Rexroth Rho 4
Signal descriptions

Project planning

Title	Rexroth Rho 4 Signal descriptions
Type of Documentation	Project planning
Document Typecode	DOK-RHO*4*-SIGNALBES**-PR06-EN-P
Purpose of Documentation	The present manual informs about: ● the signals of the rho4

Record of Revisions

Description	Release Date	Notes
DOK-RHO*4*-SIGNALBES**-PR05-EN-P	10.2003	Valid from VO07
DOK-RHO*4*-SIGNALBES**-PR06-EN-P	01.2005	Valid from VO08

Validity   The specified data is for product description purposes only and may not be deemed to be guaranteed unless expressly confirmed in the contract. All rights are reserved with respect to the content of this documentation and the availability of the product.

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Overview of all manuals

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	4	Setting the machine position
	5	Calling operating system functions
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	11	Process info
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Overview of all manuals

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Overview of all manuals

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Safety Instructions

1   Safety Instructions

Please read this manual before you startup the rho4.
Store this manual in a place to which all users have access at any time.

1.1   Intended use

This instruction manual presents a comprehensive set of instructions and information required for the standard operation of the described products. The described products are used for the purpose of operating with a robot control rho4.

The products described

● have been developed, manufactured, tested and documented in compliance with the safety standards. These products normally pose no danger to persons or property if they are used in accordance with the handling stipulations and safety notes prescribed for their configuration, mounting, and proper operation.

● comply with the requirements of

  ● the EMC Directives (89/336/EEC, 93/68/EEC and 93/44/EEC)

  ● the Low-Voltage Directive (73/23/EEC)

  ● the harmonized standards EN 50081-2 and EN 50082-2

● are designed for operation in industrial environments, i.e.

  ● no direct connection to public low-voltage power supply,

  ● connection to the medium- or high-voltage system via a transformer.

  The following applies for application within a personal residence, in business areas, on retail premises or in a small-industry setting:

  ● Installation in a control cabinet or housing with high shield attenuation.

  ● Cables that exit the screened area must be provided with filtering or screening measures.

  ● The user will be required to obtain a single operating license issued by the appropriate national authority or approval body. In Germany, this is the Federal Institute for Posts and Telecommunications, and/or its local branch offices.

☞ **This is a Class A device. In a residential area, this device may cause radio interference. In such case, the user may be required to introduce suitable countermeasures, and to bear the cost of the same.**

The faultless, safe functioning of the product requires proper transport, storage, erection and installation as well as careful operation.

Safety Instructions

1.2   Qualified personnel

The requirements as to qualified personnel depend on the qualification profiles described by ZVEI (central association of the electrical industry) and VDMA (association of German machine and plant builders) in:
Weiterbildung in der Automatisierungstechnik
edited by: ZVEI and VDMA
MaschinenbauVerlag
Postfach 71 08 64
D-60498 Frankfurt.

The present manual is designed for RC technicans. They need special knowledge on handling and programming robots.

Interventions in the hardware and software of our products, unless described otherwise in this manual, are reserved to specialized Rexroth personnel.

Tampering with the hardware or software, ignoring warning signs attached to the components, or non-compliance with the warning notes given in this manual may result in serious bodily injury or damage to property.

Only electrotechnicians as recognized under IEV 826-09-01 (modified) who are familiar with the contents of this manual may install and service the products described.

Such personnel are

● those who, being well trained and experienced in their field and familiar with the relevant norms, are able to analyze the jobs being carried out and recognize any hazards which may have arisen.

● those who have acquired the same amount of expert knowledge through years of experience that would normally be acquired through formal technical training.

With regard to the foregoing, please note our comprehensive range of training courses. Please visit our website at
http://www.boschrexroth.com
for the latest information concerning training courses, teachware and training systems. Personal information is available from our Didactic Center Erbach,
Telephone: (+49) (0) 60 62 78-600.

Safety Instructions

1.3 Safety markings on products

Warning of dangerous electrical voltage!

Warning of danger caused by batteries!

Electrostatically sensitive components!

Warning of hazardous light emissions
(optical fiber cable emissions)!

Disconnect mains power before opening!

Lug for connecting PE conductor only!

Functional earthing or low-noise earth only!

Connection of shield conductor only

Safety Instructions

1.4   Safety instructions in this manual

DANGEROUS ELECTRICAL VOLTAGE
This symbol is used to warn of a **dangerous electrical voltage.** The failure to observe the instructions in this manual in whole or in part may result in **personal injury**.

DANGER
This symbol is used wherever insufficient or lacking compliance with instructions may result in **personal injury**.

CAUTION
This symbol is used wherever insufficient or lacking compliance with instructions may result in **damage to equipment or data files**.

☞   This symbol is used to draw the user's attention to special circumstances.

★   This symbol is used if user activities are required.

Safety Instructions

1.5   Safety instructions for the described product

DANGER
Danger of life through inadequate EMERGENCY-STOP devices!
EMERGENCY-STOP devices must be active and within reach in all system modes. Releasing an EMERGENCY-STOP device must not result in an uncontrolled restart of the system!
First check the EMERGENCY-STOP circuit, then switch the system on!

DANGER
Danger for persons and equipment!
Test every new program before starting up a system!

DANGER
Retrofits or modifications may adversely affect the safety of the products described!
The consequences may include severe injury, damage to equipment, or environmental hazards. Possible retrofits or modifications to the system using third-party equipment therefore have to be approved by Rexroth.

DANGER
Do not look directly into the LEDs in the optical fiber connection. Due to their high output, this may result in eye injuries.
When the inverter is switched on, do not look into the LED or the open end of a short connected lead.

DANGEROUS ELECTRICAL VOLTAGE
Unless described otherwise, maintenance works must be performed on inactive systems! The system must be protected against unauthorized or accidental reclosing.

Measuring or test activities on the live system are reserved to qualified electrical personnel!

Safety Instructions

CAUTION
Danger to the module!
Do not insert or remove the module while the controller is switched ON! This may destroy the module. Prior to inserting or removing the module, switch OFF or remove the power supply module of the controller, external power supply and signal voltage!

CAUTION
use only spare parts approved by Rexroth!

CAUTION
Danger to the module!
All ESD protection measures must be observed when using the module! Prevent electrostatic discharges!

The following protective measures must be observed for modules and components sensitive to electrostatic discharge (ESD)!

- Personnel responsible for storage, transport, and handling must have training in ESD protection.
- ESD-sensitive components must be stored and transported in the prescribed protective packaging.
- ESD-sensitive components may only be handled at special ESD-workplaces.
- Personnel, working surfaces, as well as all equipment and tools which may come into contact with ESD-sensitive components must have the same potential (e.g. by grounding).
- Wear an approved grounding bracelet. The grounding bracelet must be connected with the working surface through a cable with an integrated 1 MΩ resistor.
- ESD-sensitive components may by no means come into contact with chargeable objects, including most plastic materials.
- When ESD-sensitive components are installed in or removed from equipment, the equipment must be de-energized.

Safety Instructions

1.6 Documentation, software release and trademarks

Documentation

The present manual provides information on the signals of the rho4.

Overview of available documentation	Part no.	
	German	**English**
Rho 4.0 Connectivity Manual	1070 072 364	1070 072 365
Rho 4.0 System description	1070 072 366	1070 072 367
Rho 4.1/IPC 40.2 Connectivity Manual	R911308219	R911308220
Rho 4.1/BT155, Rho 4.1/BT155T, Rho 4.1/BT205 Connectivity manual	1070 072 362	1070 072 363
Rho 4.1, Rho 4.1/IPC300 Connectivity manual	1070 072 360	1070 072 361
Control panels BF2xxT/BF3xxT, connection	1070 073 814	1070 073 824
Rho 4.1 System description	1070 072 434	1070 072 185
ROPS4/Online	1070 072 423	1070 072 180
BAPS plus	1070 072 422	1070 072 187
BAPS3 Short description	1070 072 412	1070 072 177
BAPS3 Programming manual	1070 072 413	1070 072 178
Control functions	1070 072 420	1070 072 179
Signal descriptions	1070 072 415	1070 072 182
Status messages and warnings	1070 072 417	1070 072 181
Machine parameters	1070 072 414	1070 072 175
PHG2000	1070 072 421	1070 072 183
DDE-Server 4	1070 072 433	1070 072 184
DLL-Library	1070 072 418	1070 072 176
Rho 4 available documentation on CD ROM	1070 086 145	1070 086 145

☞ **In this manual the floppy disk drive always uses drive letter A:, and the hard disk drive always uses drive letter C:.**

Special keys or key combinations are shown enclosed in pointed brackets:

● Named keys: e.g., <Enter>, <PgUp>, <Del>
● Key combinations (pressed simultaneously): e.g., <Ctrl> + <PgUp>

Safety Instructions

Release

☞ **This manual refers to the following versions:**
Hardware version: rho4
Software release: ROPS4

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AS-I® is a registered trademark of AS-International Association.

SERCOS interface™ is a registered trademark of Interessengemeinschaft SERCOS interface e.V. (Joint VDW/ZVEI Working Committee).

INTERBUS-S® is a registered trade mark of Phoenix Contact.

DeviceNet® is a registered trade mark (TM) of ODVA (Open DeviceNet Vendor Association, Inc.).

rho4 interface description

2 rho4 interface description

2.1 rho4 standard interface

All signal groups of the rho4 interface with the corresponding byte lengths are included in the following table. In the rho4, the signal group 'system communication' e.g. is destined for the control of a time and program-controlled processing of PLC program modules. For that purpose, BAPS uses its own commands.

Address range inputs	PCL-PLC
PHG2000 keys	8 bytes
PHG2000 outputs	8 bytes
RC outputs	160 bytes
System communication	32 bytes
Digital inputs	48 bytes
Total	256 bytes

Address range outputs	PCL-PLC
Reserve	8 bytes
PHG 2000 inputs	8 bytes
RC inputs	160 bytes
System communication	32 bytes
Digital outputs	48 bytes
Total	256 bytes

rho4 interface description

2.2   PCL/PLC address ranges

PLC inputs		PLC outputs

PHG2000 keys

Addr.   I0.0 to I7.7

Reserve

Addr.   O0.0 to O7.7

PHG2000 output data

Addr.   I8.0 to I15.7

PHG2000 input data

Addr.   O8.0 to O15.7

RC outputs

Addr.   I16.0 to I175.7

RC inputs

Addr.   O16.0 to O175.7

P C L

System communication

Addr.   I176.0 to I207.7

System communication

Addr.   O176.0 to O207.7

Digital inputs

Addr.   I208.0 to I255.7

Digital outputs

Addr.   O208.0 to O255.7
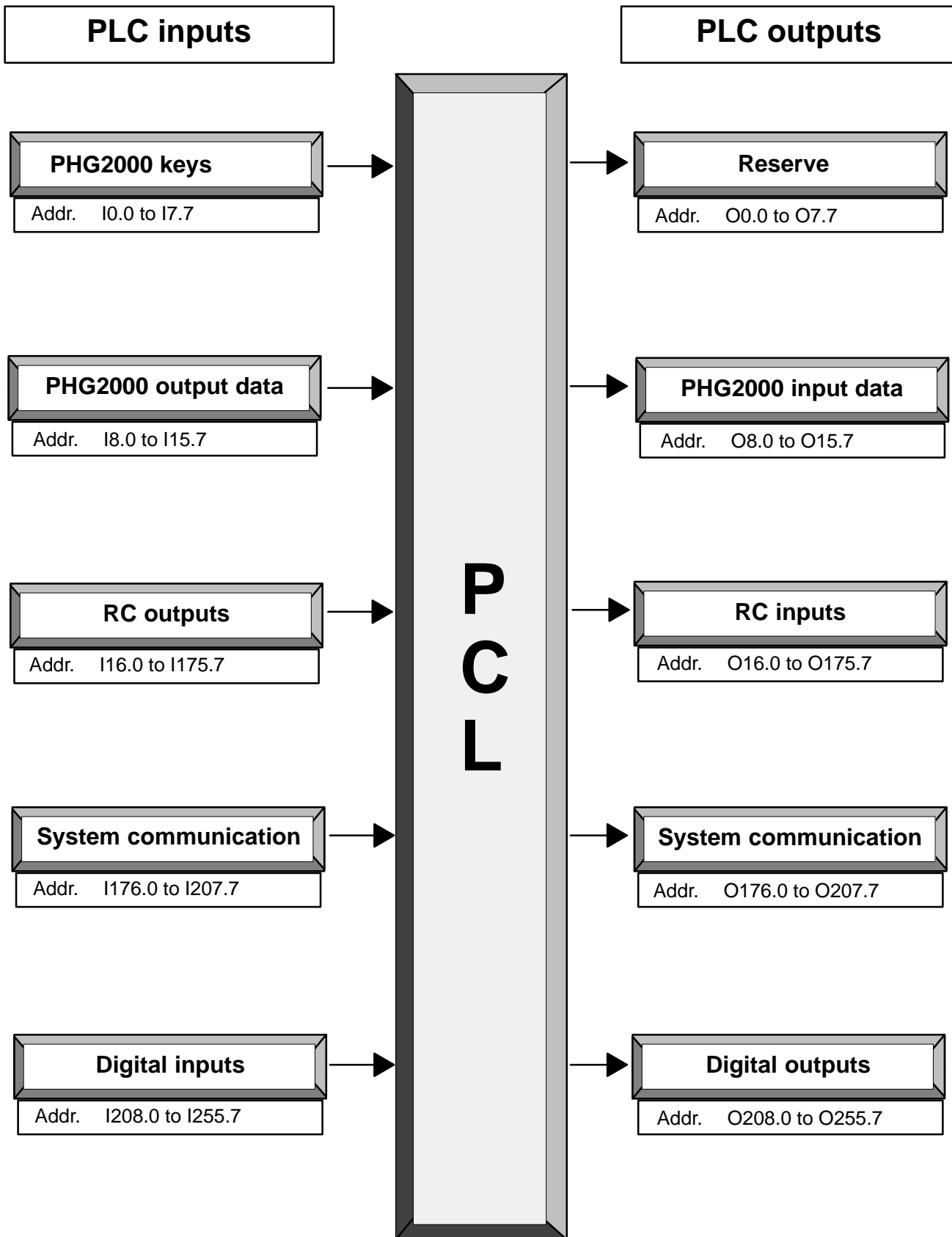
rho4 interface description

2.3   Signal groups of the rho4

The following table contains all signal groups of the rho4 and their number.

Signal group	Number
Number of axes	24
Number of kinematics	16
PHG2000 keys/reserve	64 / 64
PHG2000 inputs/outputs	64 / 64
RC inputs/outputs	1280 / 1280
System communication (bytes)	32 / 32
Digital I/O	200 / 200
Binary user I/O	199 / 199
User bytes I/O	8 / 16
PPO outputs (bytes)	16
IO-logic outputs	16
Machine configuration	8
Control variant coding	8
Coded condition output data	32
Coded text output data	8
Coded PHG2000 function selection	8
External program selection/deselection	8
V/A/D factor resolution	8
Set belt counter	16

rho4 interface description

2.4   Axis and kinematic dependent signals

The table shows the axis and kinematic dependent signals used in the rho4.

Signals	Group signal	Axis-dependent	Kinematic-dependent
In Position	x	x	
Automatic/Manual not	x		x
Reference point switch		x	
Feed allow	x		x
Drive On	x	x	
Travel allow	x		x
Travel commands		x	
Axis disable		x	
I^{2}t-limitation		x	
Selected kinematic			x

rho4 interface description

2.5   Signal designations

List of designations used in the signal table

_RC0	RC output signals
_RCI	RC input signals
_DO	Digital outputs at the interface
_DI	Digital inputs at the interface
_PHG	PHG output signals (key signals)
_PHG2000	PHG2000 specific signals
_MSD	Machine status display
_SCI	System communication inputs
_SCO	System communication outputs

rho4 interface description

Notes:

Signal description of PLC inputs

3   Signal description of PLC inputs

3.1   PHG2000 keys

PHG2000 keys		8 bytes		
Ser. No.	Symbol name PLC	rho4 inter-face ad-dress	Signal description	PHG2000 key number
0	PERMISS_PHG	I 0.0	**Permission key (deadman)**	
1	ANG_PHG2000	I 0.1	**PHG2000 connected**	
2	PROT_PHG2000	I 0.2	**PHG2000 protocol**	
3 to 7	RESERVE_I001 to RESERVE_I005	I 0.3 to I 0.7	**Reserved**	
8	N0_Z_KA_PHG	I 1.0	**0 Z @ key**	K 33
9	N1_CL_AZ_PHG	I 1.1	**1 ← ! key**	K 29
10	N2_Y_SL_PHG	I 1.2	**2 Y / key**	K 30
11	N3_CR_PR_PHG	I 1.3	**3 → % key**	K 31
12	N4_W_PL_PHG	I 1.4	**4 W + key**	K 25
13	N5_CH_ST_PHG	I 1.5	**5 ↑ * key**	K 26
14	N6_X_DPP_PHG	I 1.6	**6 X : key**	K 27
15	N7_S_KL_PHG	I 1.7	**7 S < key**	K 21
16	N8_T_GR_PHG	I 2.0	**8 T > key**	K 22
17	N9_U_J6P_PHG	I 2.1	**9 U JOG 6+ key** Manual travel in positive direction; Start manual reference point travel	K 23
18	MI_V_J6M_PHG	I 2.2	**- V JOG 6- key** Manual travel in negative direction; Start manual reference point travel	K 24
19	ALT_PHG	I 2.3	**ALT key**	K 28
20	SHIFT_PHG	I 2.4	**Shift key**	K 32
21	PT_CT_CO_PHG	I 2.5	**. ↓ , key**	K 34
22	DELETE_PHG	I 2.6	**DEL key**	K 35
23	ENTER_PHG	I 2.7	**ENTER OK key**	K 36

Signal description of PLC inputs

PHG2000 keys			**8 bytes**	
Ser. No.	**Symbol name PLC**	**rho4 inter- face ad- dress**	**Signal description**	**PHG2000 key number**
24	VP_Q_J5P_PHG	I 3.0	**V_PTP/Q/5 + key** Manual travel in positive direction; Start manual reference point travel	K 19
25	IG_R_J5M_PHG	I 3.1	**= /R/5– -key:** Manual travel in negative direction; Start manual reference point travel	K 20
26	RP_O_J4P_PHG	I 3.2	**REPEAT_END/O/4 + key** Manual travel in positive direction; Start manual reference point travel	K 15
27	HD_P_J4M_PHG	I 3.3	**HALT/P/4– key** Manual travel in negative direction; Start manual reference point travel	K 16
28	EL_K_J3P_PHG	I 3.4	**ELSE/K/3 + key** Manual travel in positive direction; Start manual reference point travel	K 11
29	SP_L_J3M_PHG	I 3.5	**JUMP/L/3– key** Manual travel in negative direction; Start manual reference point travel	K 12
30	BE_G_J2P_PHG	I 3.6	**BEGIN/G/2 + key** Manual travel in positive direction; Start manual reference point travel	K 7
31	EN_H_J2M_PHG	I 3.7	**END/H/2– key** Manual travel in negative direction; Start manual reference point travel	K 8
32	MO_IN_GR_PHG	I 4.0	**MODE/INFO/GROUP key** Selection of a PHG2000 operating mode is started with MODE. Selection of a group for manual travel. Selection of the INFO function, display of messages and information texts	K 17
33	CO_KI_BL_PHG	I 4.1	**COORD./KINEM./SPACE key** Deselection of the corresponding operating mode World coordinates (WC), Joint coordinates (JC), Gripper coordinates (GC), Coupling coordinates (CC) with manual travel of the axes selection of kinematic	K 18
34	RP_M_BRO_PHG	I 4.2	**REPEAT/M/(key**	K 13
35	TI_N_BRC_PHG	I 4.3	**TIMES/N/) key**	K 14
36	IF_I_BRO_PHG	I 4.4	**IF/I/[key**	K 9

Signal description of PLC inputs

PHG2000 keys			**8 bytes**		
Ser. No.	**Symbol name PLC**	**rho4 inter-face ad-dress**	**Signal description**		**PHG2000 key number**
37	DA_J_BRC_PHG	I 4.5	**THEN/J]**	**key**	K 10
38	WA_E_QE_PHG	I 4.6	**WAIT/E/?**	**key**	K 5
39	UNTL_F_H_PHG	I 4.7	**UNTIL/F/'**	**key**	K 6
40	MOV_A_UL_PHG	I 5.0	**MOVE/A/'_'**	**key**	K 1
41	LIN_B_SK_PHG	I 5.1	**LINEAR/B/;**	**key**	K 2
42	VI_C_J1P_PHG	I 5.2	**VIA/C/1 +** **key** Manual travel in positive direction; Start manual reference point travel		K 3
43	TO_D_J1M_PHG	I 5.3	**TO/D/1–** **key** Start manual reference point travel		K 4
44 to 47	RESERVE_E006 to RESERVE_E009	I 5.4 to I 5.7	**Reserved**		
48 to 63	RESERVE_E010 to RESERVE_E025	I 6.0 to I 7.7	**Reserved**		

Signal description of PLC inputs

3.2   PHG2000 outputs

PHG2000 outputs		8 bytes	
Ser. No.	**Symbol name PLC**	**rho4 inter-face ad-dress**	**Signal description**
64 to 127	PHG2000_OUT-PUT01 to PHG2000_OUT-PUT64	I 8.0 to I 15.7	**PHG2000 output 1** **to** **PHG2000 output 64**

Signal description of PLC inputs

3.3 RC outputs

| RC outputs		160 bytes	
Ser. No.	**Symbol name PLC**	**rho4 interface address**	**Signal description**
128	INPOS_AA_RCO	I 16.0	**INPOS all axes** Changes to 1 if all applied axes are in position. The group signal is formed in the RC by AND-ing all individual Inpos signals.
129	REF_APPR_RCO	I 16.1	**Reference points must be approached!** Remains 1 as long as not all axes have approached their reference point once. The change from 0 to 1 (after start-up) is performed at the moment from which the RC is ready for command input.
130	STARTUP_RCO	I 16.2	**Control has run up again** Is set to 1 after RC startup and remains in this status until the acknowledgement signal of RC input 'acknowledgement for start-up signal' = 1 is signalled to the RC. The signal status 1 is already available in the first PLC cycle resp. during the first data exchange with a PLC.
131	GROUPERR_RCO	I 16.3	**Group alarm** Changes to 1 if an error occurs in the operating system (e. g. servo error, Emergency Stop, runtime error, etc.) If no further errors exist, the signal is reset to 0 after reset.
132	LEISTRED_RCO	I 16.4	**Power reduction** Always set to 1 in manual mode (i.e. RC input 'Automatic/Manual, not' = 0). In all other cases, the signal is set to 1 if the RC input 'Emergency operation without RC' is set or if 'TEST movement program' is active. Can be used for power reduction in the drive booster.
133		I 16.5	**Reserved**
134	MEM_BAT_RCO	I 16.6	**Buffer battery voltage too low (rho4.0 only)**
135	PHG_ACTV_RCO	I 16.7	**PHG operation is active in Manual** The On-status after start-up is 0. Changes to 1 if any key is pressed at the PHG in the main operating mode 'Manual'. Signal change to 0 when mode 8 'Automatic enable' is selected. In the main operating mode 'Automatic' this signal remains 0. This signal can be used to prevent an unintentional switchover to Automatic (when PHG operation is active) (so implemented in the standard reach-through program).
136	PHG_DFCT_RCO	I 17.0	**PHG not connected or defective** The rho4.1 checks during runtime whether a correctly functioning PHG is connected to the PHG interface X35. If no PHG is connected or no data can be transmitted to or are received from the PHG, this signal is set to 1. After connection of a correctly functioning PHG, it changes to 0 again. Should be used for checking the function of the permission key in order to increase safety. ☞ **When a virtual PHG is used, this signal is always 0. The user must therefore guarantee the safety of the system by other actions.**
137	FEED_E_AK_RCO	I 17.1	**Feed allow, all kinematics** With 1 axis movements are allowed, with 0 they are disabled. Active movements are stopped with 'Down slope'.

Signal description of PLC inputs

RC outputs			160 bytes
Ser. No.	Symbol name PLC	rho4 interface address	Signal description
138	OMD_REF_RCO	I 17.2	**Operating mode Referencing has been selected:** The signal changes to 1 if the operating mode 'Referencing' has been selected at the PHG (mode 1) or via the RC input 'Referencing'. When leaving this operating mode, this signal changes to 0 again.
139	OMD_MANU_RCO	I 17.3	**Operating mode MANUAL has been selected** Changes to 1 if in MANUAL the operating mode 'Manual' has been selected at the PHG (mode 2) or via the RC input 'Manual operation' =1. The selection of the coordinate system and the group must only be carried out after that. When leaving 'Manual' this signal is reset to 0.
140	OMD_OC_RCO	I 17.4	**Operating mode original coordinates (OC), all kinematics, has been selected** The signal is set to 1 by the RC if the RC input 'Function original coordinates (OC) all kin.' and the RC input 'External coordinate selection manual' has been set. It is a precondition that all axes have travelled to their reference point before.
141	OMD_JC_RCO	I 17.5	**Operating mode joint coordinates (JC), all kinematics, has been selected** The signal is set to 1 by the RC if the RC input 'Function joint coordinates (JC) all kin.' and the RC input 'External coordinate selection manual' has been set.
142	OMD_WC_RCO	I 17.6	**Operating mode world coordinates (WC), all kinematics, has been selected** The signal is set to 1 by the RC if the RC input 'Function world coordinates (WC) all kin.' and the RC input 'External coordinate selection manual' has been set. It is a precondition that all axes have travelled to their reference point before.
143	OMD_GC_RCO	I 17.7	**Operating mode gripper coordinates (GC), all kinematics, has been selected** The signal is set to 1 by the RC if the RC input 'Function gripper coordinates (GC) all kin.' and the RC input 'External coordinate selection manual' has been set. It is presupposed that all axes have travelled to their reference point before (is only set for external coordinate selection at the moment).
144	OMD_DIAG_RCO	I 18.0	**Operating mode DIAGNOSIS has been selected** Is 1 as long as Diagnosis (mode 7) is selected on the PHG.
145	OMD_PROG_RCO	I 18.1	**Operating mode PROGRAMMING (Movem./sequence)** Is 1 as long as mode 3 is selected on the PHG.
146	OMD_DETI_RCO	I 18.2	**Operating mode Define/Teach** Is 1 as long as mode 4 is selected on the PHG.
147	AUTO_MN_RCO	I 18.3	**AUTOMATIC/MANUAL, not** Corresponds to the status of the RC input signal 'Automatic/Manual, not'.
148	INCSMJOG_RCO	I 18.4	**Incremental JOG steps small, all kinematics** Is set with internal speed default (in manual operation) if 'Steps small all kinematics' has been selected. For external selection, copy of the RC input 'Steps small'.

Signal description of PLC inputs

RC outputs		160 bytes	
Ser. No.	**Symbol name PLC**	**rho4 inter- face ad- dress**	**Signal description**
149	INCGRJOG_RCO	I 18.5	**Incremental JOG steps large, all kinematics** Is set with internal speed default (in manual operation) if 'Steps large all kinematics' has been selected. For external selection, copy of the RC input 'Steps large'.
150	SLOW_JOG_RCO	I 18.6	**Continual JOG slow, all kinematics** Is set with internal speed default (in manual operation) if 'slow' has been selected. For external selection, copy of the RC input 'Manual feed slow'.
151	FAST_JOG_RCO	I 18.7	**Continual JOG fast, all kinematics** Is set with internal speed default (in manual operation) if 'fast' has been selected. For external selection, copy of the RC input 'Manual feed fast'.
152	BASE_AC_RCO	I 19.0	**Basic PHG level is active** Is set to 1 by the RC as long as the operating system is in basic level. Selection of Manual and Referencing is possible. In addition, a coded PHG function selection is possible in this status.
153	PROC_ACT_RCO	I 19.1	**Permanent process active** Is set to 1 by the RC as long as one 'normal' process is active at least. The signal is reset to 0 if no 'normal' process is active any longer, e.g. at reset, stop by another process or PHG operation. The signal only changes to 1 if a process has been started. The selection alone is not sufficient (it only leads to the display 'Process active' under Diagnosis, System statuses, Process statuses).
154	PERMPR_A_RCO	I 19.2	**Permanent process is active** Is set to 1 by the RC as long as one 'permanent' process is active at least. The signal is reset to 0 if no 'permanent' process is active any longer, e.g. at reset, stop by another process or PHG operation. The signal only changes to 1 if a process has been started. The selection alone is not sufficient (it only leads to the display 'Process active' under Diagnosis, System statuses, Process statuses). The abort of a 'permanent' process can be prohibited by setting the RC input 'permanent process to remain active', no. 143, O17.7.
155	RC_READY_RCO	I 19.3	**Control is ready** Is set to 1 by the RC if the operating system is ready for external program selection or Auto start. The signal remains 1 until the next startup of the RC.
156	TXOUT_OK_RCO	I 19.4	**Acknowledgement, coded text output** Strobe signal; is set if the selected text has been put out without error. The time can be set via machine parameter P9, preset are 110 ms.
157	TXOUT_ER_RCO	I 19.5	**Error of coded text output** Strobe signal; is set if the selected text could not be put out (output channel occupied, no text available for selected number). The time can be set via machine parameter P9, preset are 110 ms.

Signal description of PLC inputs

RC outputs		160 bytes	
Ser. No.	**Symbol name PLC**	**rho4 inter-face ad-dress**	**Signal description**
158	IFPRG_OK_RCO	I 19.6	**Program selection correct** Strobe signal, preset are 110 ms (can be changed via machine parameter P9). Is set if: ● RC input 'Automatic restart' (INIT.IRD) has been selected correctly ● external program selection carried out correctly ● the program selection has been performed correctly via the PHG ● a correct program selection has been carried out via the Online functions. If this signal is used to perform an automatic start, either the negative edge of this signal should be used or the 'Program start' should be delayed for safety reasons. The delay time is dependent on the system load by already active processes.
159	IFPRG_ER_RCO	I 19.7	**Error of program selection** Strobe signal, preset are 110 ms (can be changed via machine parameter P9). Is set if: ● a non-permanent process is selected under Manual ● a non-permanent process is selected under Emergency Stop or 'Emergency operation' ● an existing process is reselected or the selected program is not in the memory ● external program selection without legal EXPROG.DAT is made ● external program selection with illegal parity is made (can be set with machine parameter P4). ● an illegal call of INIT.IRD is made resp. if the program INIT.IRD is not available after selection via RC input 'Automatic restart' ● an illegal program selection via the Online function was made. In addition, a corresponding error code is put out via the coded error output.
160	INIT_POS_RCO	I 20.0	**Reset has been selected on PHG** Strobe signal with selectable time (machine parameter P9). The signal changes to 1 if on the PHG the sub-mode 'Reset' (mode 1) has been selected in the operating mode 'Auxiliary functions' (mode 11). This signal also changes to 1 in order to verify that the control has correctly recognized the RC input 'Reset' and performs the Reset. ☞ **If processes are aborted with Reset, the abort operation is only valid when the RC outputs 153, resp. 154 have been set to 0 and can then be selected again.**
161	HALT_REC_RCO	I 20.1	**PROGRAM_END/HALT command has been recognized** Changes to 1 if in the BAPS program the 'PROGRAM_END command or the HALT command' is being executed, i.e. the program end is reached. Changes to 0 with RC input 'Program start'.
162	PAUS_REC_RCO	I 20.2	**PAUSE command has been recognized** Changes to 1 if in the BAPS program the 'PAUSE command without coding' is being executed. With RC input 'Program start' the program run continues and the signal is reset to 0.

Signal description of PLC inputs

RC outputs			160 bytes
Ser. No.	**Symbol name PLC**	**rho4 interface address**	**Signal description**
163	MSD_ACTI_RCO	I 20.3	**MSD display has been activated** Is set to 1 by the RC if under PHG DIAGNOSIS (mode 7) if one of the two display modes has been actuated in the sub–mode 'Machine statuses' (mode 12). Is reset to 0 if mode 12 is left again.
164	P_STOPOK_RCO	I 20.4	**Strobe, process has been aborted via external process abort** Changes to 1 for the time adjustable with machine parameter P9 (preset 110 ms), if the selected process could be successfully aborted.
165	P_STOPER_RCO	I 20.5	**Strobe, error with external process abort** Changes to 1 for the time adjustable with machine parameter P9 (preset 110 ms), if the selected process could not be aborted. Possible causes are: ● Process is not active or does not exist ● The file EXPROG.DAT does not exist resp. external process abort was performed without valid EXPROG.DAT. ● Parity of the data channel does not agree with the parity set with machine parameter P4.
166	STB_COER_RCO	I 20.6	**Strobe for coded status output** Changes to 1 for the time adjustable with machine parameter P9 (preset 110 ms), when a runtime error is put out coded to the RC outputs no. 168 to 199, 'coded status output', bits 0 to 31 to the interface.
167	PTY_COER_RCO	I 20.7	**Parity for coded output of status messages** Even parity is the internal default. The signal is set correspondingly.
168 to 199	STATUS_0_RCO to STATUS31_RCO	I 21.0 to I 24.7	**Coded status output, bits 0 to 31** All runtime messages, i.e. messages which stop a running program and messages occurring during the operation of the control (servo error, PLC time monitoring etc.) are put out coded to the interface. The data are valid for the time of the strobe signals (RCO 166). If several messages are existing simultaneously or if e.g. servo errors occur in several axes, all messages are put out coded and consecutively. Further information, see manual for Control functions.
200 to 207	RCTYPE_0_RCO to RCTYPE_7_RCO	I 25.0 to I 25.7	**Control variant coding, bits 0 to 7** Coding of the control variant 8 ––> corresponds to the rho4.1 16 ––> corresponds to the rho4.0
208 to 215	MA_TYP_0_RCO to MA_TYP_7_RCO	I 26.0 to I 26.7	**Machine configuration, bits 0 to 7** The value set in machine parameter 2 is put out coded to the interface.
216	PG_RES_RCO	I 27.0	**Reset via PG** Is set if with ROPS4 the function 'Reset RC' has been selected. Has no direct function in the RC. It can be implemented by the user in the PLC program if desired (e.g. Reset RC or machine, etc.).

Signal description of PLC inputs

RC outputs			160 bytes
Ser. No.	**Symbol name PLC**	**rho4 inter-face ad-dress**	**Signal description**
217	PG_START_RCO	I 27.1	**Process start via PG** This is set via the function 'Program start' in ROPS4 and reset after approx. 200 ms. Can be linked in the RC with the RC input 'program start' in order to start programs in this way.
218 to 223	RESERVE_I026 to RESERVE_I031	I 27.2 to I 27.7	**Reserved**
224 to 231	PG_OUT1_RCO to PG_OUT8_RCO	I 28.0 to I 28.7	**Output 1 to 8 of PG** These outputs can be set with the Offline programming system resp. with the Online functions.
232 to 255	I2T_A1_RCO to I2T_A24_RCO	I 29.0 to I 31.7	**I^{2}t-limitation, axes 1 to 24** Is set in case of axis selection via CAN (Servodyn-G) if the corresponding status is signalled by the drive booster via the CAN interface. See also description of connected drive boosters.

Signal description of PLC inputs

RC outputs			160 bytes
Ser. No.	**Symbol name PLC**	**rho4 inter-face ad-dress**	**Signal description**
256 to 271	SGROUP_1_RCO to SGROUP_16_RCO	I 32.0 to I 33.7	**Selection of PHG keys groups 1 to 16** In case of operating mode selection 'Referencing has been selected' (RC output no. 138 =1) or operating mode selection 'Manual has been selected' (RC output no. 139 =1), a group selection must also be made in order to be able to start a travel movement. The bit corresponding to the group No., selected via the PHG, is set to 1 by the RC. All others are set to 0 by the RC. The set group bit serves in the PLC program to assign the Jog key pressed at the PHG to the correct Jog signal of the RC inputs no. 368 to 415.
272 to 287		I 34.0 to I 35.7	**Reserved**
288 to 303	IO_L_A1_RCO to IO_L_A16_RCO	I 36.0 to I 37.7	**IO-logic output 1 to 16** The signals can be influenced via special function 1.
304 to 311	RESERVE_E032 to RESERVE_E039	I 38.0 to I38.7	**Reserved**
312 to 335	INPOS_1_RCO to INPOS_24_RCO	I 39.0 to I 41.7	**INPOS 1st to 24th axis** If the signal is 1, the corresponding axis (1 to 24) is 'In position', i.e. the current lag (drag distance) is smaller than the in-position range set per machine parameter P201.

Signal description of PLC inputs

RC outputs		160 bytes	
Ser. No.	**Symbol name PLC**	**rho4 inter-face ad-dress**	**Signal description**
336	MOTC1AP_RCO	I 42.0	**Travel command 1st to 24th axis plus**
			The signal is 1 if the travel direction of the corresponding axis is positive.
			Travel commands in manual mode and in automatic mode are partially different.
to	to	to	Manual mode:
			The travel commands are cancelled if 'Feed allow all kinematics' (RCI 136) changes to 0, or 'Drive On all axes' (RCI 135) resp. a corresponding individual signal changes to 0.
to	MOTC24AP_RCO	I 44.7	For 'Emergency operation without RC' (RCI 129) 1 and 'Emergency Stop' (RCI 128) 0, the travel commands exist until the permission key at the PHG is no longer actuated.
			If 'Feed allow all kinematics' (RCI 136) changes to 0, the travel commands are still existing.
			Automatic:
			If 'Feed allow all kinematics' (RCI 136) changes to 0, the travel commands are still existing.
359			For 'Emergency operation without RC' (RCI 129) 1, 'Emergency Stop' (RCI 128) 0 or 'Drive On a. axes' (RCI 135) resp. one of the corresponding individual signals 0, the travel commands are cancelled.
360	MOTC1AM_RCO	I 45.0	**Travel command 1st to 24th axis minus**
			The signal is 1 if the travel direction of the corresponding axis is positive.
			Travel commands in manual mode and in automatic mode are partially different.
to	to	to	Manual mode:
			The travel commands are cancelled if 'Feed allow all kinematics' (RCI 136) changes to 0, or 'Drive On all axes' (RCI 135) resp. a corresponding individual signal changes to 0.
to	MOTC24AM_RCO	I 47.7	For 'Emergency operation without RC' (RCI 129) 1 and 'Emergency Stop' (RCI 128) 0, the travel commands exist until the permission key at the PHG is no longer actuated.
			If 'Feed allow all kinematics' (RCI 136) changes to 0, the travel commands remain existing.
			Automatic:
			If 'Feed allow all kinematics' (RCI 136) changes to 0, the travel commands remain existing.
383			For 'Emergency operation without RC' (RCI 129) 1, 'Emergency Stop' (RCI 128) 0 or 'Drive On all axes' (RCI 135) resp. one of the corresponding individual signals 0, the travel commands are cancelled.
384 to 575	RESERVE_I040 to RESERVE_I231	I 48.0 to I 71.7	**Reserved**

Signal description of PLC inputs

RC outputs			160 bytes
Ser. No.	**Symbol name PLC**	**rho4 interface address**	**Signal description**
576 to 639	LIBRY_01_RCO to LIBRY_64_RCO	I 72.0 to I 79.7	**Library functions group 7000** Setting of RC outputs. Libr. fct. outputs 1 to 64.
640	RC_SHUT-DOWN_RCO	I 80.0	**Control is shut down** The signal is set when the control starts running down and is active for the time set via machine parameter 9. Only after it has been reset, the PCL is run down. The signal 'RC shutdown ' can be triggered via the PHG-mode 11.7. The signal RC input no. 148 'Shut down control' is triggered via PHG-mode 11.3.
641	UPS_TEMP_RCO	I 80.1	**Uninterruptible power supply UPS (rho4.1 only)** From version VO02B: UPS signals 'Temperature error'
642	UPS_ACCU_RCO	I 80.2	**Uninterruptible power supply UPS (rho4.1 only)** From version VO02B: UPS signals 'Accutest failed'
643	WINRHO_RCO	I 80.3	**Winrho4 does not respond (only rho4.1)** The monitoring of the Winrho4 has responded. Connection rho4 <–> Winrho4 is interrupted. An ordered shutdown is not possible. User data must be saved manually (via ROPS). The interface Bit WINRHO4_RCO is set.
644	RESERVE_E235	I 80.4	**Reserved**
645	SHUT DOWN_RCO	I 80.5	**The last shutdown was faulty.** The USV is not active, e.g. because accumulators are empty etc User memories and/or machine parameters are maybe not saved. The interface Bit SHUTDOWN_RCO is set.
646 to 647	RESERVE_E237 to RESERVE_E238	I 80.6 to I 80.7	**Reserved**
648 to 651	MF_INPUT01_RCO to MF_INPUT04_RCO	I 81.0 to I 81.3	**Input 1 axis 1 Servodyn-D** Multi-functional inputs on the Servodyn-D drive to **input 4 axis 1 Servodyn-D**

Signal description of PLC inputs

RC outputs			**160 bytes**
Ser. No.	**Symbol name PLC**	**rho4 interface address**	**Signal description**
. . .	. .	. .	. .
740 to 743	MF_INPUT93_RCO to MF_INPUT96_RCO	I 92.4 to I 92.7	**Input 1 axis 24 Servodyn-D** Multi-functional inputs on the Servodyn-D drive to **input 4 axis 24 Servodyn-D**
744 to 759	MF2INPUT01_RCO to MF2INPUT16_RCO	I 93.0 to I 94.7	**rho4.0 Input 1** **rho4.0 Input 16**
760 to 775	RESERVE_I255 to RESERVE_I406	I 95.0 to I 96.7	**Reserved**
776 to 783	VFACTOR_0_RCO to VFACTOR_7_RCO	I 97.0 to I 97.7	**VFACTOR output at the interface (bit 0 value 1)** **VFACTOR output at the interface (bit 7 value 128)**
784 to 791	AFACTOR_0_RCO to AFACTOR_7_RCO	I 98.0 to I 98.7	**AFACTOR output at the interface (bit 0 value 1)** **AFACTOR output at the interface (bit 7 value 128)**
792 to 799	DFACTOR_0_RCO to DFACTOR_7_RCO	I 99.0 to I 99.7	**DFACTOR output at the interface (bit 0 value 1)** **DFACTOR output at the interface (bit 7 value 128)**
800 to 911	RESERVE_I295 to RESERVE_I406	I 100.0 to I 113.7	**Reserved**
912 to 927	PTY_O1_RCO to PTY_O16_RCO	I114.0 to I 115.7	**Parity, byte/PPO outputs 1 to 16** Internally, even parity is the default. The signal is set correspondingly. The signal is valid for INTEGER outputs 401 to 416 and process parameters 1 to 16.

Signal description of PLC inputs

RC outputs			160 bytes
Ser. No.	**Symbol name PLC**	**rho4 interface address**	**Signal description**
928 to 935	STB_PPO1_RCO to STB_PPO8_RCO	I 116.0 to I 116.7	**Strobe, byte/PPO outputs 1 to 8** Default time is 110 ms, can be set via machine parameter P9. The signal is valid for INTEGER outputs 401 to 416 and process parameters 1 to 16.
936 to 943	STB_PPO9_RCO to STB_PPO16_RCO	I 117.0 to I 117.7	**Strobe, byte/PPO outputs 9 to 16** Default time is 110 ms, can be set via machine parameter P9. The signal is valid for INTEGER outputs 401 to 416 and process parameters 1 to 16.
944 to 951	B_PPO1_0_RCO to B_PPO1_7_RCO	I 118.0 to I 118.7	**Output integer: 401: / PPO output 1, bits 0 to 7 , valence 1 to 128** Integer-type output resp. process parameter output, can be addressed as channel from BAPS.
952 to 959	B_PPO2_0_RCO to B_PPO2_7_RCO	I 119.0 to I 119.7	**Output integer: 402: / PPO output 2, bits 0 to 7 , valence 1 to 128** Integer-type output resp. process parameter output, can be addressed as channel from BAPS.
960 to 967	B_PPO3_0_RCO to B_PPO3_7_RCO	I 120.0 to I 120.7	**Output integer: 403: / PPO output 3, bits 0 to 7 , valence 1 to 128** Integer-type output resp. process parameter output, can be addressed as channel from BAPS.
968 to 975	B_PPO4_0_RCO to B_PPO4_7_RCO	I 121.0 to I 121.7	**Output integer: 404: / PPO output 4, bits 0 to 7 , valence 1 to 128** Integer-type output resp. process parameter output, can be addressed as channel from BAPS.
976 to 983	B_PPO5_0_RCO to B_PPO5_7_RCO	I 122.0 to I 122.7	**Output integer: 405: / PPO output 5, bits 0 to 7 , valence 1 to 128** Integer-type output resp. process parameter output, can be addressed as channel from BAPS.
984 to 991	B_PPO6_0_RCO to B_PPO6_7_RCO	I 123.0 to I 123.7	**Output integer: 406: / PPO output 6, bits 0 to 7 , valence 1 to 128** Integer-type output resp. process parameter output, can be addressed as channel from BAPS.
992 to 999	B_PPO7_0_RCO to B_PPO7_7_RCO	I 124.0 to I 124.7	**Output integer: 407: / PPO output 7, bits 0 to 7 , valence 1 to 128** Integer-type output resp. process parameter output, can be addressed as channel from BAPS.

Signal description of PLC inputs

RC outputs			**160 bytes**
Ser. No.	**Symbol name PLC**	**rho4 interface address**	**Signal description**
1000 to 1007	B_PPO8_0_RCO to B_PPO8_7_RCO	I 125.0 to I 125.7	**Output integer: 408: / PPO output 8, bits 0 to 7 , valence 1 to 128** Integer-type output resp. process parameter output, can be addressed as channel from BAPS.
1008 to 1015	B_PPO9_0_RCO to B_PPO9_7_RCO	I 126.0 to I 126.7	**Output integer: 409: / PPO output 9, bits 0 to 7 , valence 1 to 128** Integer-type output resp. process parameter output, can be addressed as channel from BAPS.
1016 to 1023	B_PPO100_RCO to B_PPO107_RCO	I 127.0 to I 127.7	**Output integer: 410: / PPO output 10, bits 0 to 7 , valence 1 to 128** Integer-type output resp. process parameter output, can be addressed as channel from BAPS.
1024 to 1031	B_PPO110_RCO to B_PPO117_RCO	I 128.0 to I 128.7	**Output integer: 411: / PPO output 11, bits 0 to 7 , valence 1 to 128** Integer-type output resp. process parameter output, can be addressed as channel from BAPS.
1032 to 1039	B_PPO120_RCO to B_PPO127_RCO	I 129.0 to I 129.7	**Output integer: 412: / PPO output 12, bits 0 to 7 , valence 1 to 128** Integer-type output resp. process parameter output, can be addressed as channel from BAPS.
1040 to 1047	B_PPO130_RCO to B_PPO137_RCO	I 130.0 to I 130.7	**Output integer: 413: / PPO output 13, bits 0 to 7 , valence 1 to 128** Integer-type output resp. process parameter output, can be addressed as channel from BAPS.
1048 to 1055	B_PPO140_RCO to B_PPO147_RCO	I 131.0 to I 131.7	**Output integer: 414: / PPO output 14, bits 0 to 7 , valence 1 to 128** Integer-type output resp. process parameter output, can be addressed as channel from BAPS.
1056 to 1063	B_PPO150_RCO to B_PPO157_RCO	I 132.0 to I 132.7	**Output integer: 415: / PPO output 15, bits 0 to 7 , valence 1 to 128** Integer-type output resp. process parameter output, can be addressed as channel from BAPS.
1064 to 1071	B_PPO160_RCO to B_PPO167_RCO	I 133.0 to I 133.7	**Output integer: 416: / PPO output 16, bits 0 to 7 , valence 1 to 128** Integer-type output resp. process parameter output, can be addressed as channel from BAPS.

Signal description of PLC inputs

RC outputs			160 bytes
Ser. No.	Symbol name PLC	rho4 interface address	Signal description
1072 to 1270	USER_1_RCO to USER_199_RCO	I 134.0 to I 158.6	**User output 1 to 199** These binary interface signals can be set and reset from BAPS. It can be determined via machine parameter P24 up to which output (included) the user outputs are deleted with 'Control reset' resp. 'Reset' (signal status 0).
1271 to 1407	RESERVE_I407 to RESERVE_I539	I 158.7 to I 175.7	**Reserved**

Signal description of PLC inputs

3.4   System communication outputs

System communication outputs		32 bytes	
Ser. No.	**Symbol name PLC**	**rho4 inter-face ad-dress**	**Signal description**
1408 to 1415	TIME_1_SCO to TIME_8_SCO	I 176.0 to I 176.7	**SCO output, tasks 1 to 8, time-controlled** Time-controlled processing on the PLC is active, if the corresponding output is 1.
1416 to 1423	TIMESTR1_SCO to TIMESTR8_SCO	I 177.0 to I 177.7	**Time value transfer, tasks 1 to 8** The time value programmed in BAPS of tasks 1 to 8 is transferred to the PLC.
1424 to 1439	TIMEV_0_SCO to TIMEV_15_SCO	I 178.0 to I 179.7	**Time value, bits 0 to 15** Contains the time value programmed in BAPS of tasks 1 to 8.
1440 to 1567	PROC_001_SCO to PROC_128_SCO	I 180.0 to I195.7	**SCO outputs 1 to 128, process-controlled** Activates the corresponding PLC process (1 to 128).
1568 to 1663	RESERVE_I540 to RESERVE_I635	I 196.0 to I207.7	**Reserved**

Signal description of PLC inputs

3.5   Digital inputs

Digital inputs			48 bytes
Ser. No.	Symbol name PLC	rho4 interface address	Signal description
1664 to 1671	REFPT_1_DI to REFPT_8_DI	I 208.0 to I 208.7	**Reference point switches 1st to 8th axis** The agency of the switches is defined with machine parameters P402 and P403.
1672	RESET_DI	I 209.0	**Reset at interface** Triggers Reset in the RC. Same effect as Reset via PHG or Online function.
1673	EMERG_N_DI	I 209.1	**Emergency Stop, not** Signal generates Emergency Stop internally (see description of RC input 128).
1674	FEEDN_AK_DI	I 209.2	**Feed allow all kinematics** Enables movement for all kinematics. If the signal is cancelled during an axis movement, the movement is stopped with the slope function.
1675	TRAVE_AK_DI	I 209.3	**Travel allow all kinematics** Enables the travel blocks at signal level 1. Does not operate in case of arithmetic operations (see description of RC input 134).
1676	EMERGOP_DI	I 209.4	**Emergency operation** With signal level 1, the control loop of the RC is opened and the axis positions are internally followed if the axes are moved externally. When the Emergency operation is terminated, the current positions are set as actual positions. This means that no jerk occurs when switching on the power section of the drive amplifiers.
1677	AUTO_MN_DI	I 209.5	**Automatic/Manual, not** Mode selector switch for the two main operating modes AUTOMATIC and MANUAL. Switchover to AUTOMATIC is enabled in the standard PLC program only after selection of mode 8.
1678	CYC_STR_DI	I 209.6	**Cycle start** Start of user programs (*.ird), is copied to the RC input 132 'Program start' in the PLC program.
1679	AUTO_STRT_DI	I 209.7	**Auto start** Selection of the program INIT.IRD, as long as not all reference points have been approached. The actual program start is performed with cycle start (program start).
1680	STB_EXTP_DI	I 210.0	**Strobe external program selection** Acceptance of the coded program numbers applied to inputs I210.1 to I210.2. The signal should be present for at least 100 ms.

Signal description of PLC inputs

Digital inputs			48 bytes
Ser. No.	**Symbol name PLC**	**rho4 interface address**	**Signal description**
1681 to 1682	EXTPRG_0_DI to EXTPRG_1_DI	I 210.1 to I 210.2	**Ext. program selection data, bits 1 to 2** 4 different programs can be called. If more programs are to be called, further digital inputs must be copied to the RC inputs (no. 266 to 271), and the corresponding coding must be entered in the EXPROG.DAT. Permitted coding: 00'H to FF'H. Default HEX-coded.
1683 to 1687	PROC_1_DI to PROC_5_DI	I 210.3 to I 210.7	**Process inputs 1 to 5** Inputs which can be freely used for the evaluation of machine statuses.
1688 to 1695	USER_1_DI to USER_8_DI	I 211.0 to I211.7	**User inputs 1 to 8** Interface signals which can be addressed from BAPS. They are copied directly onto the RC inputs no. 1072 to 1079 'User input 1 to 8' in the PLC program.
1696 to 1865		I 212.0 to I 232.7	**Digital inputs 33 to 200** Inputs which can be freely used by the user.
1866 to 2047	RESERVE_I636 to RESERVE_I819	I 233.0 to I 255.7	**Reserved**

Signal description PLC outputs

4   Signal description PLC outputs

4.1   Reserve

PLC outputs			8 bytes
Ser. No.	Symbol name PLC	rho4 inter-face ad-dress	Signal description
0 to 15	RESERVE_Q001 to RESERVE_Q016	O 0.0 to O 1.7	**Reserved**
16 to 31	RESERVE_Q017 to RESERVE_Q032	O 2.0 to O 3.7	**Reserved**
32 to 47	RESERVE_Q033 to RESERVE_Q048	O 4.0 to O 5.7	**Reserved**
48 to 63	RESERVE_Q049 to RESERVE_Q064	O 6.0 to O 7.7	**Reserved**

4.2   PHG2000 inputs

PHG2000 inputs			8 Bytes
Ser. No.	Symbol name PLC	rho4- Inter-face Adresse	Signal description
64 to 87	PHG2000_IN-PUT01 to PHG2000_IN-PUT24	O 8.0 to O 10.7	**PHG2000 Input 1** **PHG2000 Input 24**
88 to 127	PHG2000_IN-PUT25 to PHG2000_IN-PUT64	O 11.0 to O 15.7	**PHG2000 Input 25** **PHG2000 Input 64**

Signal description PLC outputs

4.3   RC inputs

RC inputs		160 bytes	
Ser. No.	**Symbol name PLC**	**rho4 interface address**	**Signal description**
128	EMERG_N_RCI	O 16.0	**Emergency stop, not** Signals to the RC that Emergency stop is active . 1 = no Emergency stop, 0 = Emergency stop. A change from 1 to 0 aborts running programs (if these are 'normal' processes), the control loop in the RC is not opened. Permanent processes are not aborted if the RC input 143 (PLC addr.O17.7) is on 1. For safety reasons the Emergency stop signal can only be reset in conjunction with initial position.
129	EMERGOP_RCI	O 16.1	**Emergency operation without RC** 1 opens the servo loop of all axes, the positions of the axes are followed internally, e.g. in case of external movement of the axes. When reconnecting, these positions are used as actual positions and not jerk occurs. When changing from 0 to 1, an active program is aborted (if this is a 'normal' process). When the emergency operation is active, the program selection is not allowed. The message 'RC not ready' appears. The RC output serial number No. 132 'Power reduction' (PLC address O16.4) is set on 1 when 'Emergency operation without RC' is active. Permanent processes are not aborted if the RC input 143 (PLC addr. O17.7) is on 1.
130	INIT_POS_RCI	O 16.2	**Reset** With a change from 0 to 1, a running program is aborted (if 'normal' processes are concerned). RC internal buffers and variables are set to defined basic values. In the user memory, the gaps resulting from recopying and deleting files are removed and the files in the user memory are re-arranged. Messages are deleted if the cause is eliminated. Permanent processes are not aborted if the RC input 143 (PLC addr. O17.7) is on 1.

Signal description PLC outputs

RC inputs			160 bytes
Ser. No.	Symbol name PLC	rho4 inter-face ad-dress	Signal description
131	AUTOINIT_RCI	O 16.3	**Automatic restart (call INIT.IRD)** With this signal, the program INIT.IRD can be initialized regardless of whether all reference points have been approached or not. If INIT.IRD has been declared as permanent process, the initialization is also possible in Set-up and if error messages are pending. The actual program start is performed via 'Program start'. This signal (RCI 132) is interpreted as strobe signal. The example below illustrates the signal sequence with which an automatic restart can be achieved after switch-on of the control. RC-ready RCO 155 (autom. referencing only possible in mode 'Auto') Ref.pnt. travel RCO 129 (disappears if all axes are on ref.pnt.) Auto. restart RCI 131 Prog.select. correct RCO 158 appr.100 ms RC start RCI 132 appr.100 ms Proc. active or perm.proc. active RCO 153 or RCO 154
132	PRG_STRT_RCI	O 16.4	**Program start** Starts a previously selected (initialized) program with the change from 0 to 1. The signal must be signalled to the RC as a strobe signal with a minimum time of 100 ms. Under strong system load (e.g. several running processes) this time must be increased.
133	AUTO_MN_RCI	O 16.5	**Automatic/Manual, not** Defines the main operating mode. 1 = Automatic, 0 = Manual. Changing from 1 to 0 aborts a running program or cancels initialization of a program which has already started. For safety reasons, it should always be linked to signal RC output no. 135 'PHG operation in set-up is active' (so implemented in the standard PLC program). If RC input no. 245 is set this signal has no meaning.
134	TRAVEL_AK_RCI	O 16.6	**Travel enable all kinematics** If the signal is 1, the block processing logic of the control for all kinematics receives the enable signal for executing travel blocks, i.e. travel blocks are executed. With signal 0 travel blocks already started are executed and completed. New travel blocks are not activated. With appropriate linking in the PLC program, it is possible to implement e.g. a 'Single step operation' or 'Stop at end of block' function. This does not affect any arithmetic commands and logic operations. Instructions, as e.g. WAIT UNTIL I=1, OUTPUT=0 etc. are only affected if preceded by a travel instruction. The individual signals only work if this group signal is on 0.

Signal description PLC outputs

RC inputs		160 bytes	
Ser. No.	**Symbol name PLC**	**rho4 inter-face ad-dress**	**Signal description**
135	DRIVE_AA_RCI	O 16.7	**Drive On all axes** If the signal is 1 all axes are in the servo loop. With 0 the internal axis positions are slaved and no servo error occurs if the axes are moved externally. After activation of 'Drive On all axes' the system continues starting with the current axis position. Whenever axes are to be moved without Drive On, the message 'Drive On, enable missing' is displayed. The individual signals (RC inputs, no. 320 to 343) only work if this group signal is on 0.
136	FEEDE_AK_RCI	O 17.0	**Feed allow all kinematics** With 1 axis movements are permitted, with 0 movements are disabled. Active movements are stopped with 'Down slope'. Overwrites the signals 'Feed allow 1st to 16th kinematic'.
137	EXT_COOR_RCI	O 17.1	**External coordinate selection** If the signal status is 1 the control expects coordinate system selection in manual mode via the RC inputs. This means the RC inputs joint coordinates (RCI 139), world coordinates (RCI 140) and gripper coordinates (RCI 141) determine the coordinate system for all kinematics.
138	EXT_VMAN_RCI	O 17.2	**External speed selection for Manual** If this signal is 1, no automatic switchover of incremental step –> continuous, and slow –> fast is carried out during manual travel. The signals RC inputs no. 144, 145, 146 and 147 act directly. If this signal is 0, an incremental step must be signalled back to the RC (RC input no. 146 or no. 147).
139	OMD_JC_RCI	O 17.3	**Function JC (joint coordinates)** This must be signalled back to the RC output signal (no. 141) 'Operating mode JC has been selected' if JC is to be activated. If the signal is 0 no selection is performed. In case of external coordinate system selection, this signal determines the coordinate system for all kinematics.
140	OMD_WC_RCI	O 17.4	**Function WC (world coordinates)** This must be signalled back to the RC output signal (no. 142) 'Operating mode WC has been selected' if WC is to be activated. If the signal is 0 no selection is performed. In case of external coordinate system selection, this signal determines the coordinate system for all kinematics.
141	OMD_GC_RCI	O 17.5	**Function GC (gripper coordinates)** This must be signalled back to the RC output signal (no. 143) 'Operating mode GC has been selected' if GC is to be activated. If the signal is 0 no selection is performed. In case of external coordinate system selection, this signal determines the coordinate system for all kinematics.
142	OMD_OC_RCI	O 17.6	**Function OC (original coordinates)** This must be signalled back to the RC output signal (no. 140) 'Operating mode OC has been selected' if OC is to be activated. If the signal is 0 no selection is performed. In case of external coordinate system selection, this signal determines the coordinate system for all kinematics.

Signal description PLC outputs

RC inputs			160 bytes
Ser. No.	Symbol name PLC	rho4 interface address	Signal description
143	P_PRC_AC_RCI	O 17.7	**Permanent processes are to remain active** With signal status 1, permanent processes are not stopped in case of Reset or Auto/Manual switchover.
144	SLOW_RCI	O 18.0	**Manual feed slow, all kinematics** For signal description, see signal 'Incremental step large'.
145	FAST_RCI	O 18.1	**Manual feed fast, all kinematics** For signal description, see signal 'Incremental step large'.
146	INCSM_RCI	O 18.2	**Incremental step small, all kinematics** For signal description, see signal 'Incremental step large'.
147	INCGR_RCI	O 18.3	**Incremental step large, all kinematics** If the signal 'External speed selection for Manual' =1 (RC input no. 137), these RC inputs (no. 144-147) can be wired freely via external signals. If the signal 'External speed selection for Manual' =0 (RC input no. 137), the RC output 'Incremental JOG step small' = 1 (no. 148), if Manual is selected on the PHG. This signal must be signalled back as RC input 'Incremental step small' (no. 146) or as 'Incremental step large' (no. 147). If the system has travelled this step, the RC output (no. 150) 'Continuous JOG slow' is set to 1. This signal must be signalled back as RC input 'Manual feed slow' (ser. no. 144) or 'Manual feed fast' (no. 145). The system travels at this speed for a fixed period. Then the RC issues the signal 'Continuous JOG fast' (RCO no. 151). This signal must be signalled back as RC input 'Manual feed slow' (RCI no. 144) or 'Manual feed fast' (RCI no. 145).
148	SHUTDOWN_RCI	O 18.4	**Shut down control** If the signal is set to 1 a shutdown is released in the rho4.
149	RESERVE_Q067	O 18.5	**Reserved**
150	IF_AFAC_RCI	O 18.6	**Separate AFACTOR strobe from interface is enabled** Only active if O32.6 IF_ADFAC_RCO = 0
151	IF_DFAC_RCI	O 18.7	**Separate DFACTOR strobe from interface is enabled** Only active if O32.6 IF_ADFAC_RCO = 0
152	K01_A_MN_RCI	O 19.0	**Automatic/Manual, not kinematic 1** Defines the main operating mode. 1 = Automatic, 0 = Manual Changing from 1 to 0 aborts a running program or cancels initialization of a program which has already begun. Works only if RC input no. 245 is set to 1.
153	K01_TRAVEL_RCI	O 19.1	**Travel allow kinematic 1** If the signal is 1 the block processing logic of the control for kinematic 1 receives the enable signal for executing travel blocks. See also signal description of RC input 134. This signal only works if the group signal (RC input no. 134) is set to 0.
154	K01_FEEDE_RCI	O 19.2	**Feed allow kinematic 1** If the signal is 1 axis movements of kinematic 1 are permitted, if it is 0 they are disabled. This signal only works if the group signal (RC input no. 136) is set to 0.

Signal description PLC outputs

RC inputs			160 bytes
Ser. No.	Symbol name PLC	rho4 inter-face ad-dress	Signal description
155	K01RMOVE_RCI	O 19.3	**Remote travel allowed, kinematic 1** With signal status 1 it is possible to travel kinematic 1 via a separate PC (TCP/IP-connection). For further information see software manual of DLL-library, library functions, class 1000.
156	K02_A_HMN_RCI	O 19.4	**Automatic/Manual not, kinematic 2** See description of kinematic 1.
157	K02_TRAVEL_RCI	O 19.5	**Travel allow kinematic 2** See description of kinematic 1.
158	K02_FEEDE_RCI	O 19.6	**Feed allow kinematic 2** See description of kinematic 1.
159	K02RMOVE_RCI	O 19.7	**Remote travel allowed, kinematic 2** See description of kinematic 1.
160	K03_A_MN_RCI	O 20.0	**Automatic/Manual not, kinematic 3** See description of kinematic 1.
161	K03_TRAVEL_RCI	O 20.1	**Travel allow kinematic 3** See description of kinematic 1.
162	K03_FEEDE_RCI	O 20.2	**Feed allow kinematic 3** See description of kinematic 1.
163	K03RMOVE_RCI	O 20.3	**Remote travel allowed, kinematic 3** See description of kinematic 1.
164	K04_A_MN_RCI	O 20.4	**Automatic/Manual not, kinematic 4** See description of kinematic 1.
165	K04_TRAVEL_RCI	O 20.5	**Travel allow kinematic 4** See description of kinematic 1.
166	K04_FEEDE_RCI	O 20.6	**Feed allow kinematic 4** See description of kinematic 1.
167	K04RMOVE_RCI	O 20.7	**Remote travel allowed, kinematic 4** See description of kinematic 1.
168	K05_A_MN_RCI	O 21.0	**Automatic/Manual not, kinematic 5** See description of kinematic 1.
169	K05_TRAVEL_RCI	O 21.1	**Travel allow kinematic 5** See description of kinematic 1.
170	K05_FEEDE_RCI	O 21.2	**Feed allow kinematic 5** See description of kinematic 1.
171	K5RMOVE_RCI	O 21.3	**Remote travel allowed, kinematic 5** See description of kinematic 1.
172	K06_A_MN_RCI	O 21.4	**Automatic/Manual not, kinematic 6** See description of kinematic 1.
173	K06_TRAVEL_RCI	O 21.5	**Travel allow kinematic 6** See description of kinematic 1.

Signal description PLC outputs

RC inputs			160 bytes
Ser. No.	Symbol name PLC	rho4 inter-face ad-dress	Signal description
174	K06_FEEDE_RCI	O 21.6	**Feed allow kinematic 6** See description of kinematic 1.
175	K06RMOVE_RCI	O 21.7	**Remote travel allowed, kinematic 6** See description of kinematic 1.
176	K07_A_MN_RCI	O 22.0	**Automatic/Manual not, kinematic 7** See description of kinematic 1.
177	K07_TRAVEL_RCI	O 22.1	**Travel allow kinematic 7** See description of kinematic 1.
178	K07_FEEDE_RCI	O 22.2	**Feed allow kinematic 7** See description of kinematic 1.
179	K07RMOVE_RCI	O 22.3	**Remote travel allowed, kinematic 7** See description of kinematic 1.
180	K08_A_MN_RCI	O 22.4	**Automatic/Manual not, kinematic 8** See description of kinematic 1.
181	K08_TRAVEL_RCI	O 22.5	**Travel allow kinematic 8** See description of kinematic 1.
182	K08_FEEDE_RCI	O 22.6	**Feed allow kinematic 8** Siehe Beschreibung kinematic 1
183	K08RMOVE_RCI	O 22.7	**Remote travel allowed, kinematic 8** See description of kinematic 1.
184	K09_A_MN_RCI	O 23.0	**Automatic/Manual not, kinematic 9** See description of kinematic 1.
185	K09_TRAVEL_RCI	O 23.1	**Travel allow kinematic 9** See description of kinematic 1.
186	K09_FEEDE_RCI	O 23.2	**Feed allow kinematic 9** See description of kinematic 1.
187	K09RMOVE_RCI	O 23.3	**Remote travel allowed, kinematic 9** See description of kinematic 1.
188	K10_A_MN_RCI	O 23.4	**Automatic/Manual not, kinematic 10** See description of kinematic 1.
189	K10_TRAVEL_RCI	O 23.5	**Travel allow kinematic 10** See description of kinematic 1.
190	K10_FEEDE_RCI	O 23.6	**Feed allow kinematic 10** See description of kinematic 1.
191	K10RMOVE_RCI	O 23.7	**Remote travel allowed, kinematic 10** See description of kinematic 1.
192	K11_A_MN_RCI	O 24.0	**Automatic/Manual not, kinematic 11** See description of kinematic 1.
193	K11_TRAVEL_RCI	O 24.1	**Travel allow kinematic 11** See description of kinematic 1.

Signal description PLC outputs

RC inputs			160 bytes
Ser. No.	Symbol name PLC	rho4 interface address	Signal description
194	K11_FEEDE_RCI	O 24.2	**Feed allow kinematic 11** See description of kinematic 1.
195	K11RMOVE_RCI	O 24.3	**Remote travel allowed, kinematic 11** See description of kinematic 1.
196	K12_A_MN_RCI	O 24.4	**Automatic/Manual not, kinematic 12** See description of kinematic 1.
197	K12_TRAVEL_RCI	O 24.5	**Travel allow kinematic 12** See description of kinematic 1.
198	K12_FEEDE_RCI	O 24.6	**Feed allow kinematic 12** See description of kinematic 1.
199	K12RMOVE_RCI	O 24.7	**Remote travel allowed, kinematic 12** See description of kinematic 1.
200	K13_A_MN_RCI	O 25.0	**Automatic/Manual not, kinematic 13** See description of kinematic 1.
201	K13_TRAVEL_RCI	O 25.1	**Travel allow not, kinematic 13** See description of kinematic 1.
202	K13_FEEDE_RCI	O 25.2	**Feed allow kinematic 13** See description of kinematic 1.
203	K13RMOVE_RCI	O 25.3	**Remote travel allowed, kinematic 13** See description of kinematic 1.
204	K14_A_MN_RCI	O 25.4	**Automatic/Manual not, kinematic 14** See description of kinematic 1.
205	K14_TRAVEL_RCI	O 25.5	**Travel allow not, kinematic 14** See description of kinematic 1.
206	K14_FEEDE_RCI	O 25.6	**Feed allow kinematic 14** See description of kinematic 1.
207	K14RMOVE_RCI	O 25.7	**Remote travel allowed, kinematic 14** See description of kinematic 1.
208	K15_A_MN_RCI	O 26.0	**Automatic/Manual not, kinematic 15** See description of kinematic 1.
209	K15_TRAVEL_RCI	O 26.1	**Travel allow not, kinematic 15** See description of kinematic 1.
210	K15_FEEDE_RCI	O 26.2	**Feed allow kinematic 15** See description of kinematic 1.
211	K15RMOVE_RCI	O 26.3	**Remote travel allowed, kinematic 15** See description of kinematic 1.
212	K16_A_MN_RCI	O 26.4	**Automatic/Manual not, kinematic 16** See description of kinematic 1.
213	K16_TRAVEL_RCI	O 26.5	**Travel allow not, kinematic 16** See description of kinematic 1.

Signal description PLC outputs

RC inputs			160 bytes
Ser. No.	Symbol name PLC	rho4 inter-face ad-dress	Signal description
214	K16_FEEDE_RCI	O 26.6	**Feed allow kinematic 16** See description of kinematic 1.
215	K16RMOVE_RCI	O 26.7	**Remote travel allowed, kinematic 16** See description of kinematic 1.
216	DIS_MANU_RCI	O 27.0	**Disable Manual selection via PHG** With signal status 1, the selection of the operating mode 'Manual' (mode 2 on PHG) is disabled. If you try to carry out a selection, the message 'PHG function disabled!' appears at the PHG.
217	DIS_3OM_RCI	O 27.1	**Disable Operating modes: 4.1, 9.1, 11.4, 11.5 and 11.6** With signal status 1, the selection of sub-mode 1, 'Define' in PHG mode 4 (Define, Teach in), the 'Setting the interface parameters' in PHG mode 9 (Device and file handling, default) and the changing of 'VFACTOR', 'AFACTOR' and 'DFACTOR' in PHG mode 11 (help functions) are disabled.
218	DIS_PBAP_RCI	O 27.2	**Disable Progr.movem.progr. (mode 3.1)** With 1 the programming of BAPS programs via the PHG is disabled.
219		O 27.3	**Reserved**
220	DIS_DATIO_RCI	O 27.4	**Disable Device and file handling** With 1 the operating mode device and file handling via PHG (mode 9) is disabled.
221	DIS_PSTA_RCI	O 27.5	**Disable Program call under mode 10** With 1 the program handling, i.e. selection of programs (mode 10.1) and deselection of programs (mode 10.2) is disabled.
222	DIS_RESTA_RCI	O 27.6	**Disable Restart of the RC via PHG** With 1 the restart of the RC via the PHG is disabled.
223	DIS_PHG_RCI	O 27.7	**Disable PHG keys for RC** With 1 all PHG keys are disabled for the control. The signal works in every operating mode, also within an entry. Nevertheless, the PHG keys are still signalled to the PLC. With the PHG keys, user-specific functions can then be performed. This signal must be set for the function 'Referencing and Manual mode via interface'.
224	DIS_DEL_RCI	O 28.0	**Disable Delete programs** With 1 the function Disable user programs is deleted.
225	DIS_DEF_RCI	O 28.1	**Disable Teach in and Define (sub-modes of mode 4)** With 1 points cannot be taught or defined.
226	DIS_REF_RCI	O 28.2	**Disable Referencing via PHG** With 1 the selection of the operating mode 'Referencing' (mode 1 at PHG) is disabled. If an attempt is made to select the operating mode, the message 'PHG function disabled!' appears.
227	DIS_PHGM_RCI	O 28.3	**Disable Output of system messages to PHG** This prevents that a coded message or user texts (WRITE PHG...) are overwritten by the RC.
228	DIS_REFMS_RCI	O 28.4	**Disable Referencing message** With 1 the message 'referencing!', resp. a blank text in line 3 of the basic display of the PHG is suppressed. The display can be used entirely for user texts.

Signal description PLC outputs

RC inputs			160 bytes
Ser. No.	Symbol name PLC	rho4 inter-face ad-dress	Signal description
229	DIS_ONLIN_RCI	O 28.5	**Disable Online functions** Disables the access via the Online functions of ROPS4 This affects the following functions: ● Load, copy to rho ● Delete ● Starting, stopping of processes and settting of signals.
230	DIS_COUPL_RCI	O 28.6	**Disable Coupling to PG** Disables the coupling function on the interface which is activated for the coupling to the PG. This interface is then free for WRITE/READ from BAPS programs.
231	DIS_PRINT_RCI	O 28.7	**Disable Printer** With 1 printing under PHG mode 9.4 is disabled.
232	DIS_SER_1_RCI	O 29.0	**Disable READ/WRITE SER_1** With 1 the Read/Write from BAPS is disabled for this channel.
233	DIS_SER_2_RCI	O 29.1	**Disable READ/WRITE SER_2** With 1 the Read/Write from BAPS is disabled for this channel.
234	DIS_SER_3_RCI	O 29.2	**Disable READ/WRITE SER_3** With 1 the Read/Write from BAPS is disabled for this channel.
235	DIS_SER_4_RCI	O 29.3	**Disable READ/WRITE SER_4** With 1 the Read/Write from BAPS is disabled for this channel.
236	DIS_RESET_RCI	O 29.4	**Disable Reset via PHG** Disables the function 'Reset via PHG' (mode 11.1).
237 to 239	RESERVE_Q086 to RESERVE_Q088	O 29.5 to O 29.7	**Reserved**
240	COD_PHG_RCI	O 30.0	**Strobe, coded PHG function selection** With the signal change from 0 to 1, the value present on the inputs 'Coded PHG function selection' is adopted by the control. The respective function is activated.
241	OMD_MANU_RCI	O 30.1	**Manual mode** If the level is 1, this activates the operating mode Manual if the PHG keys are disabled. Normally, i.e. selection of mode 2 on the PHG, this signal must be signalled to the RC in response to RC output no. 139 'Operating mode Manual has been selected' in order to permit Manual to be activated.
242	OMD_REF_RCI	O 30.2	**Referencing** If the level is 1, this activates the operating mode Referencing if the PHG keys are disabled. Normally, i.e. selection of mode 1 on the PHG, this signal must be signalled to the RC in response to RC output no. 138 'Operating mode Referencing has been selected' in order to permit Referencing to be activated.
243	ENTER_RCI	O 30.3	**Enter key of PHG** Signal is required for direct travel approach of Teach points. Must be linked with PHG key signal ENTER_PHG (no. 23).

Signal description PLC outputs

RC inputs			160 bytes
Ser. No.	Symbol name PLC	rho4 interface address	Signal description
244	PERMISS_RCI	O 30.4	**Permission (or deadman) key of the PHG2000** Must be set to 1 if manual axis movements are to be carried out.
245	KIN_A_MN_RCI	O 30.5	**Kinematic-dependent Automatic/Manual not** If this signal is 1, then signal no. 133 is without meaning, the signals no. 152, 156, 160 etc. replace it.
246	PHG_INAC_RCI	O 30.6	**PHG is inactive** With signal "1" the control permits the change over in Automatic operation. In the standard PLC program this signal is generated by inverting signal no. 135 (I16.7). This signal can be used to disable Automatic operation.
247	ACKN_ERR_RCI	O 30.7	**Acknowledgement, error statuses** The signal change from 0 to 1 resets the internal error buffers. The displayed runtime messages, warnings and other messages are reset. From version VO03F: Safety relevant messages concerning the axis movements are not reset. They must be reset with INIT_POS_RCI (O16.2).
248 249 250 251 252 253 254 255	PHGFCT_1_RCI PHGFCT_2_RCI PHGFCT_4_RCI PHGFCT_8_RCI PHGFCT16_RCI PHGFCT32_RCI PHGFCT64_RCI PHGFCT128RCI	O 31.0 to O 31.7	**Coded PHG function selection, bits 0 to 7, valence 0 to 255** The assignment of the codes to the PHG functions is performed via the file 'PHGCODE.DAT'.
256	STBEXTPS_RCI	O 32.0	**Strobe, external program abort** With signal change from 0 to 1 the process selected via the data channel 'External program selection' and EXPROG.DAT is aborted. Correct abort is acknowledged by the control with the strobe signal (RCO no. 164). If the abort could not be performed, this is signalled by the control with the strobe signal (RCO no. 165).
257	STARTUP_RCI	O 32.1	**Acknowledgement for Start-Up signal** The output no. 66 'Restart control' set by the RC, is acknowledged with this signal = 1. Then, the RC sets the RC output (no. 130) = 0. No further RC internal functions are triggered.
258	PTY_EXTP_RCI	O 32.2	**Parity, external program selection/abort** Must be set dependent on the parity set with machine parameter P4. With incorrect parity, the error signal RCO159 is set in case of external program selection, with external process abort the error signal RCO165 is set.

Signal description PLC outputs

RC inputs			160 bytes
Ser. No.	**Symbol name PLC**	**rho4 inter- face ad- dress**	**Signal description**
259	STB_EXTP_RCI	O 32.3	**Strobe, external program selection** Initializes a program selected with the interface signals RC inputs (no. 264 to 271) and the file EXPROG.DAT. Correct selection is acknowledged by the control with the strobe signal (RCO no. 158). The start of the program is then triggered with 'program start' (RCI no. 132).
260	STB_TXTO_RCI	O 32.4	**Strobe, coded text output** Coded text output is activated with the change from 0 to 1. The signal is to be signalled to the RC with a minimum time of 100 ms. In case of an error, e.g. text for the selected number is not available, the RC output no. 157, 'Error with coded text output' is set as strobe signal (strobe time can be set with machine parameter P9). If selection is correct, the RC output no. 156 'Acknowledgement coded text output', is set as strobe signal.
261	IF_VFAC_RCI	O 32.5	**Acceptance VFACTOR from interface** As long as 1 is signalled to the RC, the signal statuses (RC inputs no. 272 to 279) (VFACTOR/AFACTOR/DFACTOR of interface) are adopted by the RC as globally active (i.e. for all kinematics) VFACTOR.
262	IF_ADFAC_RCI	O 32.6	**Acceptance AFACTOR/DFACTOR from interface** As long as 1 is signalled to the RC, the signal statuses (RC inputs no. 272 to 279) (VFACTOR/AFACTOR/DFACTOR of interface) are adopted by the RC as globally active (i.e. for all kinematics) AFACTOR/DFACTOR.
263	BELT_SIM_RCI	O 32.7	**Switch On belt simualtion** With 1 the actual belt speeds are not considered, the values preset in ma- chine parameter P508 are computed; i.e. all belt speeds are simulated.
264 to 271	EXTPRG_0_RCI to EXTPRG_7_RCI	O 33.0 to O 33.7	**External program selection/abort, bits 1 to 8, bit-valence 1 to 128** Eight-bit-wide data channel for external selection or abort of programs/processes. The data are interpreted in the control as 2-digit Hex number (value 00'H to FF'H). On the basis of this Hex number, a related program name is determined via a reference list (EXPROG.DAT) and this program, if available, is selected, or aborted. 256 different programs can be selected. In case of error: output error strobe (RC output no. 159).
272 to 279	IF_FAC_0_RCI to IF_FAC_7_RCI	O 34.0 to O 34.7	**VFACTOR/AFACTOR/DFACTOR from interface, bit 1 to 8, bit-valence 1 to 128** The signals are interpreted by the RC as 8-bit value and are set as global VFACTOR resp. AFACTOR and DFACTOR.
280 to 287	TXTOUT_0_RCI to TXTOUT_7_RCI	O 35.0 to O 35.7	**Coded text output, bit 1 to 8, bit-valence 1 to 128** The signals are adopted by the RC with the strobe signal (RC input no. 260) as hexadecimal coded text number (00'H to FF'H) into the RC. The related text is stored in the reference file TEXTE.DAT. 256 different texts can be selected.
288 to 311	REFPT_1_RCI to REFPT_24_RCI	O 36.0 to O 38.7	**Reference point 1st to 24th axis** The signals indicate to the servo loop logic that the reference point switches have been reached. The meaning of the signal levels resp. edges is defined with machine parameters P402 and P403.

Signal description PLC outputs

RC inputs			160 bytes
Ser. No.	Symbol name PLC	rho4 inter-face ad-dress	**Signal description**
312 to 319	RESERVE_Q089 to RESERVE_Q096	O 39.0 to O 39.7	**Reserved**
320 to 343	DRIVE_1_RCI to DRIVE_24_RCI	O 40.0 to O 42.7	**Drive On 1st to 24th axis** With 1 the relevant axis is in the servo loop. With 0 the internal axis positions are slaved and no servo errors occur, if the axes are moved by foreign forces. After activation of a Drive On signal, the system continues working with the current axis position. Whenever an axis is to be moved without Drive On, the message 'Drive On enable not available' is displayed. These individual signals only work if the group signal (RC input no. 135) is set to 0.
344 to 367	AXDIS_1_RCI to AXDIS_24_RCI	O 43.0 to O 45.7	**Reserved**
368 to 391	JOG_1_P_RCI to JOG_24_P_RCI	O 46.0 to O 48.7	**Jog 1st to 24th axis (+)** With active operating mode 'Referencing' or 'Manual', these signals trigger an axis movement in positive direction. The signals are active at 1.
392 to 415	JOG_1_M_RCI to JOG_24_M_RCI	O 49.0 to O 51.7	**Jog 1st to 24th axis (–)** With active operating mode 'Referencing' or 'Manual', these signals trigger an axis movement in negative direction. The signals are active at 1.
416 to 423	MF2OUT01_RCI to MF2OUT08_RCI	O 52.0 to O 52.7	**rho4.0 output 01** **rho4.0 output 08**
424 to 447	BRAKE_1_RCI to BRAKE24_RCI	O 53.0 to O 55.7	**Open brake axes 1 to 24** Signals are linked with Emergency stop in the standard plc program.

Signal description PLC outputs

RC inputs			160 bytes
Ser. No.	Symbol name PLC	rho4 inter-face ad-dress	Signal description
448 to 471	MF_OUT01_RCI to MF_OUT24_RCI	O 56.0 to O 58.7	**Output axes 1 to 24 Servodyn-D** Multifunctional outputs on the Servodyn-D drives.
472 to 487	BELT01RES_RCI to BELT16RES_RCI	O 59.0 to O 60.7	**Set belt counters 1 to 16** With 1 the corresponding belt counter is set to the value programmed via special function 28 (default is 0).
488 to 503	SD_CLD01_RCI to SD_CLD16_RCI	O 61.0 to O 62.7	**Safety door, kinematic 01** **Safety door, kinematic 16**
504 to 519	PK_01_RCI to PK_16_RCI	O 63.0 to O 64.7	**Permission button, kinematic 01** **Permission button, kinematic 16**
520 to 536	PW_ON01_RCI to PW_ON16_RCI	O 65.0 to O 66.7	**Power-On RSU Kin 1** **Power-On RSU Kin 16**
537 to 991	RESERVE_Q161 to RESERVE_Q616	O 67.0 to O 123.7	**Reserved** **Reserved**
992 to 999	PTY_I1_RCI to PTY_I8_RCI	O 124.0 to O 124.7	**Parity, integer input: 401 to 408** This bit must be set to 0 or 1, depending on the parity set in machine parameter P4. In case of an error, the user program is aborted with a runtime error.
1000 to 1007	STB_I1_RCI to STB_I8_RCI	O 125.0 to O 125.7	**Strobe, integer input 401 to 408** With strobe signal 1, the data at the byte input (RCI 1008 to 1015, 1016 to 1023, 1064 to 1071) are transferred to the RC inputs. The signal should exist for at least 100 ms. It is possible to switch over to transfer without strobe signal via the corresponding machine parameter option.
1008 to 1015	BYT_I1_0_RCI to BYT_I1_7_RCI	O 126.0 to O 126.7	**Integer input: 401, bits 0 to 7, bit-valence 1 to 128** Integer input channel of BAPS. The values are adopted via the strobe signal RCI1000. It is possible to switch over to transfer without strobe signal via the corresponding machine parameter option. If synchronization with the BAPS program is intended, this must be achieved via the user I/O in conjunction with the program.

Signal description PLC outputs

RC inputs			160 bytes
Ser. No.	Symbol name PLC	rho4 inter-face ad-dress	**Signal description**
1016 to 1023	BYT_I2_0_RCI to BYT_I2_7_RCI	O 127.0 to O 127.7	**Integer input: 402, bits 0 to 7, bit-valence 1 to 128** Integer input channel of BAPS. The values are adopted via the strobe signal RCI 1001. It is possible to switch over to transfer without strobe signal via the corresponding machine parameter option. If synchronization with the BAPS program is intended, this must be achieved via the user I/O in conjunction with the program.
1024 to 1031	BYT_I3_0_RCI to BYT_I3_7_RCI	O 128.0 to O 128.7	**Integer input: 403, bits 0 to 7, bit-valence 1 to 128** Integer input channel of BAPS. The values are adopted via the strobe signal RCI 1002. It is possible to switch over to transfer without strobe signal via the corresponding machine parameter option. If synchronization with the BAPS program is intended, this must be achieved via the user I/O in conjunction with the program.
1032 to 1039	BYT_I4_0_RCI to BYT_I4_7_RCI	O 129.0 to O 129.7	**Integer input: 404, bits 0 to 7, bit-valence 1 to 128** Integer input channel of BAPS. The values are adopted via the strobe signal RCI1003. It is possible to switch over to transfer without strobe signal via the corresponding machine parameter option. If synchronization with the BAPS program is intended, this must be achieved via the user I/O in conjunction with the program.
1040 to 1047	BYT_I5_0_RCI to BYT_I5_7_RCI	O 130.0 to O 130.7	**Integer input: 405, bits 0 to 7, bit-valence 1 to 128** Integer input channel of BAPS. The values are adopted via the strobe signal RCI 1004. It is possible to switch over to transfer without strobe signal via the corresponding machine parameter option. If synchronization with the BAPS program is intended, this must be achieved via the user I/O in conjunction with the program.
1048 to 1055	BYT_I6_0_RCI to BYT_I6_7_RCI	O 131.0 to O 131.7	**Integer input: 406, bits 0 to 7, bit-valence 1 to 128** Integer input channel of BAPS. The values are adopted via the strobe signal RCI 1005. It is possible to switch over to transfer without strobe signal via the corresponding machine parameter option. If synchronization with the BAPS program is intended, this must be achieved via the user I/O in conjunction with the program.
1056 to 1063	BYT_I7_0_RCI to BYT_I7_7_RCI	O 132.0 to O 132.7	**Integer input: 407, bits 0 to 7, bit-valence 1 to 128** Integer input channel of BAPS. The values are adopted via the strobe signal RCI 1006. It is possible to switch over to transfer without strobe signal via the corresponding machine parameter option. If synchronization with the BAPS program is intended, this must be achieved via the user I/O in conjunction with the program.
1064 to 1071	BYT_I8_0_RCI to BYT_I8_7_RCI	O 133.0 to O 133.7	**Integer input: 408 bits 0 to 7, bit-valence 1 to 128** Integer input channel of BAPS. The values are adopted via the strobe signal RCI 1007. It is possible to switch over to transfer without strobe signal via the corresponding machine parameter option. If synchronization with the BAPS program is intended, this must be achieved via the user I/O in conjunction with the program.
1072 to 1270	USER_1_RCI to USER_199_RCI	O 134.0 to O 158.6	**User inputs 1 to 199** These binary interface signals can be inquired from BAPS. The inputs 1 to 99 are evaluated in parallel as machine statuses.

Signal description PLC outputs

RC inputs		160 bytes	
Ser. No.	**Symbol name PLC**	**rho4 interface address**	**Signal description**
1271 to 1407	RESERVE_Q617 to RESERVE_Q753	O 158.7 to O 175.7	**Reserved**

4.4   System communication inputs

System communication inputs		32 bytes	
Ser. No.	**Symbol name PLC**	**rho4 interface address**	**Signal description**
1408 to 1415	TIME_1_SCI to TIME_8_SCI	O 176.0 to O 176.7	**SCI input 1 to 8, time-controlled (acknowledgement signals)** Indicates that the corresponding task (1 to 8) is active on the PLC.
1416 to 1543	PROC_001_SCI to PROC_128_SCI	O 177.0 to O 192.7	**SCI input 1 to 128, process-controlled (acknowledgement signals)** Indicates that the corresponding task (1 to 128) is active on the PLC.
1544 to 1631	RESERVE_Q754 to RESERVE_Q841	O 193.0 to O 203.7	**Reserved**
1632 to 1663	PCLSTATE01_SCI to PCLSTATE32_SCI	O 204.0 to O 207.7	**SCI input 1 to 32, PLC system status** Indicates the status of the system markers of the SoftPLC. In the module syszu_xy.pxo of the standard plc program, the system markers are assigned as follows: O204 = SM14 O205 = SM20 O206 = SM28 O207 = SM29 Assignment see following table:

Signal description PLC outputs

Address	Contents		Note
SM14	PLC and system error messages, error codes (Hex)		
	19	DB too short	
	1D	Address error, access to invalid address, e.g. transfer to constant or time, actual value of counter	
	20	Halt command	
	21	Control in Stop	
	22	Hardware error	
	23	User error of 'C'	
	24	User warning of 'C'	
	25	Reintrant module call	
	26	Assignment list error	
	27	No PLC program	
	28	Error of periphery driver call	
	29	Error of periphery driver installation	
	2C	Command not yet integrated	
	2D	Error in indirect jump	
	2E	Wrong operand number	
	40	Server2 work-task error	
	41	System software error	
SM20	Bit field		Read only, entire bit field
	SM20.0	Directional pulse with each start	
	SM20.1	Buffer failure	=1 if the buffering of the remanent data on the accessory hardware was corrupt
	SM20.2	Blinking marker	
	SM20.3	Outputs disabled	
	SM20.4	Fixing active	
	SM20.5	Data backup error	=1 if the data saving could not be performed
	SM20.7	Directional pulse after Mains_On or Load	
	SM21.7	Windows (WinPanel) without signal.	

Signal description PLC outputs

Address	Contents	Note
SM28	Error word 1	Read only, all errors
	SM28.0 Addressing error	
	SM28.1 Parameter error	
	SM28.2 Non-existing module has been called	
	SM28.3 Module stack error	
	SM28.4 AST_underflow	
	SM28.5 AST_overflow	
	SM28.6	
	SM28.7	
	SM29.0	
	SM29.1 Opcode_error	
	SM29.2	
	SM29.3	
	SM29.4	
	SM29.5 No DB active	
	SM29.6	
	SM29.7 Cycle time error	

4.5   Digital outputs

Digital outputs (DO)			48 bytes
Ser. No.	Symbol name PLC	rho4 inter-face ad-dress	Signal description
1664	CYCLERUN_DO	O 208.0	**Cycle is running** Indicates whether a process is active at the moment. Changes to 0 if an activated process has reached the program end or if all processes are deactivated.
1665	INPOS_AA_DO	O 208.1	**Inpos all axes** Group signal which indicates with 1 that all axes are in Inpos range.
1666	FEED_EN_DO	O 208.2	**Feed allow all kinematics** Indicates the status of the RC signal 'Feed allow all kinematics'.
1667	PRGSEL_OK_DO	O 208.3	**Program selection OK** Acknowledgement signal for correct program selection of PHG or external. Is put out as strobe signal. The time can be set with machine parameter P9 (system strobe time).
1668	ERRPRGSEL_DO	O 208.4	**Error in program selection** Signalizes an error in program selection, e.g. file not available. Is put out as strobe signal. The time can be set with machine parameter P9 (system strobe time).

Signal description PLC outputs

Digital outputs (DO)			48 bytes
Ser. No.	Symbol name PLC	rho4 inter-face ad-dress	Signal description
1669	GROUPERR_DO	O 208.5	**Group alarm** Is 1 as long as a message is pending in the RC.
1670	REF_APPR_DO	O 208.6	**Reference points must be approached!** Is 1 as long as not all axes have approached their reference point.
1671	AUTOMAMUN_DO	O 208.7	**Auto/Manual, not** Indicates the active main operating mode. With Automatic 1, otherwise 0.
1672 to 1679	PROC_1_DO to PROC_8_DO	O 209.0 to O 209.7	**Process outputs 1 to 8** Freely usable outputs for triggering machine functions. (The process output 1 indicates the status of the RC output no. 161, 'HALT command has been recognized' in the standard PLC program.
1680 to 1695	USER_1_DO to USER_16_DO	O 210.0 to O 211.7	**User outputs 1 to 16** Interface signal which can be set and reset from BAPS. Direct copy of the RC internal user outputs.
1696 to 1863		O 212.0 to O 232.7	**Digital outputs 33 to 200** Outputs which can be freely used by the user.
1864 to 2047	RESERVE_Q842 to RESERVE_Q1025	O 233.0 to O 255.7	**Reserved**

Signal description PLC outputs

Notes:

Appendix

A   Appendix

A.1   Abbreviations

Abbreviation	Meaning
BAPS3	Programming language; Bewegungs- und Ablaufprogrammiersprache, Version 3; programming language
C:	Hard disk drive
CAN	Controler Area Network
DAC	Digital-analog converter
EEPROM	Electronically erasable programmable read-only memory
EGB	Elektrostatic sensitive components
ESD	Electrostatic discharge
LF	Line feed
MPP	Machine parameter program
MSD	Machine state display
PCL	Memory-programmable control
PE	Protective earth
PHG	Hand-held programming unit
POS	Actual position
PTP	Point to point
RC	Robot control
ROD	Incremental encoder
RPM	Rounds per minute
ROPS4	Robot programming system for rho4
TCP	Tool center point
WC	World coordinates

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