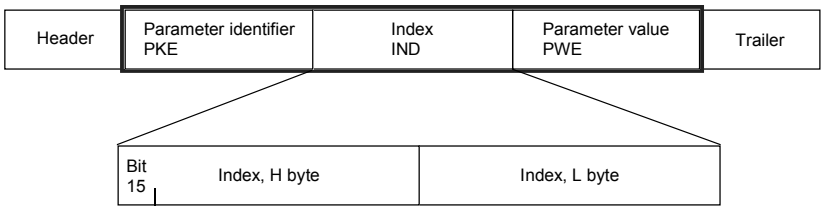
Request identifier	Meaning	**Response identifier**	
		positive	negative
0	No request	0	7 or 8
1	Request parameter value (word or double word)	1 or 2	
2	Modify parameter value (word)	1	
3	Modify parameter value (double word)	2	
4	Request descriptive element	3	
5	Reserved	-	
6	Request parameter value (array) (word or double word)	4 or 5	
7	Modify parameter value (array - word)	4	
8	Modify parameter value (array-double word)	5	
9	Request number of array elements	6	
10	Reserved	-	
11	Modify parameter value (array-double word) and store in EEPROM	5	
12	Modify parameter value (array-word) and store in EEPROM	4	
13	Modify parameter value (double word) and store in EEPROM	2	
14	Modify parameter value (word) and store in EEPROM	1	
15	Request text	15	

If the drive has been unable to process the request, it does not return the associated response identifier, but **error identifier** 7 (or 8) instead.
In this case, an error code defining the error in more detail as shown in the following list is returned as a parameter value:

Error code	Meaning	
0	Illegal parameter number (PNU)	No PNU specified
1	Parameter value cannot be modified	Visualization parameter
2	Lower or upper value limit violated	
3	Faulty subindex	
4	Parameter is not indexed (no array)	
5	Incorrect data type	
6	Parameter value can only be reset	
7	Descriptive element cannot be modified	
8	PPO Write (acc. to "Information Report") is not available	
9	Parameter description is not available	
10	Incorrect access level	
11	No parameterizing enable (P927)	
12	Keyword missing	Key parameter P051 incorrectly set
13	Text cannot be read cyclically	
15	No text	
16	PPO Write missing	
17	Incorrect operating state	
19	Value cannot be read cyclically	
101	Parameter number currently deactivated	
102	Channel not wide enough	

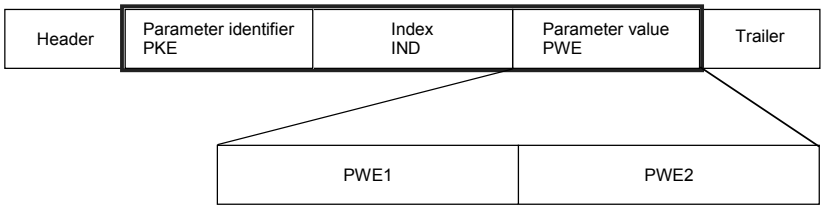
Error code	Meaning	
103	PKW number incorrect	Applies only to serial interfaces
104	Illegal parameter value	Applies to BiCo selection parameters
105	Indexed parameter	
106	Request not implemented in drive	
107	Text cannot be modified	
108	Incorrect number of parameter values	Applies to "Change all indices" request

The **index** IND contains a "0" for non-indexed parameters; a 8-bit long index value is entered (in the low-order byte) for indexed parameters.
Bit 15 (Page Select bit) has a special function. This is used to identify parameter numbers higher than 1999 (see above for details of recoding parameter numbers).
Exception: In the case of cyclical PROFIBUS services, the L and H byte sequence is reversed (see "Start-up of PROFIBUS boards").



An index value of 255 means that the request applies to all indices of the relevant parameter. In the case of a modification request, the parameter values for all indices of the parameter must be transferred. Conversely, the drive supplies all index values in its response to a read request.

The **parameter value** PWE is treated like a double word (PWE1 and PWE2). The high word is set to 0 when a single word is transferred.



7.7.10 Transmission of double-word connectors for technology and communication modules

In the receive direction, the values of two adjacent connectors (K) are combined to form a single double-word connector (KK) (e.g. K3002 and K3003 to KK3032). These double-word connectors can themselves be connected to other function blocks in the usual way. For details of how to connect double-word connectors, see Section 9.1, subsection, " The following rules apply to the selection of double-word connectors ".
In the transmit direction, a double-word connector is applied by entering the same double-word connector in two contiguous indices of the selection parameter.
Example: