Commissioning Instructions HIPERDRIVE with PROFIBUS DP

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1 General advice

These instructions apply to the positioning drives HIPERDRIVE with PROFIBUS DP and provides programmers with the necessary information about data communication with the drive.
This instruction is exemplarily written for HIPERDRIVE with bus adapter. For HIPERDRIVE Hub, the proceedings are accordant.
HIPERDRIVE drives are constructed in accordance with the guidelines which are listed in the CE conformity declaration (available upon request) and are intended for **set-up and adjustment tasks on machines and parts** which are not subject to any special electrical and mechanical safety requirements. Measures which are used to protect the plant and personnel must be provided by the plant planner and/or operator in accordance with the necessary statutory guidelines.
For identification of the areas of use and safety precautions, please refer to Part 1 of these Operating Instructions. Please also consult the information there about the proper use of the HIPERDRIVE drives.

In the case of improper use and any damage which may result from this, the manufacturer will bear no responsibility. Proper use also includes compliance with the documentation and operating instructions which apply in each case.

1.1 Documentation and validity

The overall documentation of the HIPERDRIVE comprises the following parts:

- Catalog excerpt / data for positioning systems HIPERDRIVE
- Hardware description HIPERDRIVE Hub with PROFIBUS DP
- Hardware description HIPERDRIVE HDA with PROFIBUS DP
- Commissioning instructions HIPERDRIVE with PROFIBUS DP[1]

This Operating Instruction is intended to give you the necessary information to enable the programming of a control computer (PLC, industrial PC or the like) with which the HIPERDRIVE is controlled via a PROFIBUS DP connection.
Please read through these instructions carefully and take note of the tips and warning remarks.

1.2 Scope

This documentation is valid for:

- HIPERDRIVE Hub-DP
- HDA 70-DP
- HDA 30/45-DP (replaced by HDA 70-DP)

Parameter limits are given for those drives that can be connected to a HIPERDRIVE Hub-DP. These are the following drives:

- PSE 441
- HRA 08 (replaced by PSE 441)
- HDA 70-I

[1] This is the present documentation

- HDA 30/45 (replaced by HDA70-I)

The parameter limits for all HDA 70 variants are the same, so in this manual all HDA 70 variants are denoted by “HDA 70”.

1.3 Symbols and their meanings

Text which is identified with this symbol contains very important advice, also including advice for **averting health risks**.

Text which is identified with this symbol contains very important advice, also including advice for **preventing damage to property.** Observe this text without fail.

This symbol indicates text which contains comments/advice or tips.

- This bullet identifies the descriptions of actions which you should carry out.

2 Safety advice

Failure to observe the warning advice may result in bodily injury or damage to machines and plant. Appropriately qualified personnel must be thoroughly familiar with all the warning advice in these operating instructions, the hazards which can arise as a result of the plantspecific conditions, as well as the safety regulations to be observed.

2.1 Personal protection

The safety provisions must be read and applied by every person involved with the commissioning, operation, maintenance and repair of the devices, plant or machine.

Please ensure that the voltage or power source with which the HIPERDRIVE is operated is designed in accordance with the technical and statutory guidelines which apply to your plant.
Before carrying out work on the drives themselves, or the components operated by them and the parts of the plant affected, the plant must be switched off in accordance with the regulations. In addition to the main circuits, attention must be paid to any additional or auxiliary circuits which may be present.

Caution when the drive is touched by personnel. The HIPERDRIVE may assume a high housing temperature, depending on the mode of operation, because of the integrated motor and the power electronics.
Therefore, during installation, ensure that a sufficiently large distance from combustible materials and/or cables is maintained.
The output shaft of the HIPERDRIVE rotates with a rotational speed of up to 280 rev/min. In addition to care which is generally required, please pay attention to the hazards which can result from pieces of clothing, hair and the like becoming entangled.

2.2 Safety advice for mounting, repair, and commissioning

The HIPERDRIVE positioning drive is an electromechanical subassembly. The device must be mounted and connected in the voltage-free/current-free state.
In the event of improper handling, electrical short circuits with permanent consequential damage may occur.
As a result of commissioning the positioning drive, the position of a flange mounted stop/screw or the like – referred to below as an actuator – may be changed.
As a result, the flow of liquids or solid bodies, such as packages etc., may be made possible or interrupted, or other parts may become blocked.

2.2.1 Safety advice for mounting/repair

We wish to point out expressly that the mounting, electrical and mechanical installation and the repair of the HIPERDRIVE may be undertaken only by trained specialist staff with fundamental mechanical, electrical and programming knowledge.

Opening the HIPERDRIVE Hub DP or the HIPERDRIVE base device or dismount the adapter is forbidden. Any repairs or inspections must only be carried out by the manufacturer's service department.

- Switch off all the devices/machines/plant involved in the mounting or repair.
- If appropriate, isolate the devices/machines/plant from the mains.
- Check whether switching off devices/machines/plant will cause potential danger.
- In the event of an error in the HIPERDRIVE on a plant, which is in operation, inform the shift manager/safety engineer or the operations manager without delay about the error, in order to avoid, for example, an outflow/overflow of chemicals or erroneous filling of end products in good time by means of suitable measures.
- Depressurize pneumatic/hydraulic devices/machines/plant before the mounting or repair.
- If necessary, set up warning signs, in order to prevent inadvertent starting up of the devices/machines/plant.
- Carry out the mounting/repair work whilst complying with the relevant profession safety and accident prevention regulations.
- Before completing the mounting/repair work and/or before the functional test, ensure that all the fixing screws are firmly tightened and that the cable connection is mounted correctly.
- Test the correct functioning of the safety devices (e.g. emergency off switch/safety clutches etc.).

2.2.1 Safety advice for adjustment/commissioning

The adjustment/commissioning may only be made by a person with adequate system knowledge who is aware of the potential hazards.

- Make sure that the HIPERDRIVE is mounted correctly and all the fixing screws are firmly tightened.
- When connecting the drives, the correct polarity both of the voltage supplies for motor and bus electronics and the data lines must be checked without fail. Reversing the polarity of the voltage supply of the motor can destroy the power electronics. The drive does not include reverse polarity protection for the motor supply.
- Make sure that no torques hazardous to personnel or the surrounding area arise from the commissioning or as a result of the test adjustments on the actuating drive.
- If appropriate, set up warning signs in order to prevent devices/machines/plant being started up or shut down inadvertently.

- After completing the adjustments, check the correct functioning and, if necessary, the maintenance of the intended position of the actuator.
- Check the function of the software end position switches and the position feedback.
- Check whether the actuator has actually reached the desired position when the controller indicates the corresponding position.
- By employing suitable measures, prevent elements being pinched by moving actuators.
- Check the correct functioning of any safety devices (e.g. emergency-off buttons/safety couplings etc).
- Carry out the commissioning or the adjustments only in accordance with the instructions described in this documentation.

2.3 Device safety

The HIPERDRIVE positioning drive is a quality product produced in accordance with the recognized industrial regulations and has left the manufacturing plant in perfect condition with regard to safety.
In order to maintain this condition, you – as a user, commissioner or installer – must carry out your task in accordance with this description, technically correctly and with the greatest possible precision.
We assume that, as a trained specialist, you have the necessary knowledge to install, commission and operate the drive in accordance with the rules and regulations that apply to your application.
The positioning drive may be operated only within the values predefined in the technical data.
Commissioning is prohibited until it has been established that the plant/machine in which the positioning motor has been incorporated complies with the regulations which have to be applied to the plant/machine.
Make sure that no torques hazardous to persons and environment arise as a result of the mounting, commissioning or as a result of test adjustments.
Opening the drive is forbidden. Any repairs or inspections must only be carried out by the manufacturer's service department.

3 Interface

PROFIBUS DP is an internationally standardized, open fieldbus standard, which is defined in the standards EN50170 Part 2, DIN19245 Parts 1 and 3 and IEC 61158.
PROFIBUS DP is optimized for fast, time-critical data transfers at the device level. The field bus is used for cyclic data exchange between a master and associated slaves.
HIPERDRIVE is operated on the PROFIBUS DP as a DP-V0 slave (passive bus node) and can therefore only acknowledge messages or transmit data in response to a request from the master.
HIPERDRIVE automatically detects the baud rate of the PROFIBUS DP communication. The baud rate is set uniformly by the master for all the devices connected to PROFIBUS.

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4 Data exchange

The functional diagrams, control functions and state messages and the manner of cyclic data traffic between master device and HIPERDRIVE slave follows the sequences and data structures defined in the PROFIBUS profile for Variable Speed Drives, PROFIDRIVE Version 2 (issue dated September 1997, PNO order no. 3.071).
The details needed for understanding or any possible deviations are reproduced in these instructions. For more extensive information, please use the appropriate literature.
The profile **Variable Speed Drives PROFIDRIVE Version 2** defines control functions and status messages which serve the control sequence and the proper operational management of inverter devices and drives. For this purpose, in the direction from master to slave, a **control word** (CW) is defined, and in the direction from slave to master, a **status word** (SW) is defined. The associated functions and sequences of the control and status word are displayed in functional diagrams to DIN 40719 (see chapter 5.1.3 for “positioning operating mode” and chapter 5.2.3 for “speed control operating mode”).

Mapping and designation of data correspond with the usual procedure in PROFIBUS descriptions; for example, the notation for 09 0B 00 01_{hex} is as follows:

Table 4-1: Example

Octet 1								Octet 2							
Bit number															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	0	0	1	1	0	1	1	0	0	0	0	0	0	0	1
9_{hex}				B_{hex}				0_{hex}				1_{hex}			

Numbers represented hexadecimally are identified by a “hex” subscript, e.g. $1F_{hex}$ = 31(decimal). Decimal numbers are not identified separately.

4.1 Telegram structure

4.1.1 User data

The structure of the useful data for the cyclic data traffic is designated a parameter process data Object (PPO) in the PROFIBUS profile **“Variable Speed Drives PROFIDRIVE Version 2”**
Such a Parameter Process data Object (PPO) comprises two parts,

- The process data area (PZD), that is to say control words and setpoints, or status information and actual values.
- Parameter area (PKW) for reading/writing parameter values.

By using the process data, the drive is managed in the automation assembly, for example switching on/off, predefining setpoints or transmitting the status information (e.g. transfer actual values) from the drive to the controller.
With the aid of the parameter area, the user has random access via the bus system to all the parameters in the drive. It is therefore possible, without influencing the efficiency of the process data transfer, for a higher-order system to call up further information for the visualization of the drive or to update process parameters.

Table 4-2: Telegram structure of a PPO-Object

Protocol frame (header)	Useful data		Protocol frame (trailer)
	Parameters (PKW)	Process data (PZD)	

With the division of the useful data into PKW and PZD, account is taken of various important main task points.

- Parameter data area:
  With the PKW telegram part (parameter ID value), any desired parameter in the HIPERDRIVE can be observed and/or changed. The mechanisms of task/reply IDs needed for this will be described in chapter 4.2.2 “Parameter ID value (PKW)”.
- Process data area:
  With the process data, control words and setpoints (tasks: master → drive) and state words and actual values (replies: drive → master) can be transmitted.

4.1.2 Diagnostic data

HIPERDRIVE supports the Slave-Diag function defined in PROFIBUS DP. Using this function, 6 bytes of PROFIBUS DP specific diagnostic information and a further 2 bytes of Ext_Diag_Data are read from the slave. Furthermore, only the customised, defined Ext_Diag_Data is described; the 6 remaining bytes are defined and described in the standard.
The user may choose to enable or disable the diagnostic function, using the parameter 1011. The meaning of the data supplied by Ext_diag_Data is identical to that of parameter 1009; both parts are updated in parallel.

Table 4-3: Diagnostic data

Bit	Meaning
0	Motor current or max. torque exceeded
1	Operating voltage below limit
2	Dynamic position deviation
3	Overtemperature, drive stops
4	Drive blocked (direction CCW)
5	Drive blocked (direction CW)
6	-- Not specified.
7	-- Not specified.
8	Limit working area exceeded (CCW) – min. position
9	Limit working area exceeded (CW) – max. position
10	Internal error: position registration
11	-- Not specified.
12	Internal error: EEPROM error
13	Internal error: wrong command sequence
14	Invalid value of parameter or process data.
15	Timeout for communication drive – gateway

4.2 Definition of the Parameter Process data Object (PPO)

For the HIPERDRIVE, a dedicated HIPERDRIVE PPO type with a fixed data length is defined as follows:

PKW					PZD				
					PZD1	PZD2	PZD3	PZD4	
PKE		IND	PWE		CW SW		HSW HW	HSW HW	
Octet 1									Octet 16

Table 4-4: Definition of the HIPERDRIVE PPO-Objects

PKW:	Parameter value ID	PZD (1 .. 4):	Process data (1 .. 4)
PKE:	Parameter ID	CW:	Control word
IND:	Index	SW:	Status word
PWE:	Parameter-value	HSW:	Main set value
		HIW:	Main actual value

The elements of the PKW and of the PZD module are built up word by word (2 Octets each).

4.2.1 Process data (PZD)

The process data part is used to transmit all the information which is exchanged during normal, cyclic moving operation, that is to say control commands, setpoints from the master to the drive and status word, actual values from the drive to the master. Because of the two operating modes of the HIPERDRIVE “positioning” and “speed control”, (which can be adjusted with parameter no. 930 (see chapter 7.2) different meanings may result for individual parameters, in particular for the main setpoint (main setpoint in the positioning operating mode: desired position, in the operating mode speed control: speed setpoint). The process data area is built up as follows for the HIPERDRIVE:

4.2.1.1 Data transmission master → slave

Table 4-5: Data transmission master to slave

PKW								PZD							
PKE		IND		PWE				CW		V%	T%	Setpoint			
Octet 1															Octet 16

Control word CW

For a description of the control word, see chapter 5.1.1 for “positioning operating mode” and chapter 5.2.1 for “speed control operating mode”.

Table 4-6: v%-Current travel speed (setpoint)

Parameter <v%>	Rotational speed in per cent of the maximum speed setpoint, (1 byte) as a hexadecimal number.
Parameter value range	0…100, speed in per cent of the maximum speed v-max (rev/min) predefined with parameter number 1002 <v%> = (speed [Rev/min] * 100%) / v_{max} [Rev/min] Example: v% = (12 rev/min / 35 rev/min) * 100 = 40

Table 4-7: t%-Maximum torque

Parameter <t%>	Limiting value in per cent of the maximum output torque (1 byte) as a hexadecimal number.
Parameter value range	25, 50, 75, 100, torque in per cent of the maximum torque tmax (Nm) <t%>=(torque [Nm] * 100%) / t_{max} Written values not 25, 50, 75 or 100 are roundet up.

The definition of the setpoint depends on the operating mode selected. In the “speed control” operating mode, the setpoint merely contains information about the direction of rotation and the meaning of the position limits. In the “positioning” operating mode, on the other hand, the position setpoint for the next imminent movement is transmitted.

Note:

HDA family: the torque parameter is valid for 25%, 50%, 75% and 100%, all other parameter values are rounded off.
HRA 08 / PSE 441: the torque parameter is ignored

Table 4-8: Setpoint in the speed control operating mode

Parameter setpoint	4 Byte: <Unused> <Unused> <Poslimit ON/OFF> <Direction of rotation>
Parameter value range	Poslimit = 00_{hex}: position limits (Param 1000 und 1001) active Poslimit = 99_{hex}: position limits are inactive Direction of rotation CW = 01_{hex} Direction of rotation CCW = 00_{hex}

Table 4-9: Setpoint in the positioning operating mode

Parameter setpoint	4 Byte: Position setpoint
Parameter value range	Limit operating range CCW <= position setpoint <= limit operating range CW

Position data mapping [2]

All position data in this documentation is mapped as a binary number 4 bytes in length. The first two bytes always represent the number of full revolutions of the output shaft, and the last two bytes always represent the position within a revolution.

Table 4-10: Position data mapping

Parameter	Actual position value (4byte), number of revolutions			
	Number of revolutions		Steps within one revolution	
	MSB			LSB
Parameter value range	± number of absolute turns possible with the actual drive unit as written in the data sheet, the unit is 65536 steps per revolution [3]			

4.2.1.2 Data transmission slave → master

Table 4-11: Data transmission slave to master

PKW								PZD							
PKE		IND		PWE				SW		V-act		Position-act			
Octet 1															Octet 16

Status word SW

For a description of the status word, see chapter 5.1.2 for “positioning operating mode” and chapter 5.2.2 for “speed control operating mode”.

Current travel speed v-act (actual value) [2]

Table 4-12: Current travel speed v-act

Parameter <v-act>	Rotational speed in rpm*10 (1 byte) as a hexadecimal number.
Parameter value range	0…v_{max}, absolute speed in rpm * 10. predefined with parameter number 1002 <v%> = (speed [Rev/min] * 100%) / v_{max} [Rev/min] Example: v% = (12 rev/min / 35 rev/min) * 100 = 40

Current position pos-act (actual value) [2]

Table 4-13: Current position pos-act (actual value)

Parameter	Actual position value (4 byte), number of revolutions			
	Number of revolutions		Steps within one revolution	
	MSB			LSB
Parameter value range	± number of absolute turns possible with the actual drive unit as written in the data sheet, the unit is 65536 steps per revolution [3]			

4.2.2 Parameter ID value (PKW)

The processing of parameters in the cyclic data traffic is carried out via the PKW mechanism. In the PKW mechanism, the master allocates and transfers a task. It repeats this task cyclically until the slave has carried out the task and has provided a response.
A slave provides the response until the master formulates a new task. In the case of responses which contain parameter values, the slave always responds with the current value (cyclic processing) at each repetition. These are all the responses to the tasks “request parameter value” and “request parameter value (array)”. For each slave, only one task is being processed.

[2] Depending on scaling factors, here: default value
[3] Here: steps per revolution is a theoretical number, the physical steps of the integrated encoder are shown in the catalog excerpt / data sheet of the corresponding drive

PKW								
PKE		IND		PWE				
Octet 1								

Figure 4-1: Parameter transfer master to slave and slave to master

Table 4-14: Parameter ID value

PKW:	Parameter value ID
PKE:	Parameter ID
IND:	Index
PWE:	Parameter-value

4.2.2.1 Parameter ID (PKE)

The parameter ID information PKE comprises a data word (1st and 2nd byte of the PKW part) in which the type of task/response (task ID/response ID) and associated parameter number are encoded.

Table 4-15: Parameter ID

Parameter ID (PKE)															
Bit no.															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
AK				SPM	Parameter number (PNU)										

AK: task or response ID (for encoding, see tables 4-16 and 4-17)
SPM: toggle bit for instantaneous message (function not implemented)
PNU: parameter number

The task/response processing is defined in such a way that the content of the field task ID reveals which fields of the PKW interface (Index IND and/or parameter value PWE) must also be evaluated. Added to this is the distinction between parameter value and parameter description.

Task ID (master → slave)

Table 4-16: Task IDs

Task ID	Function	Response ID [4]	
		positive	negative
0	No task 0	0	7 or 8
1	Request parameter value	1 or 2	
2	Change parameter value (word)	1	
3	Change parameter value (double word)	2	
4	Request descriptive element	3	
5	Change descriptive element	3	
6	Request parameter value (array)	4 or 5	
7	Change parameter value (array word)	4	
8	Change parameter value (array double word)	5	
9	Request the number of array elements	6	

[4] The column “Response ID” relates to the following table 4-17 response IDs and contains the responses belonging to the task if carried out successfully in the task (positive) and in the event of a fault (negative).

Response ID (slave → master)

Table 4-17: Response ID

Response ID	Function
0	No response
1	Transfer parameter value (word)
2	Transfer parameter value (double word)
3	Transfer descriptive element
4	Transfer parameter value (array word)
5	Transfer parameter value (array double word)
6	Transfer the number of array elements
7	Task cannot be executed
8	No operating authority for PKW interface
9	Instantaneous message word (not implemented)
10	Instantaneous message double word (not implemented)

Parameter number (PNU) (master → slave, slave → master)
This field contains the number of the parameter whose data are transferred in the parameter word field PWE.

4.2.2.2 Sub-index (IND)

In the case of tasks and responses which relate to array elements, the field IND contains the array sub-index.

4.2.2.3 Parameter word (PWE)

This field contains the numerical value associated with the respective parameter. For definition, see chapter 7. In the case of tasks which cannot be executed, the slave responds with an error number according to the following table:

Table 4-18: Parameter word error numbers in response

No	Meaning
0	Impermissible parameter number
1	Parameter value cannot be changed
2	Lower or upper value limit violated
3	Faulty sub-index
4	Not an array
5	Wrong data type
6	Setting not permitted (can only be reset)
7	Descriptive element cannot be changed
8	PPO write requested in the IR not present
9	Descriptive data not present
10	Access group wrong
11	No operating authority
12	Wrong password
13	Illegible text in cyclic traffic
14	Illegible name in cyclic traffic
15	No text array present
16	Missing PPO write
17	Job cannot be executed because of operating status
18	Other error
19	Illegible date in cyclic traffic

5 Functional description of the control mechanism

In this chapter, the definitions, sequences, functions and states needed for the operational management are described. The control and status words already mentioned in chapter 4.2 will be explained in detail in terms of structure and meaning.
In the stepping conditions, it is also possible for individual bits to be preset and to become effective only when the sequence step provided for this purpose has been reached. This means that all the following steps will be jumped over if their bits have already been set. This means that commands can be carried out unambiguously even when the intermediate steps have not been implemented.

Depending on the operating mode, the individual control and status bits have to some extent different meanings.

5.1 Control mechanism for positioning operating mode

5.1.1 Control word for positioning operating mode

Table 5-1: Control word for positioning operating mode

Bit	Mask	Value	Meaning according to PROFIDRIVE	HIPERDRIVE description
0	0x0001	1	ON	Motor supply voltage connected [5]
		0	OFF 1	Drive switched off
1	0x0002	1	Operating condition	Not implemented, must be set to 0
		0	OFF 2	
2	0x0004	1	Operating condition	Not implemented, must be set to 0
		0	OFF 3	
3	0x0008	1	Enable operation	Operation enabled
		0	Inhibit Operation	Operation inhibited
4	0x0010	1	Operating condition for positioning	Must be continuously available for execution of a drive task. Drive task is activated with edge in bit 6
		0	Stop	Drive stops immediately, the current drive task is cancelled.
5	0x0020	1	Operating condition for positioning	Must be continuously available for execution of a drive task.
		0	Intermediate stop	Drive brakes from an active drive task to n=0 and remains stationary with the stopping moment. The drive task is not cancelled. The drive task is continued when a change to bit 5=1 occurs.
6	0x0040	0/1	Activate drive task	Each edge enables a drive task or a new setpoint (toggle bit). A change in edge may only occur when acknowledgement that the previous drive task was accepted was performed with bit 12 of the status word and bit 11 (reference point) is set.
7	0x0080	1	Acknowledge	Group signal is acknowledged with a positive edge; HIPERDRIVE receives a “RESET” command, and then changes to “Ready to switch on”
		0	No significance	No significance
8	0x0100	1	Inching 1 ON	Drive travels with inching setpoint 1 by the configured step width in the configured direction.
		0	Inching 1 OFF	Drive brakes as quickly as possible if “Inching 1” was previously ON and, if n = 0, changes to “Operation enabled”
9	0x0200	1	Inching 2 ON	Drive travels with inching setpoint 2 by the configured step width in the configured direction
		0	Inching 2 OFF	Drive brakes as quickly as possible if “Inching 2” was previously ON and, if n = 0, changes to “Operation enabled”

[5] Only dummy Bit, necessary for consistence to state machine. Drive must be powered before.

10	0x0400	1	Control from the automation unit	Control via interface, process data valid
		0	No control	No control, current process data are invalid.
11	0x0800	1	Start referencing edge	Not implemented
		0	Stop referencing	Not implemented
12-15	0x1000-0x8000		Device-specific	Not used

5.1.2 Status word for positioning operating mode

Table 5-2: Status word for positioning operating mode

Bit	Mask	Value	Meaning according to PROFIDRIVE	HIPERDRIVE description
0	0x0001	1	Ready to switch on	Supply voltage for PROFIBUS adaptor connected.
		0	Not ready to switch on	
1	0x0002	1	Ready	Motor supply voltage connected.
		0	Not ready	(No supply voltage)
2	0x0004	1	Operation enabled	Positioning operation enabled
		0	Operation inhibited	
3	0x0008	1	Error	Drive faulty and thus not operational, goes into the switch-on inhibit status after acknowledgement and successful error rectification. Error number in the error parameter.
		0	Error-free	
4	0x0010	1	No off 2	Function not implemented, bit always “1”
		0	Off 2	
5	0x0020	1	No off 3	Function not implemented, bit always “1”
		0	Off 3	
6	0x0040	1	Switch-on inhibit	Re-close only with “OFF 1” and then “ON”.
		0	No Switch-on inhibit	
7	0x0080	1	Warning	Drive still operational; warning in service parameter; no acknowledge
		0	No warning	
8	0x0100	1	No contouring error	The dynamic setpoint/actual position comparison is within the defined contouring error window.
		0	Contouring error	
9	0x0200	1	Control request	The automation system is requested to accept control (at present always “1”)
		0	Local operation	Currently not implemented
10	0x0400	1	Setpoint position reached	The actual position value is located in the positioning window at the end of the drive task
		0	Outside position reached	
11	0x0800	1	Reference point set	Function not implemented, bit always “1”
		0	No reference point set	
12	0x1000		Setpoint acknowledgement	The edge is used to acknowledge that a new drive task or setpoint has been accepted (same level as bit 6 in the control word).
13	0x2000	1	Drive stationary	Signals the conclusion of a drive task or standstill during intermediate stop and stop.
		0	Drive moving	Drive task is being executed, n<>0.
14	0x4000	1	Motor overcurrent	Motor blocked either CW or CCW (Copy of Or-ed status bits parameter number1009)
15	0x8000	1	Range limit violated	CW or CCW operating range limit violated (Copy of Or-ed status bit in parameter number 1009

Note on notation: In the following diagrams, the control and status information is given in hexadecimal form, always with 4 bits together being noted in descending order: **e.g. 2B30**$_{hex}$ **= 0010 1011 0011 0000 (bit 15…bit 0)**

5.1.3 Functional diagram of control mechanism, positioning operating mode

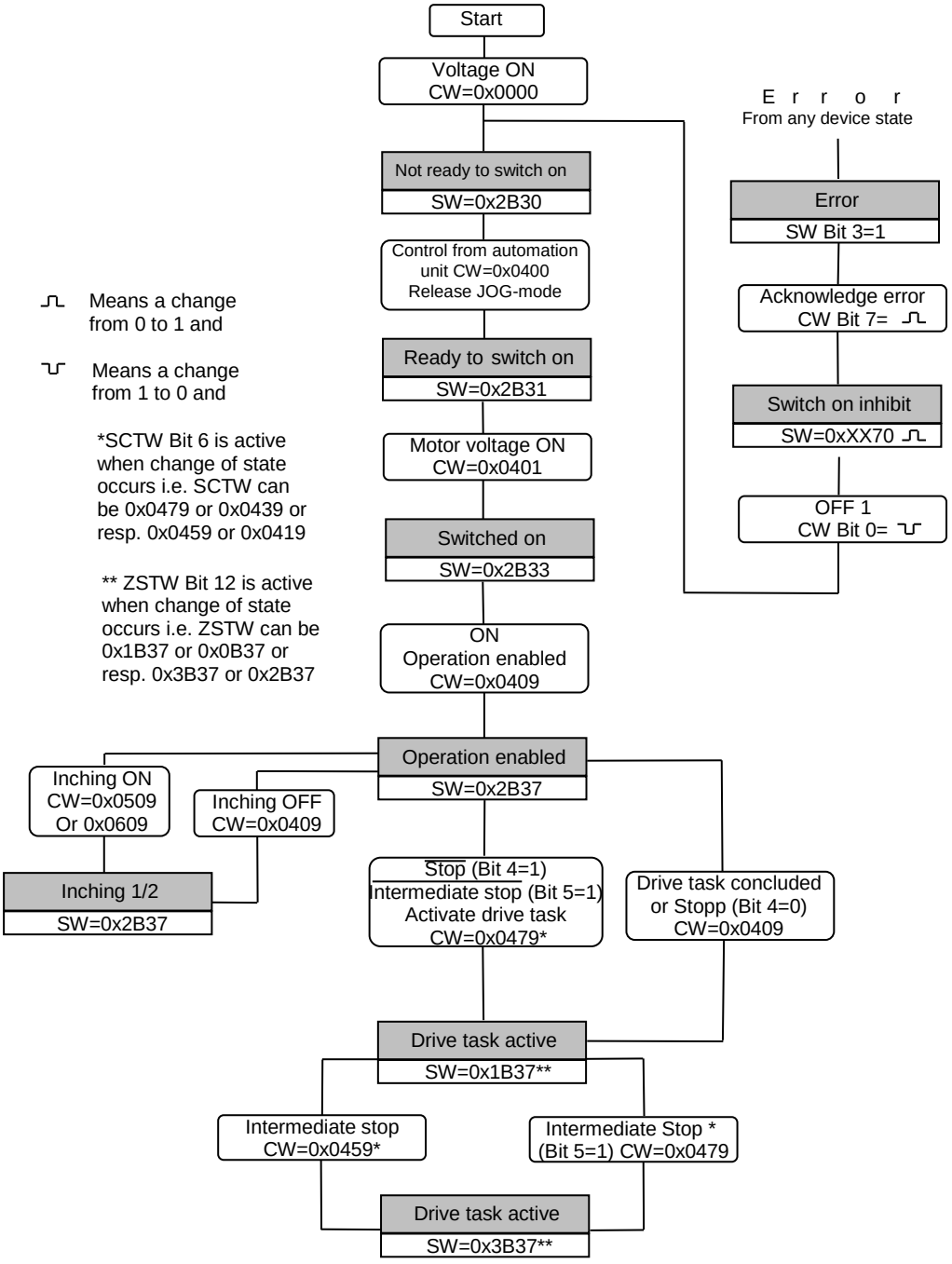


Figure 5-1: Functional diagram of control mechanism, positioning operating mode

5.2 Control mechanism for speed control operating mode

To activate speed control, set first the operating mode in parameter number 930 [$3A2_{hex}$].

5.2.1 Control word for speed control operating mode

Table 5-3: Control word for speed control operating mode

Bit	Mask	Value	Meaning according to PROFIDRIVE	HIPERDRIVE description
0	0x0001	1	ON	Motor supply voltage connected[6]
		0	OFF 1	Drive switched off
1	0x0002	1	Operating condition	Not implemented, must be set to 0
		0	OFF 2	
2	0x0004	1	Operating condition	Not implemented, must be set to 0
		0	OFF 3	
3	0x0008	1	Enable operation	Operation enabled
		0	Inhibit operation	Operation inhibited
4	0x0010	1	Operating condition	Not implemented, must be set to 0
		0	Inhibit ramp function generator	
5	0x0020	1	Enable ramp function generator	Not implemented, must be set to 0
		0	Stop ramp function generator	
6	0x0040	1	Enable setpoint	Setpoint is enabled, drive rotates at the specified speed
		0	Inhibit setpoint	Drive is stopped immediately.
7	0x0080	1	Acknowledge	Group signal is acknowledged with a positive edge; HIPERDRIVE receives a “RESET” command, and then changes to “Ready to switch on”
		0	No significance	No significance
8	0x0100	1	Inching 1 ON	Drive travels at inching setpoint 1 under speed control.
		0	Inching 1 OFF	Drive brakes as quickly as possible if “Inching 1” was previously ON and, if n = 0, changes to “Operation enabled”
9	0x0200	1	Inching 2 ON	Drive travels at inching setpoint 2 under speed control
		0	Inching 2 OFF	Drive brakes as quickly as possible if “Inching 2” was previously ON and, if n = 0, changes to “Operation enabled”
10	0x0400	1	Control from the automation unit	Control via interface, process data valid
		0	No control	No control, current process data are invalid.
11-15	0x0800-0x8000		Device-specific	Not used

[6] Only dummy bit, necessary for consistence to state machine. Drive must be powered before.

5.2.2 Status word for speed control operating mode

Table 5-4: Status word for speed control operating mode

Bit	Mask	Value	Meaning according to PROFIDRIVE	HIPERDRIVE description
0	0x0001	1	Ready to switch on	Supply voltage for PROFIBUS adaptor connected.
		0	Not ready to switch on	
1	0x0002	1	Ready	Motor supply voltage connected.
		0	Not ready	(No supply voltage)
2	0x0004	1	Operation enabled	Speed control operation enabled
		0	Operation inhibited	
3	0x0008	1	Error	Drive faulty and thus not operational, goes into the switch-on inhibit status after acknowledgement and successful error rectification. Error number in the error parameter.
		0	Error-free	
4	0x0010	1	No off 2	Function not implemented, bit always “1”
		0	Off 2	
5	0x0020	1	No off 3	Function not implemented, bit always “1”
		0	Off 3	
6	0x0040	1	Switch-on inhibit	Re-close only with “OFF 1” and then “ON”.
		0	No switch-on inhibit	
7	0x0080	1	Warning	Drive still operational; warning in service parameter; no acknowledge
		0	No warning	
8	0x0100	1	Setpoint/actual value monitoring in the tolerance range	Actual value within the defined tolerance range
		0	Setpoint/actual value monitoring outside the tolerance range	
9	0x0200	1	Control requested	Control by the automation system required (currently always “1”)
		0	Local operation	Currently not implemented
10	0x0400	1	f or n reached	Speed setpoint reached
		0	f or n not reached	Speed setpoint not reached
11-13	0x0800-0x2000		Device specific	Not used
14	0x4000	1	Motor overcurrent	Motor blocked either CW or CCW (Copy of Or-ed status bits parameter number1009)
15	0x8000	1	Range limit violated	CW or CCW operating range limit violated (Copy of Or-ed status bit in parameter number 1009

5.2.3 Functional diagram of control mechanism for speed control operating mode

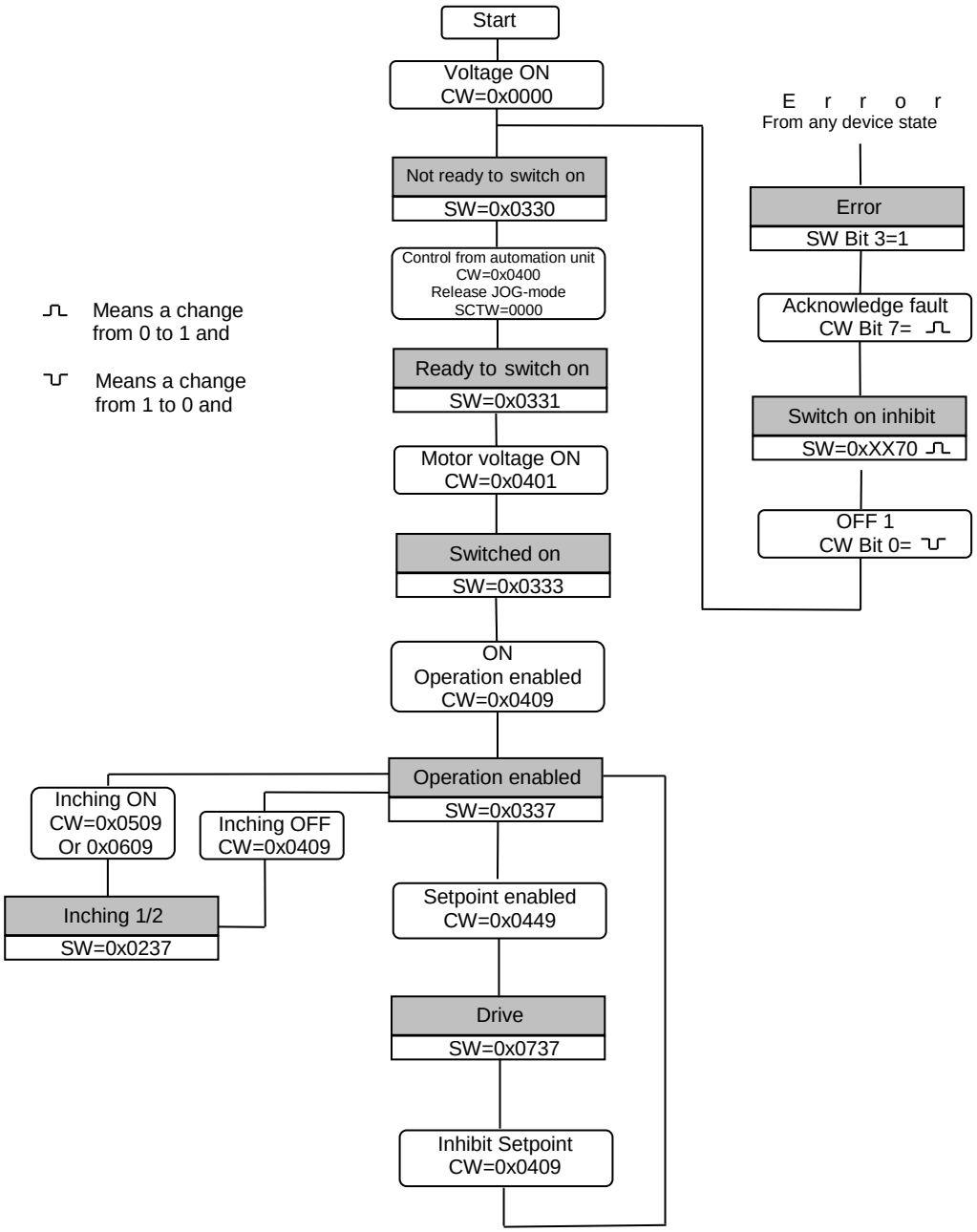


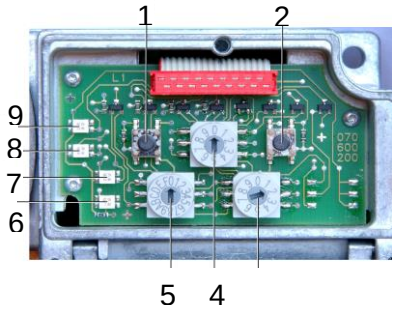
Figure 5-2: Functional diagram of control mechanism for speed control operating mode

6 JOG mode

6.1.1 Jog-button on the drive

There are two integral switches on the back of the drive to enable movement of the drives when the control is non-operational. This only requires the supply voltage to be applied and the required switch to be operated (JOG mode). This does not require the presence of control signals.
Once the drive, via the control word, receives the information that the control requires overall control (CW = 04 00_{hex}) the switches will be disabled (release JOG mode).

6.1.2 Using the Jog-button on the HIPERDRIVE Hub DP



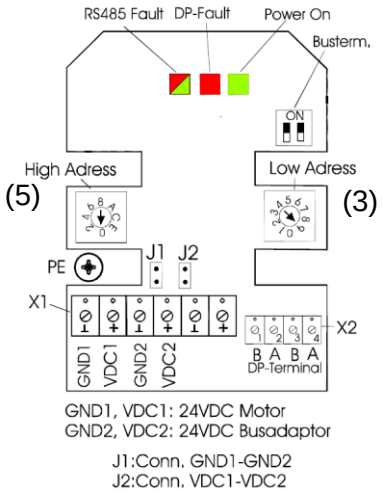
Button:
1 JOG - (counter-clockwise operation)
2 JOG + (clockwise operation)
rotary switch
3 Field bus slave address
4 Selection of the serial port (drive)
5 Field bus slave address
LED
6 Power On
7 DP-Fault
8 Diagnostic indicator
9 RS 485 Fault

Figure 6-1: Control-panel, HIPERDRIVE Hub-DP

- Set the field bus slave address to value 129. This enables the “manual controlled work mode”.
- Select the drive with the rotary switch 4 selection of the serial port (drive)
- Push the jog-button 1 for counter-clockwise operation or jog-button 2 for clockwise operation.
- The Jog-button on the back of the drive are in this mod usable too.

Danger, risk of injury: Don’t use the jog-button of the Hub and the Jog-button of the drive at the same time.

6.1.3 Using the Jog-button on the HIPERDRIVE



- Set the field bus slave address to value 129. This enables the “manual controlled work mode”.
- Use the Jog-button of the drive.

7 HIPERDRIVE parameter description

Please note that the guaranteed number of write-cycles to the internal E²PROM memory are physically limited to 1 million cycles. So please avoid continuos parameter write operation to the device.

New parameters can only be written into the HIPERDRIVE when the status word has the following value: $2B33_{hex}$ or $2B37_{hex}$. resp. 0333_{hex} or 0337_{hex}.

7.1 PROFIBUS address (parameter 918 [396_{hex}])

Data type: unsigned 16 bit, read-only.
Value range: 1…126
At this parameter number, the set PROFIBUS address can be read.

7.2 Operating mode (parameter 930 [$3A2_{hex}$])

Data type: unsigned 16 bit, read/write
This parameter is used to identify the operating mode. The HIPERDRIVE can be operated in two different modes:

- Operating mode = 1: speed control
- Operating mode = 2: positioning (Default value)

This parameter is stored in a nonvolatile memory. This means that after the supply voltage is connected, the parameter “operating mode” is prefilled with the default value 2 (positioning).

If the operating mode “speed control” is desired, this must be set by changing parameter 930 after the supply voltage has been connected.

7.3 Error buffer (parameter 945 [$3B1_{hex}$])

Data type: array [8], unsigned [16], read-only.
This parameter is defined as an array with 8 entries. Errors which occur are entered in this array with their error code. This error code can be read via the parameter number and the specification of the Sub-index.
The error codes are not saved and are lost after the supply voltage has been removed.
List of error codes:

Table 7-1: Error buffer (parameter number 945 [$3B1_{hex}$])

Error code	Meaning
8200_{hex}	Motor current or max. torque exceeded
8201_{hex}	Operating voltage below limit
8202_{hex}	Overtemperature
8203_{hex}	Dynamic position deviation
8300_{hex}	Drive blocked (direction CCW)
8301_{hex}	Drive blocked (direction CW)
8304_{hex}	Limit working area exceeded (CCW) – min. position
8305_{hex}	Limit working area exceeded (CW) – max. position
8401_{hex}	Internal error: EEPROM error
8410_{hex}	Internal error: position registration
8501_{hex}	Internal error: Invalid Value of parameter or process data.
8502_{hex}	Internal error: wrong command sequence
8601_{hex}	Timeout for communication drive – gateway

7.4 Number of errors (parameter 952 [3B8$_{hex}$])

Data type: unsigned 16 bit, read/write
With this parameter, the number of errors which have occurred can be read. The contents are not saved and are lost after the supply voltage has been removed.

If the value 0 is written to the parameter “Number of errors”, then the number of errors and the error codes registered are deleted.

7.5 Warning status of base device (parameter 953 [3B9$_{hex}$])

Warning status of base device according the configuration of PNU 1018. If there is no valid connection to base device, a reduced information {0x80.00} will indicated.

Bit	Explanation
00	Motor current or max. torque exceeded
01	Operating voltage below limit
02	Dynamic position deviation
03	Overtemperature, drive stops
04	Drive blocked (direction CCW)
05	Drive blocked (direction CW)
06	-- Not specified.
07	-- Not specified.
08	Limit working area exceeded (CCW) – min. position
09	Limit working area exceeded (CW) – max. position
10	-- Not specified.
11	Internal error: EEPROM error – correctable.
12	Internal error: EEPROM error – not correctable
13	Internal error: wrong command sequence
14	Invalid Value of parameter or process data.
15	Timeout for communication drive – gateway

7.6 Hardware configuration (parameter 961 [3C1$_{hex}$])

Data type: unsigned 16 Bit, read-only
Via this parameter, the hardware configuration of the HIPERDRIVE can be read, e.g. 0200$_{hex}$ means Version 2.00

7.7 Profile (parameter 965 [3C5$_{hex}$])

Data type: unsigned 16 Bit, read-only
This parameter indicates the version of the “variable-speed drives” profile. In the case of the HIPERDRIVE, this is 0200$_{hex}$ (Version 2.00).

7.8 CCW operating range limit (parameter 1000 [3E8$_{hex}$])

Data type: signed 32, read/write; also see chapter 4.2.1.1, section “position data mapping”
Maximum (= default) value for CCW operating range limit:
Negative value of absolute turns possible with the actual drive unit as written in the data sheet e.g.

HRA 08 / PSE 441:	-127 revolutions	(= 0xFF81 0000$_{hex}$)
HDA 30 / 45:	-512 revolutions	(= 0xFE00 0000$_{hex}$)
HDA 70:	-16000 revolutions	(= 0xC180 0000$_{hex}$)

The position limiting value for counter clockwise running (CCW) predefines the minimum position for the HIPERDRIVE. If the current position of the HIPERDRIVE is outside the

predefined limit, then a movement can be made only in the direction of the position limiting value.

Restrictions for setting the parameters:
The parameter “CCW operating range limit” must always be less than the parameter “CW operating range limit”.
A change in the value of “CCW operating range limit” beyond the limits of the parameters “CW operating range limit” will be rejected by the HIPERDRIVE.

If you set the range limit to the absolute limit written in the datasheet the error “Limit working area exceeded (CCW) – Minimum Position” can’t be detected. In this case the position is lost (roll-over).

7.9 CW operating range limit (parameter 1001 [$3E9_{hex}$])

Data type: signed 32, read/write
Maximum (= default) value for CW operating range limit:
Positive value of absolute turns possible with the actual drive unit as written in the data sheet e.g.

HRA 08 / PSE 441:	127 revolutions	(= 0x007F 0000_{hex})
HDA 30 / 45:	512 revolutions	(= 0x0200 0000_{hex})
HDA 70:	16000 revolutions	(= 0x3E80 0000_{hex})

The position limiting value for clockwise running predefines the maximum position for the HIPERDRIVE. If the current position of the HIPERDRIVE is outside the predefined limit, then a movement can be made only in the direction of the position limiting value.

Restrictions for setting the parameters:
The parameter “CW operating range limit” must always be more than the parameter “CCW operating range limit”.
A change in the value of “CW operating range limit” beyond the limits of the parameters “CCW operating range limit” will be rejected by the HIPERDRIVE.

If you set the range limit to the absolute limit written in the datasheet the error “Limit working area exceeded (CW) – maximum position” can’t be detected. In this case the position is lost (roll-over).

7.10 Speed limiting value (parameter 1002 [$3EA_{hex}$])

By using this parameter, the maximum possible travel speed of the HIPERDRIVE is predefined. The statement of the speed value in %, in the main setpoint for the HIPERDRIVE, relates to this parameter.
Value range[7]: 0 to maximum drive speed in rpm as written in the data sheet multiplied by factor 10, e.g.

HRA 08 / PSE 441:	only readable (= 800)
HDA 30 / 45:	5…350
HDA 70:	5…350

7.11 Save new position (parameter 1004 [$3EC_{hex}$])

Data type: signed 32, read/write.

[7] depending on scaling factors, here: default value

Default value: 00 00 00 00_{hex}
The current absolute position of the HIPERDRIVE can be overwritten with a new arbitrary value, in order to match the motor data to the plant-specific conditions. Writing a value to this parameter has the effect of accepting this value as the current absolute position for the HIPERDRIVE.
Value range: ± number of revolutions given in the data sheet of the corresponding drive unit, 65536 steps per revolution.

Restrictions for setting the parameter:
The value for the new position must lie only within the parameters “CW operating range limit” and “CCW operating range limit”. A change in the value beyond the limits of the parameters “CW operating range limit” or “CCW operating range limit” will be rejected by the HIPERDRIVE.

7.12 Inching 1, delta position (parameter 1005 [$3ED_{hex}$])

Data type: signed 32, read/write.
Default value: 00 01 00 00_{hex}
For the Inching 1 function, this parameter indicates a freely predefinable number of revolutions (delta) which are travelled per inching operation. This parameter value has a sign, i.e. the direction of rotation can be set via this parameter.
Value range: ± number of revolutions given in the data sheet of the corresponding drive unit, 65536 steps per revolution.

All inching parameters will not be saved in a non-volatile memory and are lost after the power supply voltage has been removed. At power-up, these parameter values are set to their default value.

Examples:
- Two revolutions in CW direction per inching operation: 00 02 00 00_{hex}
- Two revolutions in CCW direction per inching operation: FF FE 00 00_{hex}

7.13 Inching 1, rotational speed and max. torque (parameter 1006 [$3EE_{hex}$])

Data type: unsigned 16, read/write.
Default value: 64 64_{hex}
The maximum torque and the rotational speed are specified in %. The reference parameter for the torque is the nominal torque of the drive, the reference parameter for the speed is parameter 1002.

The percentage value for the speed is signed; a positive sign defines the CW direction of rotation.

Value range: max. torque = 0…100; speed = 0…±100
Example: max. torque = 100%; speed = 50%: 64_{hex} 32_{hex}

7.14 Inching 2, delta position (parameter 1007 [$3EF_{hex}$])

Data type: signed 32, read/write.
Default value: FF FF 00 00_{hex}
For the Inching 2 function, this parameter indicates a freely predefinable number of revolutions (delta) which are travelled per inching operation.

7.15 Inching 2, rotational speed and max. torque (parameter 1008 [$3F0_{hex}$])

Data type: unsigned 16, read/write.

Default value: 64 64_{hex}
The maximum torque and the rotational speed are specified in %.

7.16 HIPERDRIVE error status bits (parameter 1009 [$3F1_{hex}$])

Data type: unsigned 16, read-only.
This parameter represents the error status bits of the HIPERDRIVE.

Table 7-2: HIPERDRIVE error status bits

Bit	Meaning
0	Motor current or max. torque exceeded
1	Operating voltage below limit
2	Dynamic position deviation
3	Overtemperature
4	Drive blocked (direction CCW)
5	Drive blocked (direction CW)
6	Reserved
7	Reserved
8	Limit working area exceeded (CCW) – min. position
9	Limit working area exceeded (CW) – max. position
10	Internal error: position registration
11	Reserved
12	Internal error: EEPROM error
13	Internal error: wrong command sequence
14	Invalid value of parameter or process data.
15	Timeout for communication drive – gateway

7.17 HIPERDRIVE status bits (parameter 1010 [$3F2_{hex}$])

Data type: unsigned 16, read-only.
This parameter represents the internal status bit of the HIPERDRIVE.

Table 7-3: HIPERDRIVE status bits

Bit	Meaning
0	Reserved
1	Speed mode ready. This bit is “0” when the HIPERDRIVE is in the speed mode.
2	Position mode ready. This bit is “0” when the HIPERDRIVE is in the position mode.
3	Reserved
4	Reserved
5	Bit becomes “0”, when the end position is reached. In speed mode, this bit is not relevant.
6	Bit becomes “1” when speed mode is active, that is to say travel movement Running
7	Position mode active, that is to say travel movement running. Bit is “1”, until the end position is reached.
8	Reserved
9	Bit is “1”, if the JOG mode is active, i.e. drive can be moved via built-in JOG switches.
10-15	Reserved

In the event that there is no data connection with the base unit, e.g. no operating voltage or data line is faulty, error code 17, “Job cannot be executed because of operating status”, is returned (see also table 4-18: “Parameter word error numbers in response”).

7.18 DP diagnosis (parameter 1011 [$3F3_{hex}$])

Data type: unsigned 16, read/write.
Default value: 00 00_{hex}

Table 7-4: DP-diagnostics

Value	Meaning
00 00_{hex}	Diagnostic message OFF (default value after power-on).
00 01_{hex}	Diagnostic message ON

With this parameter, the exchange of device-specific external diagnostic data can be enabled and disabled, respectively. If the routine is activated, 2 bytes of device-specific diagnostic data (Ext_Diag_Data) are read from the slave. For further information on this see chapter 4.1.2 “Diagnostic data”). This parameter may have to be reset after power-on.

7.19 Watchdog timeout for base unit communication (parameter 1013 [$3F5_{hex}$])

Data type: unsigned 16, read/write.
Default value: 00 FF_{hex} (disabled)
Value range: 00 01_{hex} (1)…00 64_{hex} (100) x seconds; 00 FF_{hex} (255) → watchdog inactive
This parameter defines the time after which the HIPERDRIVE cancels a running motion by implementing a self-generated RESET command when there is no communication between HIPERDRIVE and gateway.

7.20 Scaling “position values” (parameter 1015 [$3F7_{hex}$])

Scaling value to all attributes, associated to 'positioning'. – Numbers {1000, 1001, 1004}.
specification is {mm.mm.dd.dd }:
mm.mm = multiplier. Default: 01 00_{hex}
dd.dd = divisor. Default 00 01_{hex}

7.21 Scaling “speed values” (parameter 1016 [$3F8_{hex}$])

Scaling speed value.
specification is {mm.mm.dd.dd }:
mm.mm = multiplier. Default: 00 $0A_{hex}$
dd.dd = divisor. Default 00 01_{hex}

Position and velocity scaling is not implemented in HRA 08 / PSE 441 (see chapter 7.22)!

7.22 Position and velocity scaling, functionality

Some drives of the HIPERDRIVE product family support a scaling function of both, position & velocity. Both parameters are implemented as 32 Bit values consisting of a signed multiplier (High word) and an unsigned divider (low word).
The position factor refers to an internal resolution of [8 Bit/turn]; the velocity factor refers to [rpm].
The result of the scaling must be within
[± 31 Bit] for the position value, and
[± 15 Bit] for the velocity value
The factory settings are:
position factor: 256
velocity factor: 10

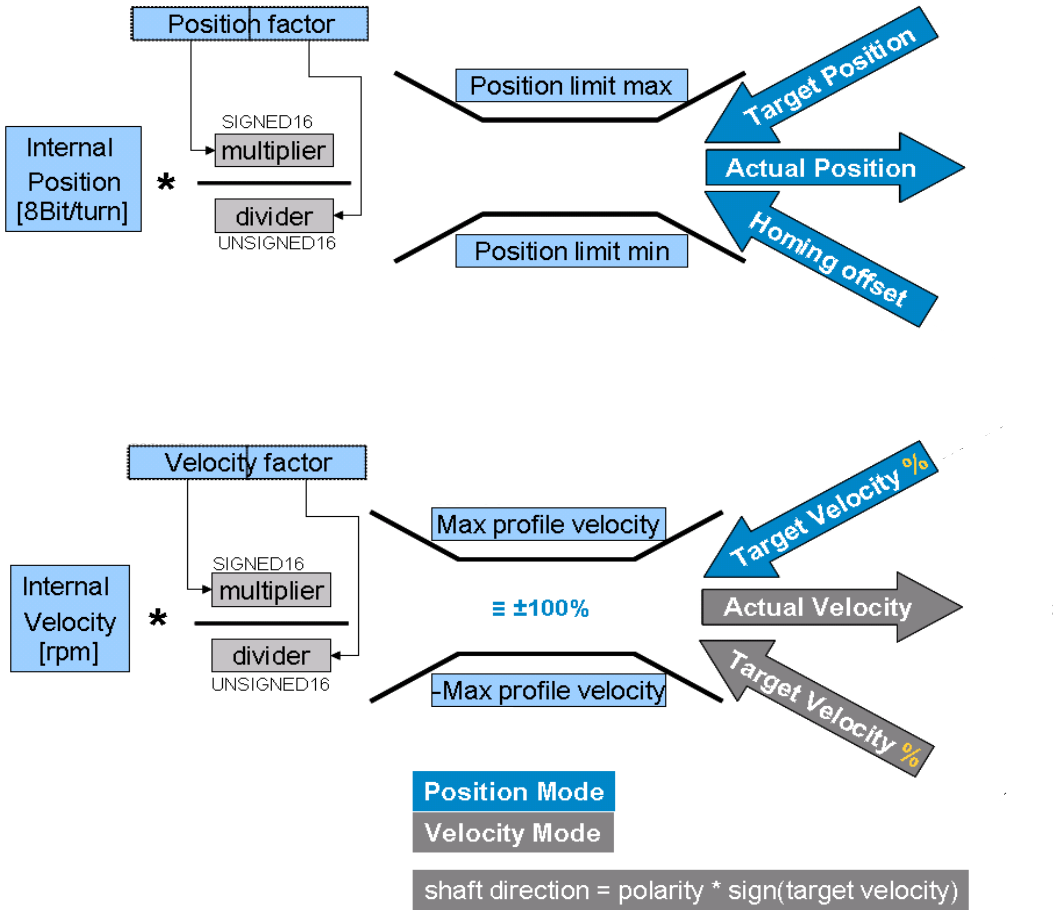


Figure 7-1: Position and velocity scaling

7.23 Error Configuration (parameter 1018 [3FA$_{hex}$])

This parameter defines the behaviour of error or warning indication. There is the possibilities to show a failure indication as a 'warning' or as an 'error'.
There are two possibilities to show an error/warning indication:
(1) Error: shown in parameter number 1009.
(2) Warning: shown in parameter 953.

An error, means a severe failure. There is generated an entry into the error stack. Also you have to acknowledge this situation by activating a specific Bit of the process data.
A warning, means an unimportant failure. There is no need for further actions to continue in process. The error stack is not influenced. The warning status disappears when the warning is no more present.
Each bit of this parameter defines the corresponding status of the parameters 1009/953.
Setting bit to 'zero': Failure is shown as a warning.
Setting bit to 'one': Failure is shown as an error.

Table 7-5: Error configuration

Bit-No.	Explanation	Shown as warning PNU 953	Shown as error PNU 1009
00	Motor current or max. torque exceeded	(val = 0)	(val = 1)
01	Operating voltage below limit	(val = 0)	(val = 1)
02	Dynamic position deviation	(val = 0)	(val = 1)
03	Overtemperature	(val = 0)	(val = 1)
04	Drive blocked (direction CCW)	(val = 0)	(val = 1)
05	Drive blocked (direction CW)	(val = 0)	(val = 1)
06	-- Not specified.	---	---
07	-- Not specified.	---	---
08[8]	Limit working area exceeded (CCW) – min. position	(val = 0/1)	(val = 1)
09[8]	Limit working area exceeded (CW) – max. position	(val = 0/1)	(val = 1)
10:	Internal error: position registration	---	(val = 0/1)
11	Internal error: EEPROM error – correctable.	(val = 0/1)	---
12	Internal error: EEPROM error – not correctable.	(val = 0)	(val = 1)
13	Internal error: wrong command sequence	(val = 0)	(val = 1)
14	Invalid value of parameter or process data.	(val = 0/1)	---
15[9]	Timeout for communication drive – gateway	X	X

The default setting is: $973F_{hex}$ (subject to alterations)

7.24 Reset operating parameters to factory default values (parameter 1019 [$3FB_{hex}$])

Data type: Data unsigned 16, write only
Via a write procedure to this parameter, all variable parameters are set to factory default values. The value of the written data is without any meaning.

Please note that this service takes approx. 400 msec execution time. During this time no further command can be executed.

List of parameters which are set to their default value:
- CCW operating range limit (parameter number 1000 [$3E8_{hex}$])
- CW operating range limit (parameter number 1001 [$3E9_{hex}$])
- Scaling “position values” (parameter number 1015 [$3F7_{hex}$])
- Scaling “speed values” (parameter number 1016 [$3F8_{hex}$])
- Speed limiting value (parameter number 1002 [$3EA_{hex}$])

7.25 Item number of the bus gateway (parameter 1020 [$3FC_{hex}$])

Data type: array [3], unsigned 32, read-only
Via this parameter, the item number of the bus gateway can be read. The item number is composed of a total of 12 bytes and is stored in an array [3] with sub-index 0 to subindex 2.

[8] This type of error/warning is shown in addition as a warning (independent the configuration), if drive is in standstill or moving from outside the boundary towards work area.
[9] This type of error/warning is shown as a warning or an error. The definition is not configurable. If there is no drive task active (positioning or velocity mode) the Hub shows a warning. If there is a drive task active, the Hub shows a fault.

Table 7-6: Item number of the bus gateway

Octet 1											Octet 12
MSB			LSB	MSB			LSB	MSB			LSB
Sub-Index 0				Sub-Index 1				Sub-Index 2			

The characters should be considered as ASCII encoded byte by byte. Example:

Table 7-7: Example to table 6-6

Octet 1											Octet 12
32_{hex}	35_{hex}	37_{hex}	$4F_{hex}$	50_{hex}	31_{hex}	31_{hex}	41_{hex}	53_{hex}	32_{hex}	30_{hex}	31_{hex}
“2”	“5”	“7”	“O”	“P”	“1”	“1”	“A”	“S”	“2”	“0”	“1”

7.26 Serial number of the bus gateway (parameter 1021 [$3FD_{hex}$])

Serial number Data type: array [2], unsigned 32, read-only
This parameter contains the serial number of the bus gateway. The serial number is composed of a total of 8 bytes and is stored in an array [2] with sub-index 0 to sub-index 1.

Table 7-8: Serial number of the bus gateway

Octet 1							Octet 8
MSB			LSB	MSB			LSB
Sub-Index 0				Sub-Index 1			

The characters should be considered as ASCII encoded byte by byte. Example:

Table 7-9: Example to table 6-8

Octet 1							Octet 8
30_{hex}	30_{hex}	30_{hex}	30_{hex}	30_{hex}	30_{hex}	32_{hex}	31_{hex}
“0”	“0”	“0”	“0”	“0”	“0”	“2”	“1”

7.27 Production date of the bus gateway (parameter 1022 [$3FE_{hex}$])

Data type: array [2], unsigned 32, read-only
The production date of the bus gateway is composed of a total of 8 bytes and is stored in an array [2] with sub-index 0 to sub-index 1

Table 7-10: Production date of the bus gateway

Octet 1							Octet 8
MSB			LSB	MSB			LSB
Sub-Index 0				Sub-Index 1			

The characters should be considered as ASCII encoded byte by byte. Example:

Table 7-11: Example to table 6-10

Octet 1							Octet 8
30_{hex}	30_{hex}	30_{hex}	30_{hex}	30_{hex}	37_{hex}	30_{hex}	35_{hex}
“0”	“0”	“0”	“0”	“0”	“7”	“0”	“5”
No meaning				07.05 (calendar week 05/year 2007)			

7.28 Software version of the bus gateway (parameter 1023 [3FF$_{hex}$])

Data type: array [3], unsigned 32, read-only
The number of the software version of the bus gateway comprises a total of 12 bytes, which are stored in an array [3] with sub-index 0 to sub-index 2.

Table 7-12: Software version of the bus gateway

Octet 1											Octet 12
MSB			LSB	MSB			LSB	MSB			LSB
Sub-Index 0				Sub-Index 1				Sub-Index 2			

The characters should be considered as ASCII encoded byte by byte. Example:

Table 7-13: Example to table 6-12

Octet 1											Octet 12
53$_{hex}$	57$_{hex}$	2E$_{hex}$	5F$_{hex}$	52$_{hex}$	45$_{hex}$	56$_{hex}$	5F$_{hex}$	31$_{hex}$	2E$_{hex}$	32$_{hex}$	30$_{hex}$
“S”	“W”	“.”	“_”	“R”	“E”	“V”	“_”	“1”	“.”	“2”	“0”

7.29 Nominal voltage of the HIPERDRIVE (parameter 1030 [406$_{hex}$])

Data type: unsigned 32, read-only
Via this parameter, the nominal value of the supply voltage of the HIPERDRIVE can be read.
The characters should be considered as ASCII encoded byte by byte. Example:

Table 7-14: Nominal voltage of the HIPERDRIVE

Octet 1			Octet 4
30$_{hex}$	30$_{hex}$	32$_{hex}$	34$_{hex}$
“0”	“0”	“2”	“4”
0024 → 24 V			

7.30 Nominal current of the HIPERDRIVE (parameter 1031 [407$_{hex}$])

Data type: unsigned 32, read-only
Via this parameter, the nominal value of the supply current of the HIPERDRIVE can be read.
The characters should be considered as ASCII encoded byte by byte. See the related datasheet. Example:

Table 7-15: Nominal current of the HIPERDRIVE

Octet 1			Octet 4
30$_{hex}$	30$_{hex}$	34$_{hex}$	38$_{hex}$
“0”	“0”	“4”	“8”
48 → 4.8 A			

7.31 Nominal torque of the HIPERDRIVE (parameter 1032 [408$_{hex}$])

Data type: unsigned 32, read-only
Via this parameter, the nominal value of the torque of the HIPERDRIVE can be read.
The characters should be considered as ASCII encoded byte by byte. If the Value is e.g.:
1.2 Nm “A” is written to Octet 1, showing, that the value must divided by 10. Example:

Table 7-16: Nominal torque of the HIPERDRIVE

Octet 1			Octet 4
30_{hex}	30_{hex}	31_{hex}	35_{hex}
"0"	"0"	"1"	"5"
0015 → 15 Nm			
Octet 1			Octet 4
41_{hex}	30_{hex}	31_{hex}	32_{hex}
"A"	"0"	"1"	"2"
0015 → 1.2 Nm			

7.32 Nominal speed of the HIPERDRIVE (parameter 1033) [409_{hex}])

Data type: unsigned 32, read-only
Via this parameter, the nominal value of the speed of the HIPERDRIVE can be read.
The characters should be considered as ASCII encoded byte by byte. Example:

Table 7-17: Nominal speed of the HIPERDRIVE

Octet 1			Octet 4
30_{hex}	30_{hex}	32_{hex}	37_{hex}
"0"	"0"	"2"	"7"
0027 → 27 revolutions per minute			

7.33 Item number of the HIPERDRIVE (parameter 1035 [$40B_{hex}$])

Data type: array [3], unsigned 32, read-only
Via this parameter, the item number of the HIPERDRIVE can be read. The item number is composed of a total of 12 bytes and is stored in an array [3] with sub-index 0 to subindex 2.

Table 7-18: Item number of the HIPERDRIVE

Octet 1											Octet 12
MSB			LSB	MSB			LSB	MSB			LSB
Sub-Index 0				Sub-Index 1				Sub-Index 2			

The characters should be considered as ASCII encoded byte by byte. Example:

Table 7-19: Example to table 6-18

Octet 1											Octet 12
32_{hex}	35_{hex}	37_{hex}	$4F_{hex}$	50_{hex}	31_{hex}	31_{hex}	41_{hex}	53_{hex}	32_{hex}	30_{hex}	31_{hex}
"2"	"5"	"7"	"O"	"P"	"1"	"1"	"A"	"S"	"2"	"0"	"1"

7.34 Serial number of the HIPERDRIVE (parameter 1036 [$40C_{hex}$])

Serial number Data type: array [2], unsigned 32, read-only
This parameter contains the serial number of the the basic drive unit. The serial number is composed of a total of 8 bytes and is stored in an array [2] with sub-index 0 to sub-index 1.

Table 7-20: Serial number of the HIPERDRIVE

Octet 1							Octet 8
MSB			LSB	MSB			LSB
Sub-Index 0				Sub-Index 1			

The characters should be considered as ASCII encoded byte by byte. Example:

Table 7-21: Example to the HIPERDRIVE serial number

Octet 1							Octet 8
30_{hex}	30_{hex}	30_{hex}	30_{hex}	30_{hex}	30_{hex}	32_{hex}	31_{hex}
“0”	“0”	“0”	“0”	“0”	“0”	“2”	“1”

7.35 Production date of the HIPERDRIVE (parameter 1037 [$40D_{hex}$])

Data type: array [2], unsigned 32, read-only
The production date of the basic drive unit is composed of a total of 8 bytes and is stored in an array [2] with sub-index 0 to sub-index 1.

Table 7-22: Production date of the HIPERDRIVE

Octet 1							Octet 8
MSB			LSB	MSB			LSB
Sub-Index 0				Sub-Index 1			

The characters should be considered as ASCII encoded byte by byte. Example:

Table 7-23: Example to table 6-22

Octet 1							Octet 8
30_{hex}	30_{hex}	30_{hex}	30_{hex}	30_{hex}	37_{hex}	30_{hex}	35_{hex}
“0”	“0”	“0”	“0”	“0”	“7”	“0”	“5”
no meaning				07.05 (calendar week 05/year 2007)			

7.36 Software version of the HIPERDRIVE (parameter 1038 [$40E_{hex}$])

Data type: array [3], unsigned 32, read-only
The number of the software version of the basic drive unit comprises a total of 12 bytes, which are stored in an array [3] with sub-index 0 to sub-index 2.

Table 7-24: Software version of the HIPERDRIVE

Octet 1											Octet 12
MSB			LSB	MSB			LSB	MSB			LSB
Sub-Index 0				Sub-Index 1				Sub-Index 2			

The characters should be considered as ASCII encoded byte by byte. Example:

Table 7-25: Example to table 6-24

Octet 1											Octet 12
53_{hex}	57_{hex}	$2E_{hex}$	$5F_{hex}$	52_{hex}	45_{hex}	56_{hex}	$5F_{hex}$	31_{hex}	$2E_{hex}$	32_{hex}	30_{hex}
“S”	“W”	“.”	“_”	“R”	“E”	“V”	“_”	“1”	“.”	“2”	“0”

7.37 BusCfgControlNode (parameter 1090 [442_{hex}])

Read/write
Reset complete Bus-IF Adapter (**Software Reset!**).
Simulates a Re-Start. Takes current EEPROM configuration.
Value only 0x1D

7.38 Reset to HD base device (parameter 1091 [443_{hex}])

'Reset' service (Software Reset) to HD base device. Simulates a Re-Start. Takes current EEPROM configuration. Service is used to validate parameters, which needs a restart for update. Read service: returns value zero (0).

7.39 Ident Prod (parameter 1092 [444_{hex}])

Meaning: DP-Ident-Number
Value: STEGxxxx

7.40 Ident ModulType (parameter 1093 [445_{hex}])

Meaning: Adapter Modul Type (Hardware Layout).
Value: {0, 1, 2}, Single (1), Multi (2)

7.41 Ident NumCfgStage (parameter 1094 [446_{hex}])

Meaning: Size of configuration stage (number of slave units supported by the gateway).
Value: {1…8}, 8

7.42 Ident NetProtBaudr (parameter 1095 [447_{hex}])

Protocol specification to RS 485 network.
Meaning: Bit_7…4: Protocol selection.
Value: {0…7}, 0
Meaning: Bit_3…0: Baudrate selection.
Value: {1…3}, 1

7.43 IdentModulFailStatus (parameter 1096 [448_{hex}])

Flag shows Failure Status of Adapter Modul.
Meaning: Bit_15-8: - -
Meaning: Bit_7: number of connected units > configuration stage.
Meaning: Bit_6…2: - -
Meaning: Bit_1: faulted “EEPROM_Save” operation (write).
Meaning: Bit_0: faulted “EEPROM_Restore” operation (read).
Set the field bus slave address to value 129. This enables the “manual controlled work mode”. Than you can use the Jog-button on the back of the drive

8 Tables

8.1 Parameters

Table 8-1: List of parameters

Parameter number [DEC]	Meaning	Data type	Access
918	PROFIBUS address	Unsigned 16	R
930	Operating mode	Unsigned 16	R/W
945	Error buffer	Array [8] Unsigned 16	R
952	Number of errors	Unsigned 16	R/W
953	Error/warning status of base device	Unsigned 16	R
961	Hardware configuration	Unsigned 16	R
965	Profile number	Octet-String 2	R
1000	CCW operating range limit	Signed 32	R/W
1001	CW operating range limit	Signed 32	R/W
1002	Speed limiting value	Unsigned 16	R/W
1003	Maximum torque	Unsigned 16	R/W
1004	Save new position	Signed 32	R/W
1005	Inching 1: delta position	Signed 32	R/W
1006	Inching 1: speed, max. torque	Unsigned 16	R/W
1007	Inching 2: delta position	Signed 32	R/W
1008	Inching 2: speed, max torque	Unsigned 16	R/W
1009	HIPERDRIVE status bits	Unsigned 16	R
1010	HIPERDRIVE status information	Unsigned 16	R
1011	DP-diagnostics	Unsigned 16	R/W
1013	Watchdog timeout for base unit	Unsigned 16	R/W
1015	Scaling “position values” (not for HRA 08 / PSE 441)	Signed 32 (see chapter 7.22)	R/W
1016	Scaling “speed values” (not for HRA 08 / PSE 441)	Signed 32 (see chapter 7.22)	R/W
1018	Error configuration	Unsigned 16	R/W
1019	Reset parameters to default values	Unsigned 16	W
1020	Item number of the bus gateway	Array[3] Unsigned 32	R
1021	Serial number of the bus gateway	Array[2] Unsigned 32	R
1022	Production date of the bus gateway	Array[2] Unsigned 32	R
1023	Software version of the bus gateway	Array[3] Unsigned 32	R
1030	Nominal voltage of the HIPERDRIVE	Unsigned 32	R
1031	Nominal current of the HIPERDRIVE	Unsigned 32	R
1032	Nominal torque of the HIPERDRIVE	Unsigned 32	R
1033	Nominal speed of the HIPERDRIVE	Unsigned 32	R
1035	Item number of the HIPERDRIVE	Array[3] Unsigned 32	R
1036	Serial number of the drive	Array[2] Unsigned 32	R
1037	Production date of the drive	Array[2] Unsigned 32	R
1038	Software version of the drive	Array[3] Unsigned 32	R
1090	BusCfgControlNode; Software reset, Value only 0x1D	Unsigned 16	R/W
1091	Reset to HD base device	Unsigned 16	R/W
1092	Ident ProdNumber	Unsigned 16	R
1093	Ident ModulType	Unsigned 16	R
1094	Ident NumCfgStage	Unsigned 16	R/W
1095	Ident NetProtBaudr	Unsigned 16	R/W
1096	IdentModulFailStatus	Unsigned 16	R

8.2 Baud rates supported

HIPERDRIVE supports the following baud rates:
9.6 kBd, 19.2 kBd, 93.75 kBd, 187.5 kBd, 500 kBd, 1.5 Mbd, 3 Mbd, 6 Mbd, 12 MBd.

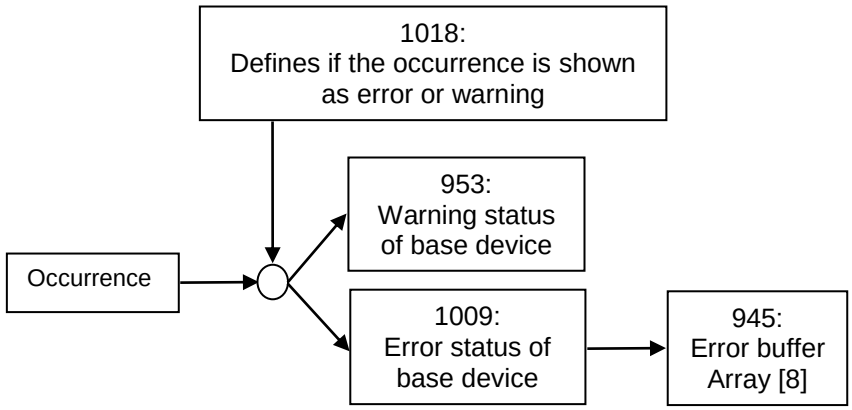
8.3 List of abbreviations

AK	Task or response ID (for encoding, see tables 4-16 and 4-17)
GSD	General Station Description
HIW	Main actual value
HSW	Main set value
IND	Index
LSB	Least Significant Bit/Byte
MSB	Most Significant Bit/Byte
PKE	Parameter ID
PKW	Parameter data frame/area
PNU	Parameter number
Pos-act	Position, actual value
Pos-min	Position minimum
PPO	Process parameter data object
PWE	Parameter-value
PZD	Process data frame/area
SPM	Toggle bit for instantaneous message
CW	Control word
v-act	Speed, actual value
v-max	Maximum speed
SW	Status word

9 LED status and error handling

An error condition, which can include one or more error messages, leads to the drive stopping. In order to store the error messages, an error buffer is defined. The number of errors is stored in parameter 952. If this is reset to “0”, then the entire error buffer is deleted.
An error condition has been cleared when all the errors that are present have been eliminated and the error has been acknowledged. Acknowledgement is implemented via an edge change in bit 7 in the control word. The error buffer can be read out by means of an increasing Sub-index.

Error/warning parameter and their meaning:



9.1 In general

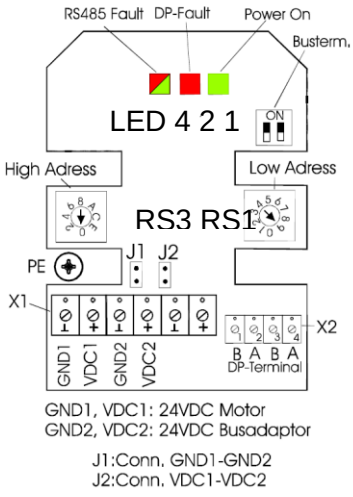
Check cabling[10].
Check the voltage of the power supply.
Please ensure that a termination is present at each end of the PROFIBUS line.
Check the required address on the PROFIBUS DP in accordance with your plant project engineering. Please note that a change in the switch position becomes effective only after the voltage supply has been switched off and on again.
Look at the LED status and check the application according to the table in chapter 9.2.
If the bus-communication works, read out the error and check the application according to the table in chapter 9.3.
Check your system by means of the diagnostic software of your bus master.
If you need support, please answer the following Questions.

Please describe the symptoms of the error.
Which drive is used? HDA 70, PSE 441, …
Was the drive once working properly? If so, what has changed.
How is the status of the LED?
Is the drive running using the jog-button?
Do the drive have Communication with the master?
What error bit are set?
How is the proceeding, especially describe the start up sequence?
Can you create a trace/log-file of the bus communication?

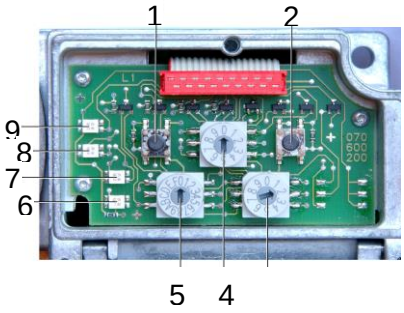
[10] The electronics of the bus gateway can optionally be fed via separate connection points (X1: VDC2, GND2) or wired to the motor supply (X1: VDC1, GND1) via the jumpers J1 and J2 in the adapter.

9.2 Status indicates by LED

9.2.1 In general



Note: LED 3 and RS 2 are not available in de single



Button:
1 JOG - (J1) (counter-clockwise operation)
2 JOG + (J2) Rotary switch
(clockwise operation)
3 Field bus slave address (RS1) (low)
4 Selection of the serial port (drive) (RS2)
5 Field bus slave address (RS3) (high) LED
6 Power On (LED 1)
7 DP-Fault (LED 2)
8 Diagnostic indicator (LED 3)
9 RS 485 fault (LED 4)

9.2.2 Power-on LED 1

LED	Status	Indicates	Action
Off	Not powered	No power to device	Check cabling
			Check the voltage of the power supply
			Check the max. current of the power supply

9.2.3 DP-error (status) LED 2

LED	Status	Indicates	Action
Off	Not powered Not on-line	No power to device No DP functionality stablished.	Check the power-supply
			Check cabling (especially the polarity)
Flashing green	Ready for cyclic communication	DPC initialized, but NO cyclic communication established. – Ready for configuration data from master.	Check cable connection
			Check configuration settings within master
			Start master
Steady green	Online	Valid cyclic communication (data exchange) between master and slave.	No action is needed.
Flashing red	Communication error	DPC initialized. Faulty configuration telegram. (SET_PRM, CHK_CFG).	Check cable connection
			Check address setting
			Check master configuration
Steady red	Communication error	Aborted or faulty cyclic data exchange mode. (TimeOut, wrong data frame). Master starts reconfiguration.	Check cable connection
			Check configuration settings within master.
			Start master.

9.2.4 RS 485 drive error LED 4 and diagnostic Indicator LED 3

LED 3	LED 4	Status	Indicates	Action
X	Off	x	No connected unit is selected	
	Flashing green or flashing red		Self-test period (approx. 1 sec. after power on)	No action is needed.
	Steady green	Communication of the selected drive is ok	Connections are established	No action is needed.
	Steady orange	Error of the selected drive	Drive indicates an error, the communication is ok	Error acknowledge, check the status of the drive.
	Steady red	Communication error of the selected drive	No response of the drive	Power on drive, check cabling, check the voltage of the power supply
Green	x	No error	Connections to all drives are error and warning free	none
Flashing green	x	Warning of one or more drive	One of the connected drive reports a warning	Check the status of the drive
Flashing green-orange	x	Only if Jog-mode selected	The drives can be selected with rotary switch RS2 and moved in Jog Mode	none
Orange	x	Error of one or more drive	One of the connected drive reports an error	Error acknowledge, check the status of the drive
Flashing orange	x	Only if jog-mode selected	Valid selection of one drive and activation by push-button to start moving	Select the correct drive
Flashing red-orange	x	Only if Jog-mode selected	Invalid action, e.g. press more than one button at the same time, …	
Red	x	Error	Hardware failure	Check cabling, check the voltage of the power supply, check the max current of the power supply
Flashing red	x	Error of one or more drive connections	No connection to at least one connected drive	With switch RS2 {1 .. 8}, the “delinquent” drive can be selected
Flashing green	Off	Error of one or more drive	No connected unit is selected	With switch RS2, the drive causing this error message can be selected
	Green	Error of one or more drive	One of the not selected drive reports error or warning	With switch RS2, the drive causing this error message can be selected
	Orange	Error of one or more drive	The selected drive reports error or warning	Error acknowledge, check the status of the drive
Flashing green-orange	Green	Only if Jog-mode selected	Valid selection of one drive with the switches RS2 and the selected drive is reporting no error	
Flashing green-orange	Orange	Only if jog-mode selected drive error	Valid selection of one drive with the switches RS2 and the selected drive is reporting an error	
Flashing green-orange	red	Only if Jog-mode selected Drive error	The connection to the selected drive is faulty	
Flashing red	Off	Error of one or more drive connections	No drive is selected	With switch RS2, the drive causing this error message can be selected
	Green	Error of one or more drive connections	One of the not selected drive reports error or warning	With switch RS2, the drive causing this error message can be selected
	Orange	Error of one or	Connection with the selected	Error acknowledge, check

		more drive connections	drive is OK, but the drive reports an error	the status of the drive.
	Red	Error of one or more drive connections	Connection with the selected drive is faulty.	Check cabling, check the voltage of the power supply, check the max current of the power supply

Note: check at first LED 3, if an error or warning is signed, search for the drive using RS2 and the state of LED 4.

9.3 Error handling

9.3.1 Status indicates by "HIPERDRIVE warning/error information"

Bit	Status	Description	Action
0	Motor current or max. torque exceeded	Load is over limit, or the drive is defect, the drive stops	Check if the load is over limit or the drive is blocked.
			Compare the torque of the application with the maximum torque of the drive
1	Operating voltage below limit	Voltage of the drive is below limit, the drive stops	Check the voltage of the power supply.
			Check the power supply for voltage drop.
			Check the max current of the power supply.
			Check the cabling (regarding to length, diameter and damage)
2	Dynamic position deviation	The drive loses steps (only HRA 08/PSE 441) The drive stops	Compare the torque of the application with the maximum torque of the drive
3	Overtemperature	Temperature of the drive-electronic is over limit, the drive stops	Decrease the period of operation
			Check the ambient temperature.
			Improve the cooling.
4	Drive blocked (direction CCW)	The drive is blocked in direction CCW, the drive stops, rotation in CW direction is possible	Check if the load is over limit or the drive is blocked.
			Compare the torque of the application with the maximum torque of the drive
5	Drive blocked (direction CW)	The drive is blocked in direction CW, the drive stops, rotation in CCW direction possible	Check if the load is over limit or the drive is blocked.
			Compare the torque of the application with the maximum torque of the drive
8	Limit working area exceeded (CCW) - min. position	Position out of limit. Lost of the position is possible (roll-over) if the limit in parameter 1000 is set to the absolute limit written in the catalog excerpt / data sheet	Check the readout position, compared with the mechanical position.
			Check the limits and change them.
			Set the position into the Limit.
			Drive the drive into inside the allowed range.
			Check your application, if you drive in Velocity mode with ignoring the limits (MC_MoveVelocity, setting the parameter PosLimits)
			Check your application, if the load is able do move the drive (vibrations)
9	Limit working area exceeded (CW) - max. position	Position out of limit. Lost of the position is possible (roll-over) if the limit in parameter 1001 is set to the absolute limit written in the datasheet	Check the readout position, compared with the mechanical position.
			Check the limits and change them.
			Set the position into the Limit.
			Drive the drive into inside the allowed range.
			Check your application, if you drive in Velocity mode with ignoring the limits (MC_MoveVelocity, setting the parameter PosLimits)
			Check your application, if the load is able do move the drive (vibrations)
10	Internal error: position accuracy	Internal error of the position sense	Send a acknowledge
			Do a hardware reset
			If the error not disappears, change the drive
11	Internal error: EEPROM error – correctable	Internal error in data integrity of the drive. The data are automatically restored. The drive is still able to work	Send a acknowledge
			Do a hardware reset
			If the error not disappears, change the drive as soon as possible

12	Internal error: EEPROM error – not correctable	Internal error in data integrity of the drive. The data are lost. The drive is not working	Send a acknowledge Do a hardware reset If the error not disappears, change the drive
13	Internal error: wrong command sequence	Wrong command sequence caused for example by truncated data transmission between gateway and drive	Send a acknowledge Check the cabling Check your application regarding to the sequence of the move-commands
14	Invalid value of parameter or process data.	Try to access not accessable parameter via PROFIBUS DP	Check your application
15	Timeout for communication drive – gateway	Time Out, stated by adapter or time Out, stated by drive	Check the power supply Check the cabling Reduce the traffic between master and gateway on the bus