WAGO I/O SYSTEM 750

Fieldbus Independent I/O Modules

DC Drive Controller 750-636

Manual

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WAGO® INNOVATIVE CONNECTIONS

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Every conceivable measure has been taken to ensure the correctness and completeness of this documentation. However, as errors can never be fully excluded, we would appreciate any information or ideas at any time.

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We wish to point out that the software and hardware terms as well as the trademarks of companies used and/or mentioned in the present manual are generally trademark or patent protected.

Content

1 Important Notes

This section includes an overall summary of the most important safety requirements and notes that are mentioned in each individual section. To protect your health and prevent damage to devices as well, it is imperative to read and carefully follow the safety guidelines.

1.1 Legal Bases

1.1.1 Copyright

This Manual, including all figures and illustrations, is copyright-protected. Any further use of this Manual by third parties that violate pertinent copyright provisions is prohibited. Reproduction, translation, electronic and phototechnical filing/archiving (e.g., photocopying) as well as any amendments require the written consent of WAGO Kontakttechnik GmbH & Co. KG, Minden, Germany. Non-observance will involve the right to assert damage claims.

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1.1.2 Personnel Qualifications

The use of the product described in this Manual requires special personnel qualifications, as shown in the following table:

Activity	Electrical specialist	Instructed personnel*)	Specialists**) having qualifications in PLC programming
Assembly	X	X	
Commissioning	X		X
Programming			X
Maintenance	X	X	
Troubleshooting	X		
Disassembly	X	X	

*) Instructed persons have been trained by qualified personnel or electrical specialists.

**) A specialist is a person, who – thanks to technical training – has the qualification, knowledge and expertise to meet the required specifications of this work and to identify any potential hazardous situation in the above listed fields of activity.

All responsible persons have to familiarize themselves with the underlying legal standards to be applied. WAGO Kontakttechnik GmbH & Co. KG does not assume any liability whatsoever resulting from improper handling and damage incurred to both WAGO´s own and third-party products by disregarding detailed information in this Manual.

1.1.3 Use of the 750 Series in Compliance with Underlying Provisions

Couplers, controllers and I/O modules found in the modular WAGO-I/O-SYSTEM 750 receive digital and analog signals from sensors and transmit them to the actuators or higher-level control systems. Using programmable controllers, the signals can also be (pre-)processed.

The components have been developed for use in an environment that meets the IP20 protection class criteria. Protection against finger injury and solid impurities up to 12.5 mm diameter is assured; protection against water damage is not ensured. Unless otherwise specified, operation of the components in wet and dusty environments is prohibited.

1.1.4 Technical Condition of Specified Devices

The components to be supplied Ex Works, are equipped with hardware and software configurations, which meet the individual application requirements. Changes in hardware, software and firmware are permitted exclusively within the framework of the various alternatives that are documented in the specific manuals. WAGO Kontakttechnik GmbH & Co. KG will be exempted from any liability in case of changes in hardware or software as well as to non-compliant usage of components.

Please send your request for modified and new hardware or software configurations directly to WAGO Kontakttechnik GmbH & Co. KG.

1.2 Standards and Guidelines for Operating the 750 Series

Please adhere to the standards and guidelines required for the use of your system:

- The data and power lines shall be connected and installed in compliance with the standards required to avoid failures on your system and to substantially minimize any imminently hazardous situations resulting in personal injury.
- For assembly, start-up, maintenance and troubleshooting, adhere to the specific accident prevention provisions which apply to your system (e.g. BGV A 3, "Electrical Installations and Equipment").
- Emergency stop functions and equipment shall not be made ineffective. See relevant standards (e.g. DIN EN 418).
- The equipment of your system shall be conform to EMC guidelines so that any electromagnetic interferences will be eliminated.
- Operating 750 Series components in home applications without further measures is permitted only if they meet the emission limits (emissions of interference) in compliance with EN 61000-6-3. You will find the detailed information in section "WAGO-I/O-SYSTEM 750" → "System Description" → "Technical Data".
- Please observe the safety precautions against electrostatic discharge in accordance with DIN EN 61340-5-1/-3. When handling the modules, please ensure that environmental factors (persons, working place and packaging) are well grounded.
- The valid standards and guidelines applicable for the installation of switch cabinets shall be adhered to.

1.3 Symbols

Danger
Always observe this information to protect persons from injury.

Warning
Always observe this information to prevent damage to the device.

Attention
Marginal conditions that must always be observed to ensure smooth and efficient operation.

ESD (Electrostatic Discharge)
Warning of damage to the components through electrostatic discharge. Observe the precautionary measure for handling components at risk of electrostatic discharge.

Note
Make important notes that are to be complied with so that a trouble-free and efficient device operation can be guaranteed.

Additional Information
References to additional literature, manuals, data sheets and internet pages.

1.4 Safety Information

When connecting the device to your installation and during operation, the following safety notes must be observed:

Danger
The WAGO-I/O-SYSTEM 750 and its components are an open system. It must only be assembled in housings, cabinets or in electrical operation rooms. Access is only permitted via a key or tool to authorized qualified personnel.

Danger
All power sources to the device must always be switched off before carrying out any installation, repair or maintenance work.

Warning
Replace defective or damaged device/module (e.g. in the event of deformed contacts), as the functionality of field bus station in question can no longer be ensured on a long-term basis.

Warning
The components are not resistant against materials having seeping and insulating properties. Belonging to this group of materials is: e.g. aerosols, silicones, triglycerides (found in some hand creams). If it cannot be ruled out that these materials appear in the component environment, then the components must be installed in an enclosure that is resistant against the above mentioned materials. Clean tools and materials are generally required to operate the device/module.

Warning
Soiled contacts must be cleaned using oil-free compressed air or with ethyl alcohol and leather cloths.

Warning
Do not use contact sprays, which could possibly impair the functioning of the contact area.

Warning
Avoid reverse polarity of data and power lines, as this may damage the devices.

ESD (Electrostatic Discharge)
The devices are equipped with electronic components that may be destroyed by electrostatic discharge when touched.

Warning
For components with ETHERNET/RJ-45 connectors:
Only for use in LAN, not for connection to telecommunication circuits.

1.5 Font Conventions

italic	Names of paths and data files are marked in italic-type. e.g.: *C:\Programs\WAGO-IO-CHECK*
italic	Menu items are marked in italic-type, bold letters. e.g.: ***Save***
\	A backslash between two names characterizes the selection of a menu point from a menu. e.g.: ***File \ New***
END	Pushbuttons are marked as bold with small capitals e.g.: **ENTER**
< >	Keys are marked bold within angle brackets e.g.: **<F5>**
`Courier`	The print font for program codes is Courier. e.g.: `END_VAR`

1.6 Number Notation

Number code	Example	Note
Decimal	100	Normal notation
Hexadecimal	0x64	C notation
Binary	'100' '0110.0100'	In quotation marks, nibble separated with dots (.)

1.7 Scope

This manual describes the Special Module 750-636
DC Drive Controller of the modular WAGO-I/O-SYSTEM 750.

Handling, assembly and start-up are described in the manual of the Fieldbus Coupler. Therefore this documentation is valid only in the connection with the appropriate manual.

2 DC Drive Controller Overview 750-636 (/xxx-xxx)

I/O module	750-636 [DC Drive Controller]	750-636/000-700 [DC Drive Controller 24V/5A/U_A]
Function	DC Drive Controller	DC Drive Controller
Motor supply 24 V DC	via internal power jumper contacts	via external Cage Clamp® connections.
Reference input	P, Z	P

3 750-636 [DC Drive Controller]

DC Drive Controller, 24 V, 5 A, Z input

3.1 View

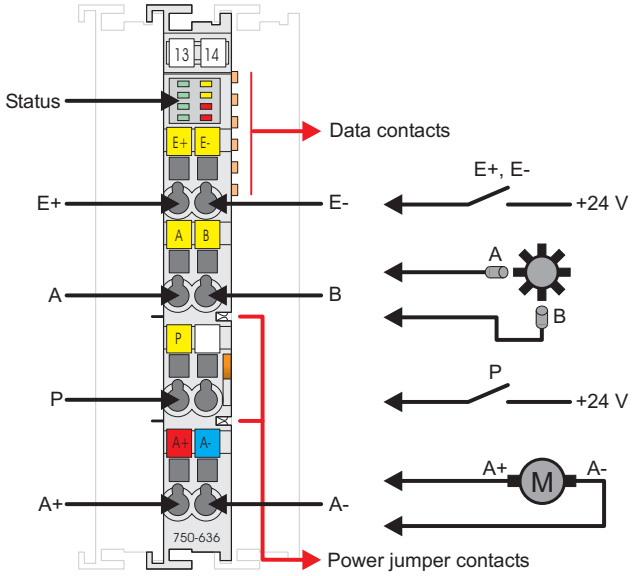


Fig. 1.1.4-1: View

g063600e

3.2 Description

The 750-636 DC Drive Controller provides DC collector motors with a nominal current of up to 5 A and an inrush current of 15 A max. The bi-directional control of the DC motor is executed via short circuit -proof and temperature-monitored H-bridge.

The DC Drive Controller can be used as a simple power controller and to simply detect incremental encoder signals.

In addition to basic move commands (MovePos, MoveNeg), automatic positioning may be optimized for different applications via different functions and parameters. Both switched operation and soft-start/stop or current reduction are possible through PWM control.

The 750-636 DC Drive Controller provides inputs A and B with the connection of an incremental encoder, two digital 24 V inputs E+ and E- for the connection of limit switches as well as the digital P input for a preset signal as well as an input Z to set the reference point based on the angle of rotation of the motor shaft (firmware 03 or higher).

24 V DC motors can be connected via outputs A+ and A-.
The limit switches automatically disable the motor output.

A green LED indicates the switching status for the digital inputs and the power supply status.Two yellow LEDs and a red LED indicate the operating mode and errors.

Field and system levels are electrically isolated.

Individual I/O modules can be arranged in any combination when configuring the fieldbus node. An arrangement in groups is not necessary.

The DC Drive Controller receives the 24 V DC supply voltage for the field level via an upstream I/O module or a supply module. Power connections are made automatically from module to module via internal power jumper contacts when snapped onto the DIN rail.

CAUTION:
The maximum current that is permitted to flow through the power jumper contacts is 10 A. When configuring the system, the total current should not be exceeded. If this occurs, an additional supply module must be used.

The DC Drive Controller can be operated with all of the couplers and controllers in the WAGO-I/O-SYSTEM 750 Series.

3.3 Connectors

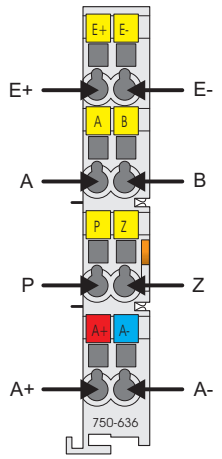


Fig. 1.1.4-1: Connecting elements g063603x

Connector	Function
E+	Input for positive limit switch (break/make contact configurable)
E-	Input for negative limit switch (break/make contact configurable)
A	Input for the A signal from the magnetic transmitter (negative switching)
B	Input for the B signal from the magnetic transmitter (negative switching)
P	Input for the preset switch (break/make contact configurable)
Z	Input for the Z signal from the magnetic transmitter (negative switching)
A+	Motor connection +
A-	Motor connection -

3.4 Indicators

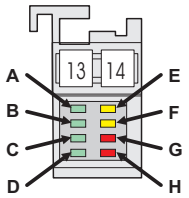


Fig. 1.1.4-1: Indicators
g063602x

LED	Name	Status	Function
A	LimitSwitch _Pos	off	Input E+: Signal voltage (0)
		green	Input E+: Signal voltage (1)
B	LimitSwitch _Neg	off	Input E-: Signal voltage (0)
		green	Input E-: Signal voltage (1)
C	PresetInput	off	Input P: Signal voltage (0)
		green	Input P: Signal voltage (1)
D	24 V Ok	off	No motor operating voltage
		green	Motor operating voltage available
E	PWM_ Active	off	Motor control without PWM (0 % or 100 %)
		yellow	Motor control with PWM >0 % and <100 % (current limitation)
F	OnTarget	off	Actual position is not setpoint position
		yellow	Actual position is setpoint position
		yellow, 5 Hz blinking	Positioning drive enabled
G	Reserved	off	No function
		red	
H	Error	off	No error
		red	Internal error or H-bridge diagnostic signal

3.5 Operating Elements

The 750-636 DC Drive Controller has no operating elements. The configuration and the parameters can be changed via higher-level control or the WAGO-I/O-CHECK configuration tool.

3.6 Schematic Diagram

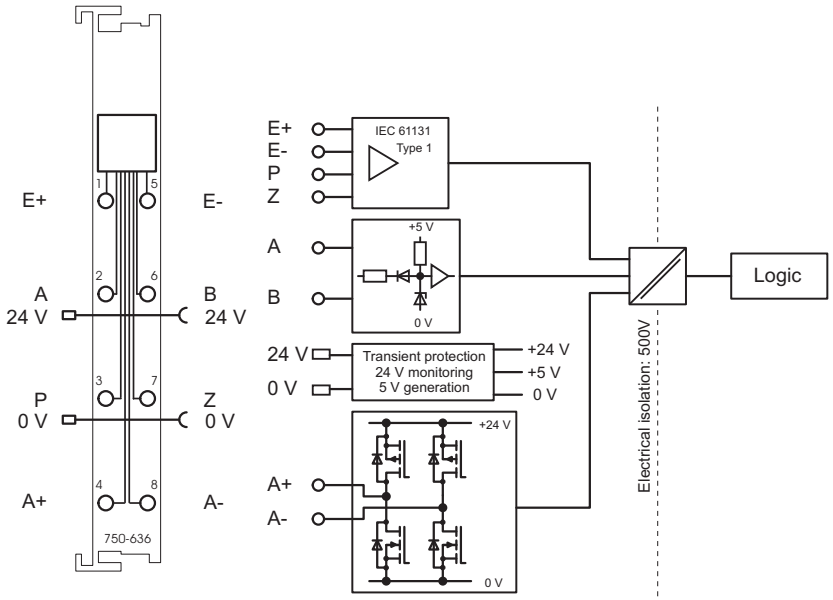


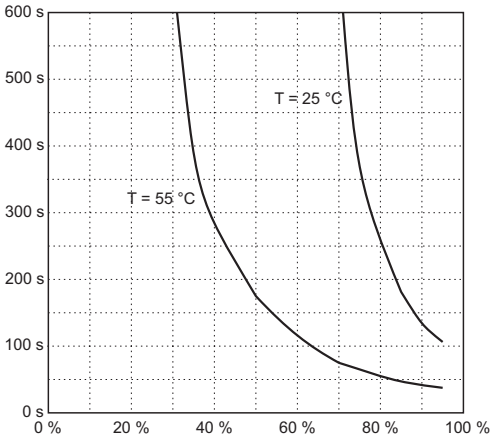
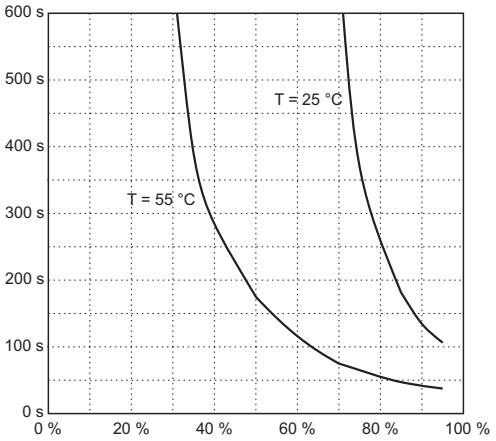
Fig. 1.1.4-1: Schematic Diagram g063601e

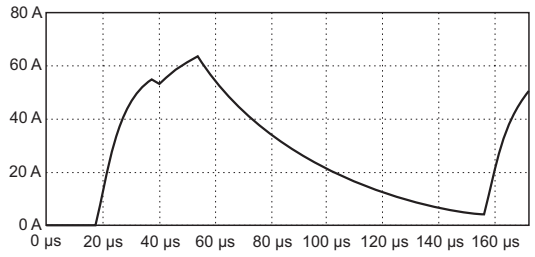
NOTICE

Energy can be recovered to the power supply during generator operation when braking or switching off the motor. For small power supplies or without additional consumers, the supply voltage can increase beyond the permissible value. If so, the DC Drive Controller shuts down for the period of the overvoltage and generates the "Overload" message. Possible remedies: larger power supply capacity, additional consumers or extending the braking ramp (see Chapter 2.1.2.8.3 "Extended Status Bytes").

3.7 Technical Data

Encoder inputs	
Number of inputs	2 (A, B), low active, DC 5 V ... 24 V or Open Collector
Input voltage	DC -3 V … 30 V
Signal voltage (0)	DC -3 V … +1.5 V
Signal voltage (1)	DC 2.4 V … 30 V
Input current typ.	-3.2 mA at +0.3 V, 0 mA at >+5 V
Limiting frequency $_{max.}$	50 kHz
Quadrature decoder report	single, double, 4-fold
Counter	32 bits binary
Digital inputs	
Number of inputs	3 (E+, E-, Preset), positive switching, IEC 61131 Type 1
Input voltage	DC -3 V … 30 V
Signal voltage (0)	DC -3 V … +5 V
Signal voltage (1)	DC 15 V … 30 V
Input current typ.	2.7 mA at 24 V

Outputs	
No. of outputs	2 (A+, A-), H-bridge output
Output current	5 A, short-circuit protected
Output current acc. to UL test point.184 at 100 % PWM and continuous operation	5 A
Inrush current $_{max.}$ Output type DC13 ($U_{Power\ jumper\ contacts\ max.}$ = ± 26.4 V) Output type DC43 ($U_{Power\ jumper\ contacts\ max.}$ = ± 25.2 V) Output type DC45 ($U_{Power\ jumper\ contacts\ max.}$ = ± 25.2 V)	 ± 5.5 A ± 12.5 A ± 12.5 A
Inrush current max. The inrush current can be maintained or reduced by setting suitable start and stop ramps. If the maximum inrush current is exceeded, the driver short circuit limitation takes effect in range 1) and a shutdown occurs with the "Overload" error message. In range 2), temperature monitoring of the board takes effect and a shutdown occurs with the "Overtemperature" error message.	 Fig. 1.1.4-1: On time g063608x
Einschaltdauer bei PWM-Betrieb (27,5 V / 5A at 25°C and 55°C) If the on time is exceeded at the appropriate ambient temperature, a shutdown occurs with the "Overload" message.	 Fig. 1.1.4-2: On time g063608x
Short circuit current $_{max.}$	65 A

Short circuit diagram The peak value is 65 A. The cycle duration of the chip pulsing is 140 µs.	 Fig. 1.1.4-3: Short circuit diagram g063607x
PWM frequency typ.	20 kHz

Module-Specific Data		
Voltage supply	Via system voltage internal bus (5 V DC) and power jumper contacts (24 V DC)	
Current consumption (system voltage 5 V DC) typ.	55 mA	
Voltage via power jumper contacts	DC 20 V … 27,5 V Low voltage/overvoltage are monitored	
Low voltage switching threshold typ.	DC 19 V	
Threshold for overvoltage error. “Overload” diagnostic bit is set. Both outputs are activated during overvoltage. This corresponds to the “Brake” status. This switching threshold is above the maximum operating voltage of 27.5V and can be exceeded by switching residual inductances. This might also occur in motor mode when the brake ramp is set to short.	DC 29 V	
Current consumption (power jumper contacts 24 V DC) typ.	12 mA + load	
Current via power jumper contacts max.	10 A	
Electrical isolation	500 V system voltage/field level (power jumper contacts)	
Data width, internal	1 x 32 bits data, 2 x 8 bits control/status	
Dimensions W x H* x D (* from upper edge of rail)	12 mm x 64 mm x 100 mm	
Weight	Approx. 70 g	
Standards and directives (see section 2.2 in manual on coupler/controller)		
EMC -Immunity to interference	Acc. to EN 61000-6-2: 2005	
EMC -Emission of interference	Acc. to EN 61000-6-3: 2007	
Approvals (see section 2.2 in manual on coupler/controller)		
cULus	cULus (UL508)	
CE	Conformity marking	

3.8 Process Image

The 750-636 DC Drive Controller provides 6 bytes of input and output process image to the fieldbus coupler/controller via 1 logical channel.
The position data to be sent and received is stored in 4 output bytes (D0 … D3) and 4 input bytes (D0 … D3). Two control bytes (C0, C1) and 2 status bytes (S0, S1) control the I/O module and the drive.
In addition to the position data in the input process image (D0 … D3), it is possible to display extended status information (S2 … S5).

NOTICE
Mapping the process data of some I/O modules (or their variations) into the process image is specific to the fieldbus coupler/controller used. Both this information and the specific configuration of the relevant control/status bytes, are located in the section on "Fieldbus Specific Configuration of Process Data", which describes the process image of the particular coupler/controller.

3.8.1 Overview

<table>
<tr><th rowspan="2">Offset</th><th colspan="2">Input Data</th><th rowspan="2">Output Data</th></tr>
<tr><th>ExtendedInfo_ON = 0</th><th>ExtendedInfo_ON = 1</th></tr>
<tr><td>0</td><td>Status byte S0</td><td>Status byte S0</td><td>Control byte C0</td></tr>
<tr><td>1</td><td>Status byte S1</td><td>Status byte S1</td><td>Control byte C1</td></tr>
<tr><td>2</td><td rowspan="4">Process data
D0 … D3</td><td rowspan="4">Ext. status bytes
S2 … S5</td><td rowspan="4">Process data
D0 … D3</td></tr>
<tr><td>3</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td></tr>
</table>

Bit 3 (ExtendedInfo_ON) of control byte C1 (C1.3) switches between the process data and the extended status bytes in the input process image.
Bit 3 of status byte S1 (S1.3) acknowledges the switching process.

3.8.2 Control Bytes and Status Bytes

Control byte C0							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Reg _Com	X	X	Current Control _ON	Preset	Position ing	Move Pos	Move Neg

MoveNeg	Drive is supposed to move in negative direction. This function is only executed if MovePos and Positioning are not enabled. Otherwise, the drive is stopped.	
	0:	Drive does not move in negative direction
	1:	Drive moves in negative direction
MovePos	Drive is supposed to move in positive direction. This function is only executed if MoveNeg and Positioning are not enabled. Otherwise, the drive is stopped.	
	0:	Drive does not move in positive direction
	1:	Drive moves in negative direction
Positioning	Drive is supposed to move to its setpoint position. This function is only executed if MoveNeg and MovePos are not enabled. Otherwise, the drive is stopped.	
	0:	No positioning drive
	1:	Positioning drive to setpoint position
Preset	When the bit changes from LOW to HIGH, the value of the setpoint position is transfered as preset value into the actual position. The preset register is unaffected by this action. The L/H ramp is only considered during a “MovePos” and “MoveNeg” motion, or in the rest position of the terminal (‘Busy’ = 0). The state change has no results during a positioning motion and when the preset input is activated or released, respectively.	
	0→1:	Setpoint position is transferred as preset value into the actual position
CurrentControl _ON	This bit moves the drive using the configured CurrentControl_PWM. During the moving process with “MoveNeg” and “MovePos” the PWM is directly set at the motor final stage if CurrentControl_ON = 1. When in the "Positioning" mode, this bit is only considered in phase 3 of the positioning process. Please find more detailed information on this subject in section "PWM control during positioning process."	
	0:	Drive is not moved using CurrentControl_PWM.
	1:	Drive is moved using CurrentControl_PWM.
Reg_Com	Register communication (see section 6.4).	
	0:	Process data communication enabled.
	1:	Register communication enabled.
X	Reserved	

Control byte C1							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Error_ Quit	X	X	X	X	Extended Info_On	Optimize _On	Preset Input _Enable

PresetInput _Enable	If this bit is set before, or during, a ‘MovePos’ or ‘MoveNeg’ moving process, the preset input is enabled, the preset register value is copied into the actual value and the motor is stopped. If the ‘PresetInput_Enable’ bit is set during a positioning process, then it will be ignored.	
	0:	Preset input is not enabled.
	1:	Preset input is enabled.
Optimize_On	This bit optimizes the prestop during a positioning process. This means that the prestop is reset as of the next moving cycle at every stop using the determined braking distance. To determine the braking distance see section 0, “Positioning with activated optimization”.	
	0:	Prestop is not optimized.
	1:	Prestop is optimized.
ExtendedInfo _On	This bit switches between different data in the input process image (bytes 2 to 5), instead of the current position the extended information is shown.	
	0:	Extended status information disabled.
	1:	Extended status information enabled.
Error_Quit	If this bit is set to "1," the following error bits are acknowledged: S2.0 → Overtemperature_Warning S2.1 → Overtemperature S2.2 → Overflow_Warning S2.3 → 24V_OK, S2.4 → Overload S2.5 → MotionDetectionTimeout.	
	0:	Error bits are not acknowledged.
	1:	Error bits are acknowledged.
X	Reserved	

Status byte S0							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Reg _Com	Error	Refer ence_OK	Standstill	Busy	OnTarget	Move Pos	Move Neg

MoveNeg	This bit indicates that drive moves in negative direction.	
	0:	Drive does not move in negative direction
	1:	Drive moves in negative direction
MovePos	This bit indicates that drive moves in positive direction.	
	0:	Drive does not move in positive direction
	1:	Drive moves in positive direction
OnTarget	This bit indicates that the positioning process in the target window is complete. The bit resets upon quitting the target window, independent of a positioning process. Also see section 6.2, „I/O module-specific Parameter Data, Parameter 3 (TargetWindow)“	
	0:	Target window was quit.
	1:	Positioning process in the target window is completed.
Busy	The bit sends back logic "1" while the command is executed. Otherwise, the bit is "0."	
	0:	No command is being executed.
	1:	A command is being executed.
Standstill	This bit is set to logic ‘1’ when the module detects the standstill condition or does not detect incremental encoder pulses, does not depend on a command execution. Please find more detailed information on this subject in section 5.13, „Standstill Condition “.	
	0:	Standstill condition is not fulfilled or the module receives incremental encoder pulses.
	1:	Standstill condition is fulfilled and the module does not receive incremental encoder pulses.
Reference_OK	This bit is set to logic ‘1’ when a preset function was completed successfully. It may be reset to logic ‘0’ during operation. Please find more detailed information on this subject in section 5.2, „Preset Functions“.”.	
	0:	Preset function not completed successfully.
	1:	Preset function completed successfully.
Error	This bit indicates there is a status/error message. To view detailed information, set the control bit ‘ExtendedInfo_ON’ (C1.2) to ‘1,’ rather than the actual position the extended information is shown.	
	0:	No status/error message.
	1:	Status/error message.

Reg_Com	Register communication (see section 6.4).	
	0:	Process data communication enabled.
	1:	Register communication enabled.

Status byte S1							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Limit Switch _Pos	Limit Switch _Neg	Preset Input	Current Control _ON	PWM_ Active	Extended Info_On	Optimize _On/ Z_Input	Preset Input _Enabled

PresetInput _Enabled	This bit indicates activation of the preset inputs and switching the meaning of status byte S1, bit 1.		
	0:	Preset input is not enabled. Status byte S1, bit 1 means "Optimize_ON".	
	1:	Preset input is enabled. Status byte S1, bit 1 means "Z_Input".	
Optimize_On/ Z_Input	This bit means different things depending on control byte C1, bit 0 or status byte S1, bit 0. When "PresetInput_Enabled" = "0", this bit indicates prestop optimization during the positioning process. When "PresetInput_Enabled" = "1", this bit indicates the status of the Z input.		
	Bit 0	Bit 1	Dependent meaning
	0	0	Prestop is not optimized.
	0	1	Prestop is optimized.
	1	0	Z input is not enabled.
	1	1	Z input is enabled.
ExtendedInfo _On	This bit indicates that the data in the input process image (byte 2 to 5) was changed.		
	0:	Extended status information disabled.	
	1:	Extended status information enabled.	
PWM_Active	This bit indicates if the DC Drive Controller has generated a PWM signal at the motor output.		
	0:	No PWM signal at the motor output.	
	1:	PWM signal at the motor output.	
CurrentControl _ON	This bit indicates if the motor final stage is operated with CurrentControl_PWM.		
	0:	Motor final stage is not operated with CurrentControl_PWM.	
	1:	Motor final stage is operated with CurrentControl_PWM.	
PresetInput	This bit indicates the input status of the preset switch.		
	0:	Signal voltage (0) at the input.	
	1:	Signal voltage (1) at the input.	

LimitSwitch _Neg	This bit indicates the input status of the negative limit switch.	
	0:	Signal voltage (0) at the input.
	1:	Signal voltage (1) at the input.
LimitSwitch _Pos	This bit indicates the input status of the positive limit switch.	
	0:	Signal voltage (0) at the input.
	1:	Signal voltage (1) at the input.

3.8.3 Extended Status Bytes

Extended status byte S2							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
X	Param _Write _Failed	Motion Detection Timeout	Overload	24V_OK	Overflow _Warn ing	Overtem perature	Overtem perature_ Warning

Overtemperature _Warning	The temperature of the module/electronics has reached a critical value.	
	0:	The temperature is below the warning threshold.
	1:	The temperature has exceeded the warning threshold.
Overtemperature	The temperature of the module electronics has exceeded the temperature threshold; the module has been turned off automatically.	
	0:	The temperature is below the turn-off threshold.
	1:	The temperature has exceeded the turn-off threshold.
Overflow_ Warning	This bit is set to logic 1 when the actual position is not in the range of values defined by the limit values -2.147.400.000 and +2.147.400.000.	
	0:	The actual position is within the limit values.
	1:	The actual position is not within the limit values.
24V_OK	If the field-side 24V fails during operation, this bit will be set to logic '0'. The actual position value remains, although a position control using the quadrature decoder/counter is no longer possible due to the 24 V failure (see chapter 5.2, “Preset Functions”).	
	0:	The 24 V field power supply failed.
	1:	The 24 V field power supply is available.
Overload	The module output stage detected an overload error. Both an overcurrent and an overvoltage trigger the overload error, which is derived from driver diagnostics. An overvoltage can occur if the power supply unit can no longer compensate for the energy that is fed back during the braking phase. To protect the module, the overload error is generated and the motor is at idle.	
	0:	No overload error.
	1:	Overload error.
MotionDetection Timeout	If no incremental encoder pulses are received within the configured time period ‘MotionDetectionTimeout’ after a motion command has been released, the motion or positioning process is terminated and the corresponding ‘MotionDetectionTimeout’ error bit in the ExtendedInfos is set. It is only possible to acknowledge this error bit if ‘MoveNeg’, ‘MovePos’ and ‘Positioning’ control bits are set to 0.	
	0:	Pulses were received within the configured time period.
	1:	No pulses were received within the configured time period.

Param_Write _Failed	Parameterization Status	
	0:	Parameterization successfully completed.
	1:	Wrong parameters.
X	Reserved	

Extended status byte S3							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
X	X	X	X	X	X	X	X
X	Reserved						

Extended status byte S4							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
X	X	X	X	X	X	X	X
X	Reserved						

Extended status byte S5							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
X	X	X	X	X	X	X	X
X	Reserved						

4 750-636/000-700 [DC Drive Controller 24V/5A/U_A]

DC-Drive Controller, 24 V, 5 A, external motor supply (separate U_A)

4.1 View

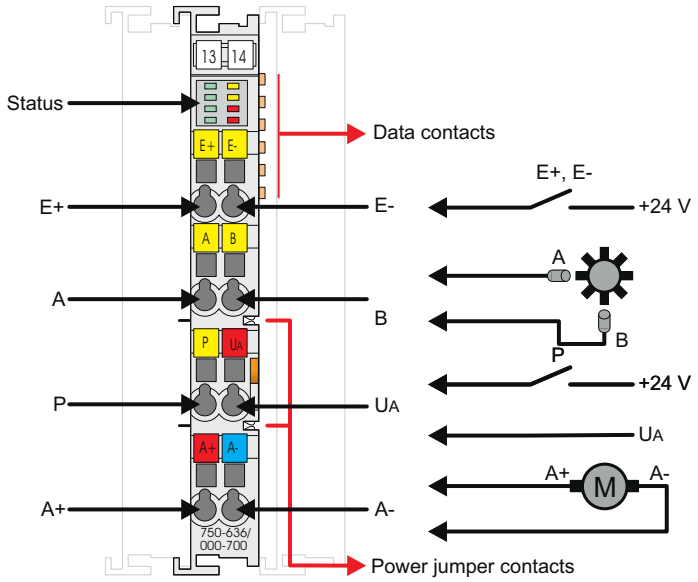


Fig. 3.8.3-1: View

g063670e

4.2 Description

The 750-636/000-700 DC Drive Controller provides DC collector motors with a nominal current of up to 5 A and an inrush current of 15 A max. The bi-directional control of the DC motor is executed via short circuit -proof and temperature-monitored H-bridge.

The DC Drive Controller can be used as a simple power controller and to simply detect incremental encoder signals.

In addition to basic move commands (MovePos, MoveNeg), automatic positioning may be optimized for different applications via different functions and parameters. Both switched operation and soft-start/stop or current reduction are possible through PWM control.

The 750-636/000-700 DC Drive Controller provides inputs A and B with the connection of an incremental encoder, two digital 24 V inputs E+ and E- for the connection of limit switches as well as the digital P input for a preset signal and a separate connection for the motor supply voltage UA.

The limit switches automatically disable the motor output.

A green LED indicates the switching status for the digital inputs and the power supply status.
Two yellow LEDs and a red LED indicate the operating mode and errors.

Field and system levels are electrically isolated.

Individual I/O modules can be arranged in any combination when configuring the fieldbus node.

The DC Drive Controller receives the 24 V DC supply voltage for the field level via an upstream I/O module or a supply module. Power connections are made automatically from module to module via internal power jumper contacts when snapped onto the DIN rail.

CAUTION:
The maximum current that is permitted to flow through the power jumper contacts is 10 A. When configuring the system, the total current should not be exceeded. If this occurs, an additional supply module must be used.

The DC Drive Controller can be operated with all of the couplers and controllers in the WAGO-I/O-SYSTEM 750 Series.

4.3 Connectors

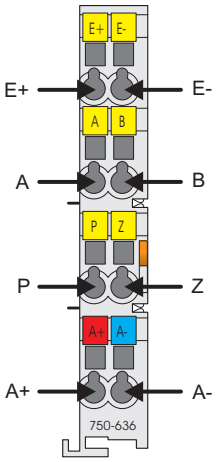


Fig. 3.8.3-1: Connecting elements g063603x

Connector	Function
E+	Input for positive limit switch (break/make contact configurable)
E-	Input for negative limit switch (break/make contact configurable)
A	Input for the A signal from the magnetic transmitter (negative switching)
B	Input for the B signal from the magnetic transmitter (negative switching)
P	Input for the preset switch (break/make contact configurable)
U_A	Connection for motor supply voltage
A+	Motor connection +
A-	Motor connection -

4.4 Indicators

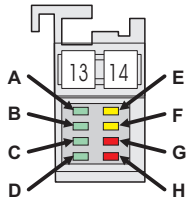


Fig. 3.8.3-1: Indicators
g063602x

LED	Name	Status	Function
A	LimitSwitch _Pos	off	Input E+: Signal voltage (0)
		green	Input E+: Signal voltage (1)
B	LimitSwitch _Neg	off	Input E-: Signal voltage (0)
		green	Input E-: Signal voltage (1)
C	PresetInput	off	Input P: Signal voltage (0)
		green	Input P: Signal voltage (1)
D	24 V Ok	off	No motor operating voltage
		green	Motor operating voltage available
E	PWM_ Active	off	Motor control without PWM (0 % or 100 %)
		yellow	Motor control with PWM >0 % and <100 % (current limitation)
F	OnTarget	off	Actual position is not setpoint position
		yellow	Actual position is setpoint position
		yellow, 5 Hz blinking	Positioning drive enabled
G	Reserved	off	No function
		red	
H	Error	off	No error
		red	Internal error or H-bridge diagnostic signal

4.5 Operating Elements

The 750-636/000-700 DC Drive Controller has no operating elements. The configuration and the parameters can be changed via higher-level control or the WAGO-I/O-CHECK configuration tool.

4.6 Schematic Diagram

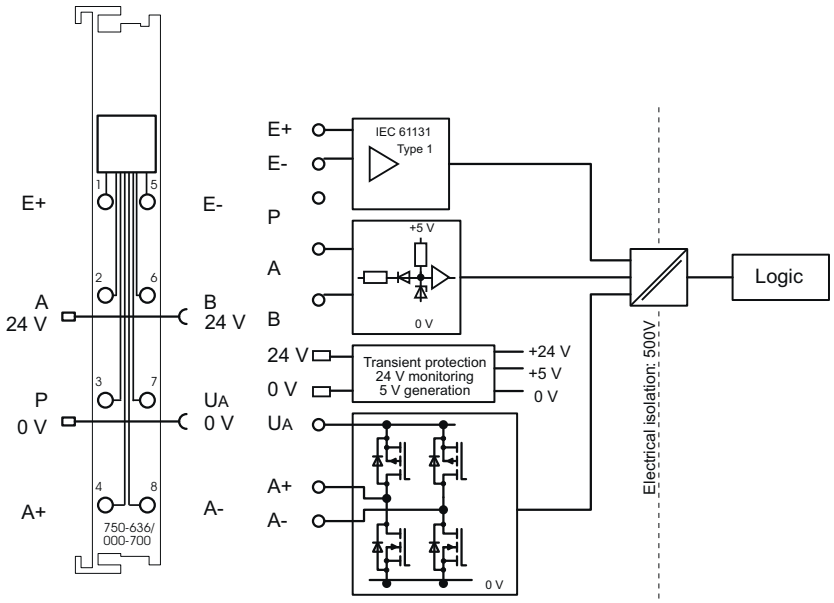
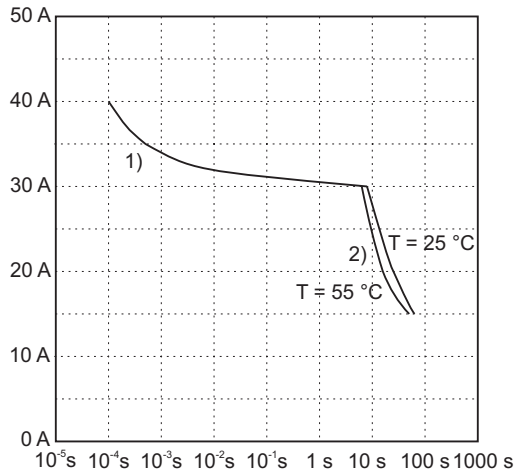
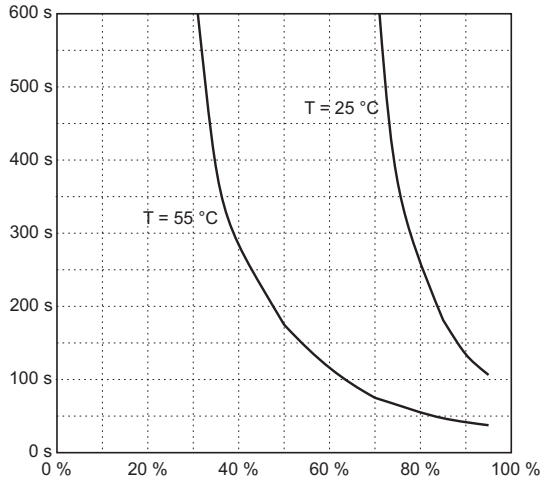


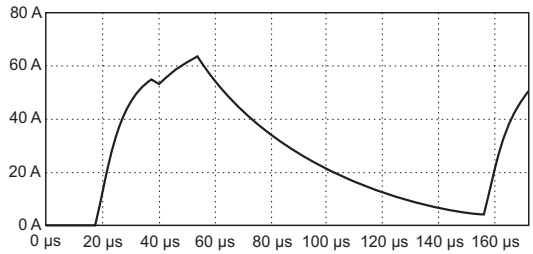
Fig. 3.8.3-1: Schematic Diagram g063671e

CAUTION:
Energy can be recovered to the power supply during generator operation when braking or switching off the motor. For small power supplies or without additional loads, the supply voltage can increase beyond the permissible value. If so, the DC Drive Controller shuts down for the period of the overvoltage and generates the "Overload" message. Possible remedies: larger power supply capacity, additional loads or extending the braking ramp (see Section 2.1.2.8.3 "Extended Status Bytes").

4.7 Technical Data

Encoder inputs	
Number of inputs	2 (A, B), low active, DC 5 V ... 24 V or Open Collector
Input voltage	DC -3 V … 30 V
Signal voltage (0)	DC -3 V … +1.5 V
Signal voltage (1)	DC 2.4 V … 30 V
Input current typ.	-3.2 mA at +0.3 V, 0 mA at >+5 V
Limiting frequency $_{max.}$	50 kHz
Quadrature decoder report	single, double, 4-fold
Counter	32 bits binary
Digital inputs	
Number of inputs	3 (E+, E-, Preset), positive switching, IEC 61131 Type 1
Input voltage	DC -3 V … 30 V
Signal voltage (0)	DC -3 V … +5 V
Signal voltage (1)	DC 15 V … 30 V
Input current typ.	2.7 mA at 24 V

Outputs	
No. of outputs	2 (A+, A-), H-bridge output
Output current	5 A, short-circuit protected
Output current acc. to UL test point.184 at 100 % PWM and continuous operation	5 A
Inrush current $_{max.}$ Output type DC13 ($U_{Power\ jumper\ contacts\ max.}$ = ± 26.4 V) Output type DC43 ($U_{Power\ jumper\ contacts\ max.}$ = ± 25.2 V) Output type DC45 ($U_{Power\ jumper\ contacts\ max.}$ = ± 25.2 V)	 ± 5.5 A ± 12.5 A ± 12.5 A
Inrush current max. The inrush current can be maintained or reduced by setting suitable start and stop ramps. If the maximum inrush current is exceeded, the driver short circuit limitation takes effect in range 1) and a shutdown occurs with the "Overload" error message. In range 2), temperature monitoring of the board takes effect and a shutdown occurs with the "Overtemperature" error message.	 Fig. 3.8.3-1: On time g063609x
On time during PWM operation (27,5 V / 5A at 25°C and 55°C) If the on time is exceeded at the appropriate ambient temperature, a shutdown occurs with the "Overload" message.	 Fig. 3.8.3-2: On time g063608x
Short circuit current max.	65 A

Short circuit diagram The peak is at 65 A. The period duration of the pulsing induced by the chip is at 140 µs.	
PWM frequency typ.	20 kHz

Module-Specific Data		
Voltage supply		Via system voltage internal bus (5 V DC) and power jumper contacts (24 V DC) and motor supply voltage (24 V DC)
Current consumption (system voltage 5 V DC) $_{typ.}$		55 mA
Voltage via power jumper contacts		DC 24 V (-15 % ... +20 %)
Current consumption (power jumper contacts 24 V DC) $_{typ.}$		10 mA
Current via power jumper contacts max.		10 A
Motor supply voltage $U_{A\ typ.}$		DC 20 V … 27,5 V Low voltage/overvoltage are monitored
Low voltage switching threshold $U_{A\ typ.}$		DC 19 V
Threshold for overvoltage error. “Overload” diagnostic bit is set. Both outputs are activated during overvoltage. This corresponds to the “Brake” status. This switching threshold is above the maximum operating voltage of 27.5V and can be exceeded by switching residual inductances. This might also occur in motor mode when the brake ramp is set to short.		DC 29 V
Current consumption $U_{A\ typ.}$		2 mA + load
Electrical isolation		500 V system voltage/field level (power jumper contacts)
Data width, internal		1 x 32 bits data, 2 x 8 bits control/status
Dimensions W x H* x D (* from upper edge of rail)		12 mm x 64 mm x 100 mm
Weight		Approx. 70 g
Standards and directives (see section 2.2 in manual on coupler/controller)		
EMC -Immunity to interference		Acc. to EN 61000-6-2: 2005
EMC -Emission of interference		Acc. to EN 61000-6-3: 2007
Approvals (see section 2.2 in manual on coupler/controller)		
c UL us	$_{C}UL_{US}$ (UL508)	
CE	Conformity marking	

4.8 Process Image

The 750-636/000-700 DC Drive Controller provides 6 bytes of input and output process image to the fieldbus coupler/controller via 1 logical channel. The position data to be sent and received is stored in 4 output bytes (D0 … D3) and 4 input bytes (D0 … D3). Two control bytes (C0, C1) and 2 status bytes (S0, S1) control the I/O module and the drive.
In addition to the position data in the input process image (D0 … D3), it is possible to display extended status information (S2 … S5).

NOTICE
Mapping the process data of some I/O modules (or their variations) into the process image is specific to the fieldbus coupler/controller used. Both this information and the specific configuration of the relevant control/status bytes, are located in the section on "Fieldbus Specific Configuration of Process Data", which describes the process image of the particular coupler/controller.

4.8.1 Overview

Offset	Input Data		Output Data
	ExtendedInfo_ON = 0	ExtendedInfo_ON = 1	
0	Status byte S0	Status byte S0	Control byte C0
1	Status byte S1	Status byte S1	Control byte C1
2	Process data D0 … D3	Ext. status bytes S2 … S5	Process data D0 … D3
3			
4			
5			

Bit 3 (ExtendedInfo_ON) of control byte C1 (C1.3) switches between the process data and the extended status bytes in the input process image.
Bit 3 of status byte S1 (S1.3) acknowledges the switching process.

4.8.2 Control Bytes and Status Bytes

Control byte C0							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Reg _Com	X	X	Current Control _ON	Preset	Position ing	Move Pos	Move Neg

MoveNeg	Drive is supposed to move in negative direction. This function is only executed if MovePos and Positioning are not enabled. Otherwise, the drive is stopped.	
	0:	Drive does not move in negative direction
	1:	Drive moves in negative direction
MovePos	Drive is supposed to move in positive direction. This function is only executed if MoveNeg and Positioning are not enabled. Otherwise, the drive is stopped.	
	0:	Drive does not move in positive direction
	1:	Drive moves in negative direction
Positioning	Drive is supposed to move to its setpoint position. This function is only executed if MoveNeg and MovePos are not enabled. Otherwise, the drive is stopped.	
	0:	No positioning drive
	1:	Positioning drive to setpoint position
Preset	When the bit changes from LOW to HIGH, the value of the setpoint position is transfered as preset value into the actual position. The preset register is unaffected by this action. The L/H ramp is only considered during a “MovePos” and “MoveNeg” motion, or in the rest position of the terminal (‘Busy’ = 0). The state change has no results during a positioning motion and when the preset input is activated or released, respectively.	
	0→1:	Setpoint position is transferred as preset value into the actual position
CurrentControl _ON	This bit moves the drive using the configured CurrentControl_PWM. During the moving process with “MoveNeg” and “MovePos” the PWM is directly set at the motor final stage if CurrentControl_ON = 1. When in the "Positioning" mode, this bit is only considered in phase 3 of the positioning process. Please find more detailed information on this subject in section "PWM control during positioning process."	
	0:	Drive is not moved using CurrentControl_PWM.
	1:	Drive is moved using CurrentControl_PWM.
Reg_Com	Register communication (see section 6.4).	
	0:	Process data communication enabled.
	1:	Register communication enabled.
X	Reserved	

Control byte C1							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Error_ Quit	X	X	X	X	Extended Info_On	Optimize _On	Preset Input _Enable

PresetInput _Enable	If this bit is set before, or during, a 'MovePos' or 'MoveNeg' moving process, the preset input is enabled, the preset register value is copied into the actual value and the motor is stopped. If the 'PresetInput_Enable' bit is set during a positioning process, then it will be ignored.	
	0:	Preset input is not enabled.
	1:	Preset input is enabled.
Optimize_On	This bit optimizes the prestop during a positioning process. This means that the prestop is reset as of the next moving cycle at every stop using the determined braking distance. To determine the braking distance see section 0, " Positioning with activated optimization".	
	0:	Prestop is not optimized.
	1:	Prestop is optimized.
ExtendedInfo _On	This bit switches between different data in the input process image (bytes 2 to 5), instead of the current position the extended information is shown.	
	0:	Extended status information disabled.
	1:	Extended status information enabled.
Error_Quit	If this bit is set to "1," the following error bits are acknowledged: S2.0 → Overtemperature_Warning S2.1 → Overtemperature S2.2 → Overflow_Warning S2.3 → 24V_OK, S2.4 → Overload S2.5 → MotionDetectionTimeout. S2.7 → 24V_Motor_OK S3.0 → 24V_Field_OK.	
	0:	Error bits are not acknowledged.
	1:	Error bits are acknowledged.
X	Reserved	

Status byte S0							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Reg _Com	Error	Refer ence_OK	Standstill	Busy	OnTarget	Move Pos	Move Neg

MoveNeg	This bit indicates that drive moves in negative direction.	
	0:	Drive does not move in negative direction
	1:	Drive moves in negative direction
MovePos	This bit indicates that drive moves in positive direction.	
	0:	Drive does not move in positive direction
	1:	Drive moves in positive direction
OnTarget	This bit indicates that the positioning process in the target window is complete. The bit resets upon quitting the target window, independent of a positioning process. Also see section 6.2, „I/O module-specific Parameter Data, Parameter 3 (TargetWindow)“	
	0:	Target window was quit.
	1:	Positioning process in the target window is completed.
Busy	The bit sends back logic "1" while the command is executed. Otherwise, the bit is "0."	
	0:	No command is being executed.
	1:	A command is being executed.
Standstill	This bit is set to logic ‘1’ when the module detects the standstill condition or does not detect incremental encoder pulses, does not depend on a command execution. Please find more detailed information on this subject in section **Fehler! Verweisquelle konnte nicht gefunden werden.**, “**Fehler! Verweisquelle konnte nicht gefunden werden.**”.	
	0:	Standstill condition is not fulfilled or the module receives incremental encoder pulses.
	1:	Standstill condition is fulfilled and the module does not receive incremental encoder pulses.
Reference_OK	This bit is set to logic ‘1’ when a preset function was completed successfully. It may be reset to logic ‘0’ during operation. Please find more detailed information on this subject in section 5.2, “Preset Functions”.	
	0:	Preset function not completed successfully.
	1:	Preset function completed successfully.
Error	This bit indicates there is a status/error message. To view detailed information, set the control bit ‘ExtendedInfo_ON’ (C1.2) to ‘1,’ rather than the actual position the extended information is shown.	
	0:	No status/error message.
	1:	Status/error message.

Reg_Com	Register communication (see section 6.4).	
	0:	Process data communication enabled.
	1:	Register communication enabled.

Status byte S1							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Limit Switch _Pos	Limit Switch _Neg	Preset Input	Current Control _ON	PWM_ Active	Extended Info_On	Optimize _On	Preset Input _Enabled

PresetInput _Enabled	This bit indicates that the preset input is enabled.	
	0:	Preset input is not enabled.
	1:	Preset input is enabled.
Optimize_On	This bit indicates prestop optimization during the positioning process.	
	0:	Prestop is not optimized.
	1:	Prestop is optimized.
ExtendedInfo _On	This bit indicates that the data in the input process image (byte 2 to 5) was changed.	
	0:	Extended status information disabled.
	1:	Extended status information enabled.
PWM_Active	This bit indicates if the DC Drive Controller has generated a PWM signal at the motor output.	
	0:	No PWM signal at the motor output.
	1:	PWM signal at the motor output.
CurrentControl _ON	This bit indicates if the motor final stage is operated with CurrentControl_PWM.	
	0:	Motor final stage is not operated with CurrentControl_PWM.
	1:	Motor final stage is operated with CurrentControl_PWM.
PresetInput	This bit indicates the input status of the preset switch.	
	0:	Signal voltage (0) at the input.
	1:	Signal voltage (1) at the input.
LimitSwitch_ Neg	This bit indicates the input status of the negative limit switch.	
	0:	Signal voltage (0) at the input.
	1:	Signal voltage (1) at the input.
LimitSwitch_ Pos	This bit indicates the input status of the positive limit switch.	
	0:	Signal voltage (0) at the input.
	1:	Signal voltage (1) at the input.

4.8.3 Extended Status Bytes

Extended status byte S2							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
24V_ Motor_ OK	Param _Write _Failed	Motion Detection Timeout	Overload	24V_OK	Overflow _Warn ing	Overtem perature	Overtem perature_ Warning

Overtemperature _Warning	The temperature of the module/electronics has reached a critical value.	
	0:	The temperature is below the warning threshold.
	1:	The temperature has exceeded the warning threshold.
Overtemperature	The temperature of the module electronics has exceeded the temperature threshold; the module has been turned off automatically.	
	0:	The temperature is below the turn-off threshold.
	1:	The temperature has exceeded the turn-off threshold.
Overflow_ Warning	This bit is set to logic 1 when the actual position is not in the range of values defined by the limit values -2.147.400.000 and +2.147.400.000.	
	0:	The actual position is within the limit values.
	1:	The actual position is not within the limit values.
24V_OK	If the field-side 24V fails during operation, this bit will be set to logic '0'. The actual position value remains, although a position control using the quadrature decoder/counter is no longer possible due to the 24 V failure (see chapter 5.2, “Preset Functions”).	
	0:	The 24 V field power supply failed.
	1:	The 24 V field power supply is available.
Overload	The module output stage detected an overload error. Both an overcurrent and an overvoltage trigger the overload error, which is derived from driver diagnostics. An overvoltage can occur if the power supply unit can no longer compensate for the energy that is fed back during the braking phase. To protect the module, the overload error is generated and the motor is at idle. Possible remedies: larger power supply capacity, additional loads or extending the braking ramp.	
	0:	No overload error.
	1:	Overload error.
MotionDetection Timeout	If no incremental encoder pulses are received within the configured time period ‘MotionDetectionTimeout’ after a motion command has been released, the motion or positioning process is terminated and the corresponding ‘MotionDetectionTimeout’ error bit in the ExtendedInfos is set. It is only possible to acknowledge this error bit if ‘MoveNeg’, ‘MovePos’ and ‘Positioning’ control bits are set to 0.	
	0:	Pulses were received within the configured time period.
	1:	No pulses were received within the configured time period.

Param_Write _Failed	Parameterization Status	
	0:	Parameterization successfully completed.
	1:	Wrong parameters.
24V_Motor_OK	This bit is set to logic '0' when the 24 V motor supply voltage fails during operation.	
	0:	The 24 V motor supply voltage has failed.
	1:	The 24 V motor supply voltages is available.

Extended status byte S3							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
X	X	X	X	X	X	X	24V_ Field_ OK

24V_Field_OK	This bit is set to logic '0' when the 24 V field power supply fails during operation.	
	0:	The 24 V field power supply has failed. The reference is lost due to the failure (Reference_OK = 0).
	1:	The 24 V field power supply is available.
X	Reserved	

Extended status byte S4							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
X	X	X	X	X	X	X	X

X	Reserved

Extended status byte S5							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
X	X	X	X	X	X	X	X

X	Reserved

5 Function Description

5.1 Operating Modes and Drive Functions

The operating modes of the DC Drive Controller permit positive and negative movement with position feedback and automatically approach a setpoint position.

When positioning automatically, the positioning accuracy can be optimized via optional parameters (Prestop, Retry, etc.).

Other parameters for target window size, stop interval for reversion of rotating direction or compensation of gearbox clearance adapt the system to the mechanics.

5.2 Preset Functions

Two different preset functions can be used to reference the drive.

5.2.1 Hardware Preset

The value can be specified via parameter; after enabling the preset input, this value is assigned to its position when approaching the reference cam. Afterward, the drive is stopped.
With the 750-636 module, the reference can also be made from the Z input.

5.2.2 Software Preset

A second option is using the control to assign the setpoint value to the actual position.

Notification of preset function execution is returned via terminal status; the bit 'Reference_OK' goes to logic 1. During running operation, this bit is reset to logic 0 by one of the following events:

- restart a preset motion
- failure of field-sided 24 V (with the exception of the separate 24 V motor supply with the 750-636/000-700 module),
- overflow or underflow of the actual position counter.
- Changing the result type of the Quadrature decoder (1x / 2x / 3x evaluation)

5.3 Brake Functions

The brake mode is set here. A brake mode can be assigned for the following events:

- Brakemode_STANDARD (Move/Positioning),
- Brakemode_EXCEPTION (on actuation of the limit switch),
- Brakemode_EMERGENCY (see Chapter 5.5, “Protective Functions”).

The following brake modes can be assigned to these events:

- Idle (motor outputs at zero voltage),
- Ramp (see Section 6.2, “I/O module-specific Parameter Data”, Parameter 0”),
- Brake (the motor outputs are short-circuited and are at 24 V (750-636) or at motor voltage potential UA (750-636/000-700)).

5.4 Stop Functions

The idle/deceleration (stopmode) is set after braking. It can be distinguished whether the hold state should be applied at the end of the electric ramp or when the drive stops only (tab 49.8). A hold state can be assigned for the following events:

- Stopmode_STANDARD (Move/Positioning),
- Stopmode_EXCEPTION (on actuation of the limit switch),
- Stopmode_EMERGENCY (see Chapter 5.5, “Protective Functions”).
- Stopmode_Pwr_Up (after switching on the node).

The following hold states can be assigned to these events:

- Idle (motor outputs at zero voltage),
- Brake (the motor outputs are short-circuited and are at 24 V (750-636) or at motor voltage potential UA (750-636/000-700)).

5.5 Protective Functions

The module monitors the following events:

- activation of the limit switches
- overtemperature of the module
- overtemperature of the motor final stage in the module
- overcurrent in the motor final stage (e.g., triggered by energy recover if the brake ramp is too steep, correct by supporting the power supply or extending the brake ramp),
- short-circuit in the motor final stage
- failure of field-sided 24 V (for version 750-636/000-700 differentiated by motor and logic supply).

In each case, the drive is turned off automatically and cannot be restarted until the malfunction has been corrected.

5.6 Operating Modes for Positioning

The operating modes for setting the drive are divided into basic and auto mode. The following table illustrates the configuration conditions for the selection of the corresponding operating mode.

Source	Name	Description
Configuration parameter	Overtravel	Minimum drive distance for gearbox clearance compensation. The sign determines the direction from which the setpoint position is to be approached.
Configuration parameter	Retry	Number of permitted repetitions in case of bad positioning.
Control byte	Optimize_ON	'Optimize_ON' initializes the prestop value during positioning at every stop using the determined braking distance.

Mode		Over-travel	Retry	Enable 'Optimize'	Comment
Base		0	0	0	Drive until it is stopped or until the setpoint position is reached. If Prestop <> 0, then it is decelerated in prestop increments before the setpoint position.
Auto	A	0	0	1	Prestop value is updated using the braking distance
	B	0	n	0	Maximum number (n) of positioning attempts. (Optimize_ON = 0)
	C	0	n	1	Maximum n of positioning attempts. (Optimize_ON = 1)
	D	<> 0	0	0	One drive while considering the gearbox clearance and the drive direction. (Optimize_ON = 0)
	E	<> 0	0	1	One drive while considering the gearbox clearance and the drive direction. (Optimize_ON = 1)
	F	<> 0	n	0	Maximum n of positioning attempts while considering the gearbox clearance and the drive direction. (Optimize_ON = 0)
	G	<> 0	n	1	Maximum n of positioning attempts while considering the gearbox clearance and the drive direction. (Optimize_ON = 1)

5.7 Prestop

Prestop increases the positioning accuracy in both base and auto modes. Every drive direction has its own prestop value. The direction-dependent value is considered during the positioning process to determine the stop or deceleration position.

If "Optimize_ON" = 1, the prestop is determined at every stop as a function of the braking distance. When moving to a position while "Optimize_ON" = 1 in the optimized auto mode, or with gearbox clearance compensation, the new prestop value is written into the corresponding module's RAM registers and is then available to the positioning interface as an updated value for the next drive.

If "Optimize_ON" = 0, the prestop value is not written back, but the current value of the corresponding RAM register is taken into account. In this operating mode, the higher-level PLC can optimize values in the RAM registers via parameter channel — depending on the application.

5.8 Base mode

For the following examples, it is presumed the acceleration distance and the braking distance are equal.

Abbreviations used:

IP	Actual position	BD	Braking Distance	RT	Retry
SP	Setpoint position	AD	Acceleration Distance	PU	Prestop Up (RAM Register)
OT	Overtravel	BM	Base mode	PD	Prestop Down (RAM Register)
AP	Motor turn-off position	AM	Auto mode	D	Distance
HP	Holding position	OZ	Optimize	V	Value

Example 1:

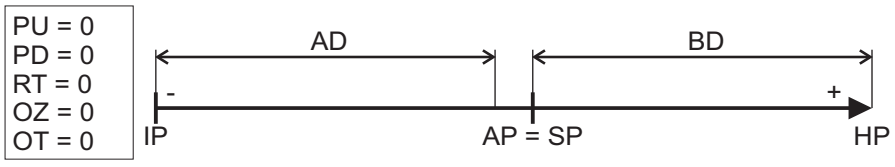


Fig. 5.2.2-1: Example 1 g063610x

Zero (0) initializes the prestop. The motor turn-off position equals setpoint position. The setpoint position is overtravelled by the braking distance.

Example 2:

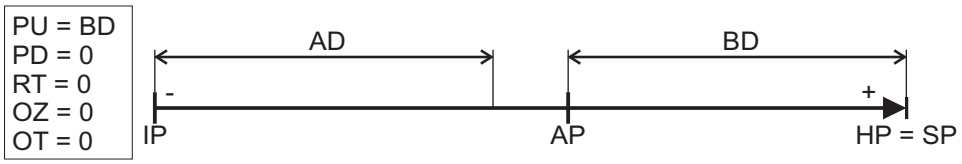


Fig. 5.2.2-2: Example 2 g063611x

The braking distance initializes the prestop. The motor turn-off position is below the setpoint position. Due to the prestop, the stop position is exactly the setpoint position.

Example 3:

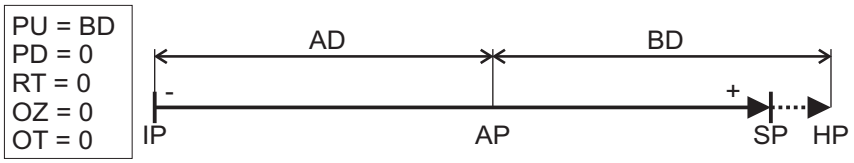


Fig. 5.2.2-3: Example 3 g063612x

The short distance to the setpoint position (SP-IP) < (AD+BD) has made it impossible to precisely reach the setpoint position, despite the prestop being set correctly.

NOTICE:
The program prevents the acceleration phase in both the base and auto modes from being stopped prematurely. This mainly affects a ramp drive.

5.9 Auto mode

For the following examples, it is presumed that the acceleration and the brake path have the same distance.

Abbreviations used:

IP	Actual position	BD	Braking Distance	RT	Retry
SP	Setpoint position	AD	Acceleration Distance	PU	Prestop Up (RAM Register)
OT	Overtravel	BM	Base mode	PD	Prestop Down (RAM Register)
AP	Motor turn-off position	AM	Auto mode	D	Distance
HP	Holding position	OZ	Optimize	V	Value

5.9.1 Positioning with activated optimization

Example 4:

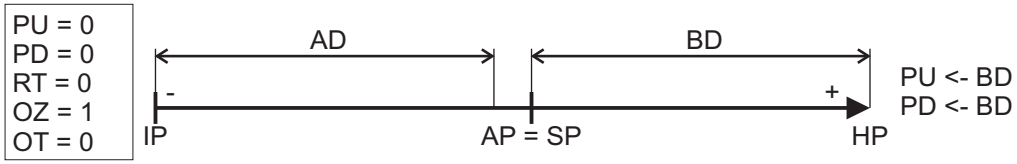


Fig. 5.9.1-1: Example 4 g063613x

Zero (0) initializes the prestop for the Up direction. The motor turn-off position equals setpoint position. The setpoint position is overtravelled by the braking distance and, due to the enabled optimization, the braking distance in the Up direction initializes the prestop. Furthermore, the braking distance also initializes the prestop for the Down direction because it is still 0. The following positioning approaches in Down direction will not require calibration.

Example 5:

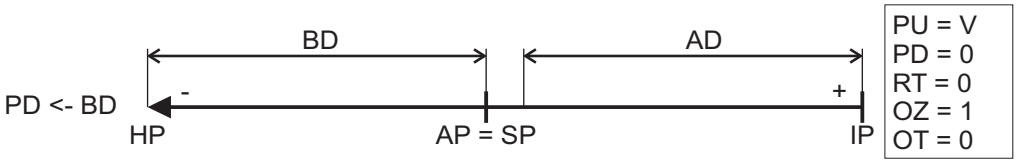


Fig. 5.9.1-2: Example 5 g063614x

Zero (0) initializes the prestop for the Down direction. The motor turn-off position equals the setpoint position. The setpoint position is overtravelled by the braking distance and, due to the enabled optimization, the braking distance in Down direction initializes the prestop.

NOTICE:
In this case, the prestop for the Up direction is not set because it already has a valid value.

5.9.2 Positioning with Enabled Optimization and Retry Not Equal to 0 (Loop Traverse)

Example 6:

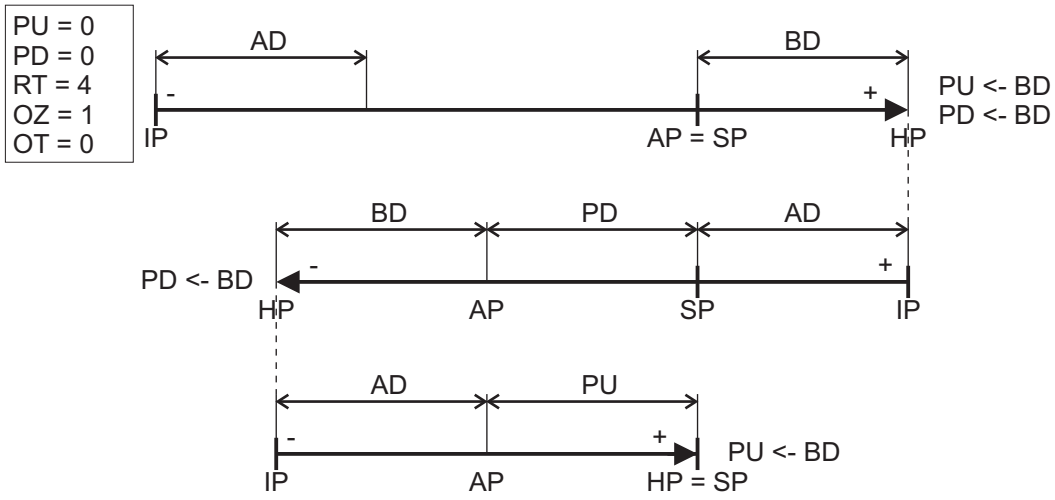


Fig. 5.9.2-1: Example 6 g063615x

Zero (0) initializes the prestop for the Up and Down directions and the actual position is below the setpoint position. At least 1 repetition is required for positioning. First, the prestop value for the Up direction must be determined and the setpoint position must be reached. Furthermore, the braking distance also initializes the prestop for the Down direction because it is still 0. If this assignment was not made, this example would require another repetition.

5.9.3 Positioning with Enabled Optimization and too Short Distance

Example 7:

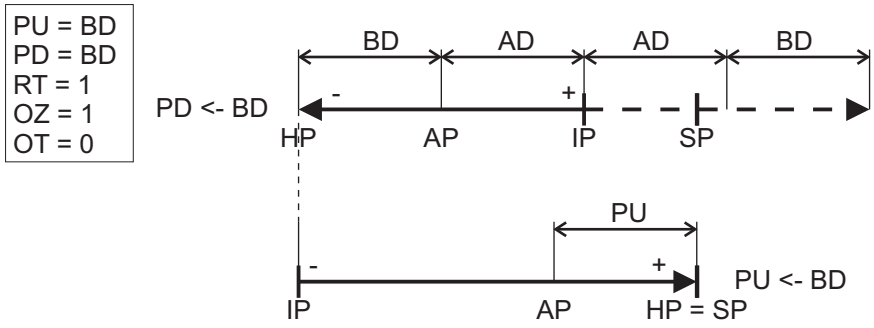


Fig. 5.9.3-1: Example 7 g063616x

The prestops for the Up and Down direction are initialized and the actual position is below the setpoint position. It is now detected that the distance to the setpoint position is too short to be reached directly. Since the retry is initialized with 1 in order to compensate for overtravel. If retry is initialized with 0, the setpoint position approach is made immediately even if the result of this approach may be worse than without driving cycle.

5.9.4 Positioning with negatively initialized overtravel

Example 8:

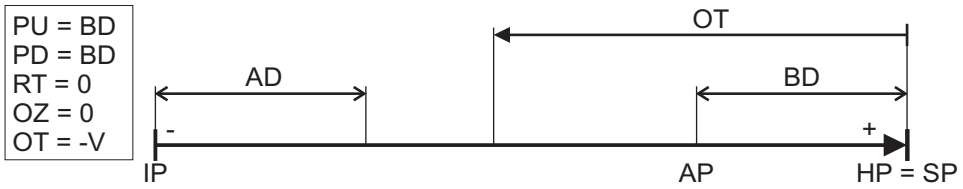


Fig. 5.9.4-1: Example 8 g063617x

The negatively initialized overtravel forces the setpoint position to be approached from below.
The approach position is generated by adding setpoint position (SP) and overtravel (OT).

Example: SP = 1000, OT = -200 → Approach position = 800.

In this example, the actual position is further below the setpoint position than the absolute value of the overtravel; the setpoint position can be reached within the first moving cycle.

Example 9:

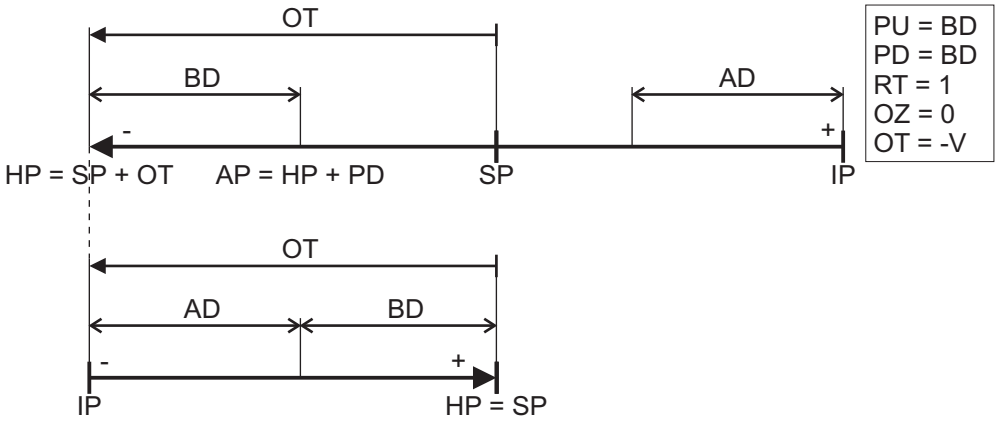


Fig. 5.9.4-2: Example 9 g063618x

In example 9, the actual position is above the setpoint position. The drive must overtravel the setpoint position by the amount of the overtravel value, in order to approach the setpoint position from below. However, exact positioning is only possible if the acceleration distance does not exceed the braking distance and if the absolute value of the overtravel is at least twice as large as the braking distance. If this is not the case, please see section 5.9.5, “Positioning with positively initialized overtravel” in order to find out what must be considered.

5.9.5 Positioning with positively initialized overtravel

Example 10:

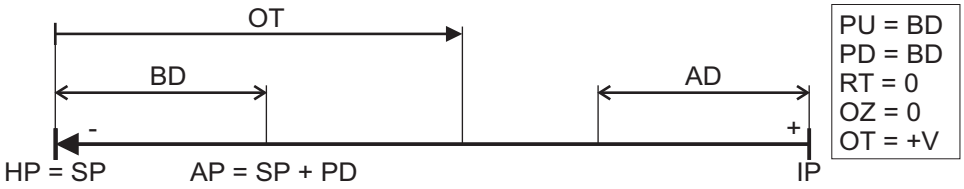


Fig. 5.9.5-1: Example 10 g063619x

The positively initialized overtravel forces the setpoint position to be approached from above. In example 10, the actual position is further above the setpoint position than the absolute value of the overtravel. Thus the setpoint position can be reached within the first moving cycle.

Example 11:

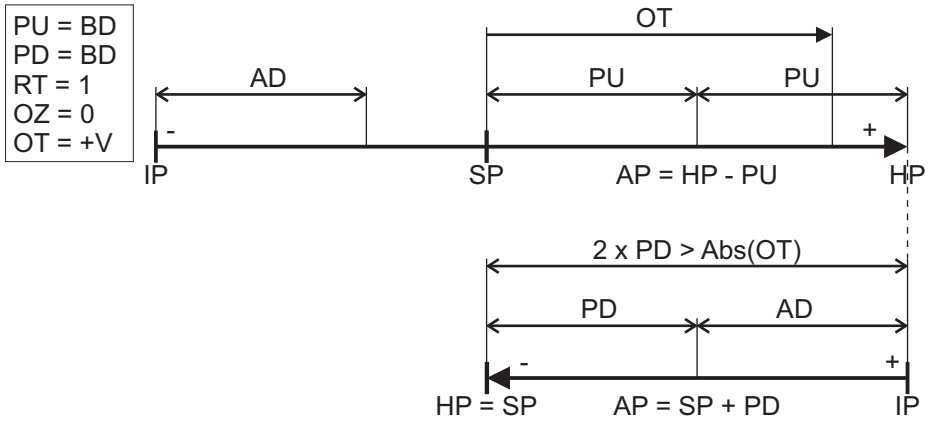


Fig. 5.9.5-2: Example 11 g063620x

In example 11, the actual position is below the setpoint position. The drive should now overtravel the setpoint position by the amount of the absolute overtravel value. It is detected, however, that the absolute overtravel value is not at least twice as large as the current prestop value for the Down direction. In order to compensate for this, the setpoint position is overtravelled by a greater distance than the given overtravel so that the first setpoint position approach of the moving cycle can be successful.

5.9.6 Positioning with negatively initialized overtravel at too little distance

Example 12:

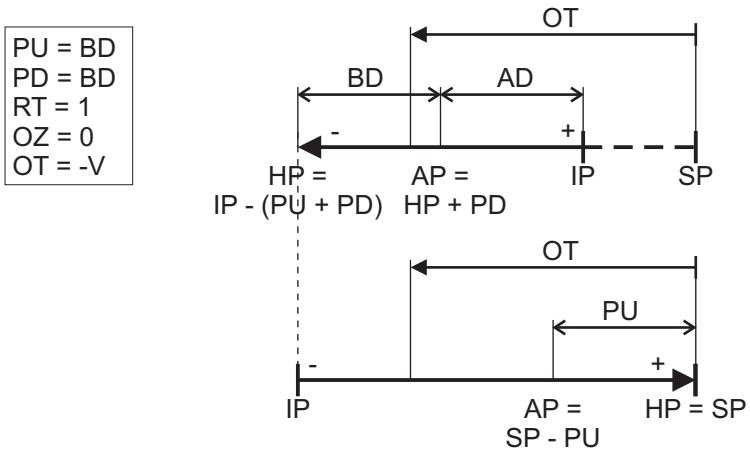


Fig. 5.9.6-1: Example 12 g063621x

The negatively initialized overtravel forces the setpoint position to be approached from below. It is detected that the distance to the setpoint position is smaller than the absolute value of the overtravel. The actual position is below the setpoint position; however, it is not far enough for successful positioning. Therefore, the first moving cycle increases the distance to the setpoint position; afterward, the setpoint position is approached.

5.10 Setpoint change on the fly

If during an active positioning motion the setpoint position is changed in the process image, the terminal should react. If this new setpoint position is in direction of the motion, the terminal will attempt to reach this position with an intermediate stop. The earliest possible time for this evaluation is after the conclusion of the acceleration or softstart phase. Furthermore, the distance will be examined for its compliance with the configured approach criteria. If this is not the case, or the new setpoint position is in an opposite direction, the drive will stop. If so, the determined brake path for the current direction of motion is not copied to the corresponding RAM register. If the configured retry counter for the maximum admissible retries is set to 0, the positioning process is terminated and a positioning failure is output. In all other cases, the first retry attempt to reach the new setpoint position will begin.

Example 13:

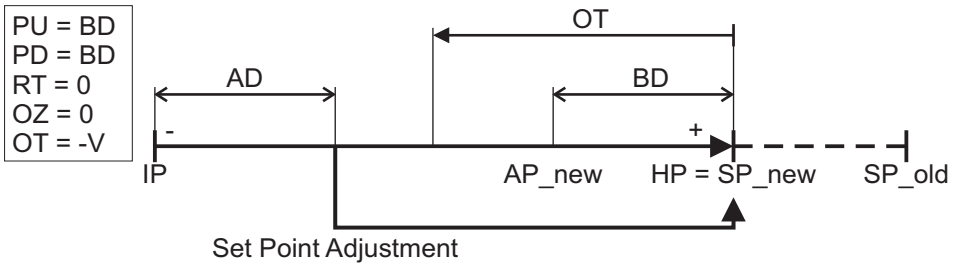


Fig. 5.9.6-1: Example 13 g063622e

The I/O module detects that it is possible to approach the new setpoint position and continues the positioning process.

Example 14:

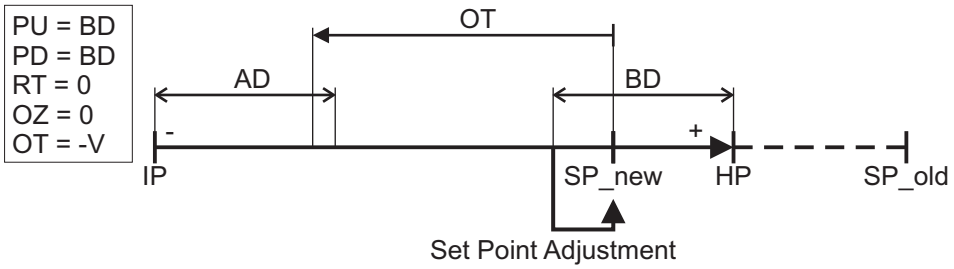


Fig. 5.9.6-2: Example 14 g063623e

In this example, the distance to the new setpoint position is too small for successful positioning. The process is stopped and no further positioning attempts are made as the retry counter is initialized with 0. Example 9 shows the re-positioning of SP_new.

5.11 PWM Control during Positioning

5.11.1 General

It is possible to enable PWM control independently of the drive mode. Basically, PWM control will have no impact on the direction and the number of moving cycles during the positioning process. It is, in fact, possible to control the revolution speed or the torque during a moving cycle using PWM control.

In order to illustrate the positioning process via PWM control, the moving cycle is divided up into five phases:

Phase	Function
P1	Start ramp
P2	Current limiting phase (CurrentLimit_PWM)
P3	Approach at high speed
P4	Approach at lower speed (creep feed)
P5	Deceleration ramp

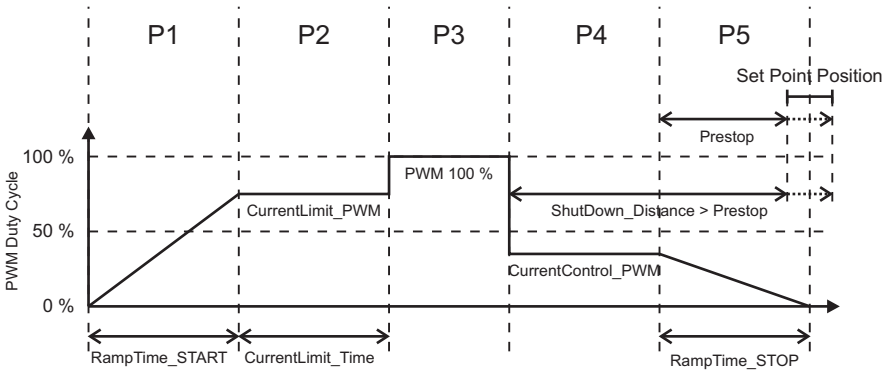


Fig. 5.11.1-1: Division of the moving cycle g063624e

P1:

Phase P1 only exists if a soft start is configured via parameter RampTime_START. Without ramp, this phase has a runtime of 0 s so that the revolution speed only increases in phase P2 or even phase P3.

P2:

Phase P2 is defined by the two parameters CurrentLimit_PWM and CurrentLimit_Time. CurrentLimit_PWM defines the pulse duty cycle of the final stage trigger signal and CurrentLimit_Time defines the duration of Phase P2.

P3:

The duration of phase P3 results from the total duration and the subtraction of all other phases: P3 = Ptot –(P1 + P2 + P4 + P5).

P4:

A waypoint in the direction of travel before the setpoint position determines the start of phase P4. The waypoint is always calculated from the ShutDown_Distance parameter, relative to the setpoint position. The pulse duty cycle for PWM of phase P4 is set via CurrentControl_PWM parameter.

P5:

Phase P5 defines the deceleration ramp and is set via RampTime_STOP parameter. If its value is 0, the process is stopped immediately according to StopMode.

Additionally, it is possible to enable CurrentControl_PWM during a ‘MovePos’ or ‘MoveNeg’ approach via CurrentControl_ON=1 control bit. This can also be done during a positioning drive in phase P3.

5.11.2 Drive Versions Including Change to Lower Speed

Example 15, "ShutDown_Distance is reached in phase P3":

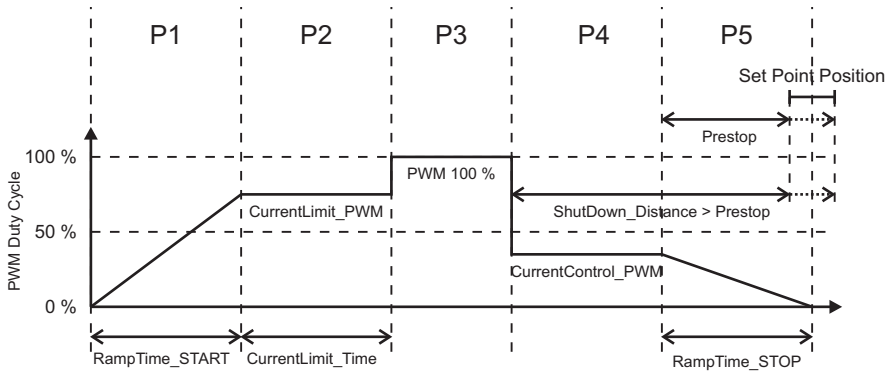


Fig. 5.11.2-1: Example 15, "ShutDown_Distance is reached in phase P3" g063624e

In this example, the individual phases do not overlap due to configuration and are executed sequentially from P1 to P5. If the distance between the start position and the setpoint position decreases, phase 3, and even phase 2, may be skipped by the moving cycle. The following two figures illustrate this example. The CurrentControl_ON control bit is disabled.

Example 16, "ShutDown_Distance is reached in phase P2":

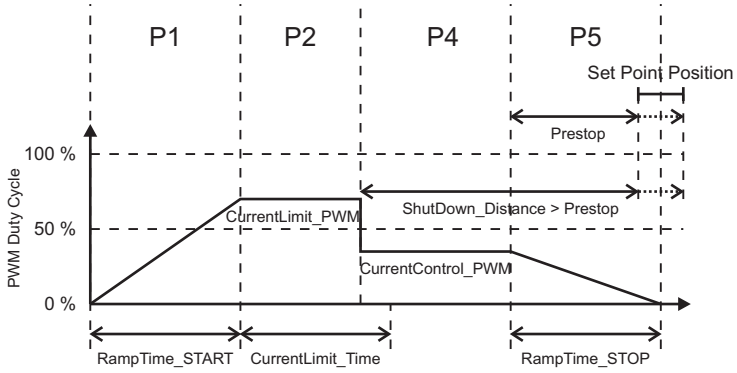


Fig. 5.11.2-2: Example 16, "ShutDown_Distance is reached in phase P2" g063625e

The waypoint that starts phase 4, which is defined by the ShutDown_Distance, is reached before phase P2 is completed. In this example, phase P2 may be terminated prematurely.

Example 17, "ShutDown_Distance is reached in phase P1":

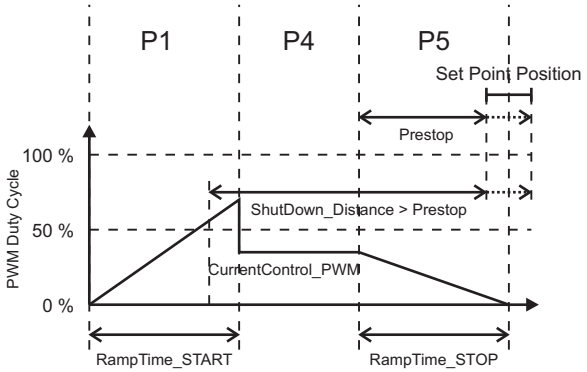


Fig. 5.11.2-3: Example 17, "ShutDown_Distance is reached in phase P1" g063626e

The waypoint that is supposed to start phase P4 is already in phase P1. However, since it is not allowed to interrupt the start ramp for the soft start, phase P4 may only be started after the elapse of the configured RampTime_START. Phases P2 and P3 are skipped.

NOTICE:
If the distance between the start and setpoint positions becomes shorter than the actual distance that can be covered, as based on the RampTime_Start and RampTime_Stop runtime, then phase P4 will be skipped.

Example 18, "Approach without CurrentControl_PWM":

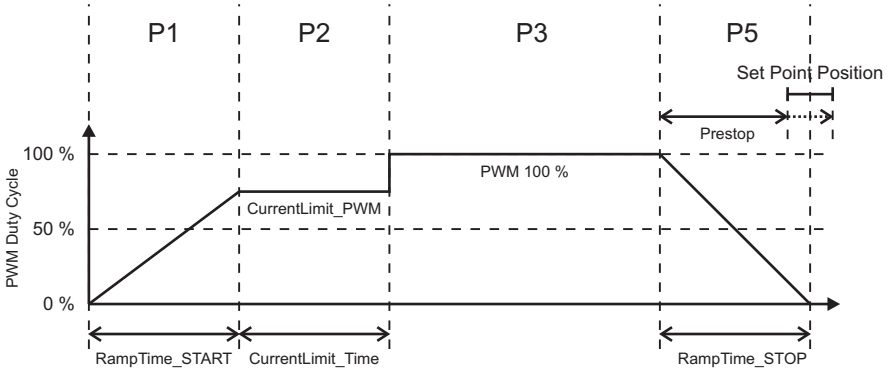


Fig. 5.11.2-4: Example 18, "Approach without CurrentControl_PWM" g063627e

A positioning operation without phase P4 or CurrentControl is possible if the ShutDown_Distance value is set to 0. Another reason for the absence of phase P4 could be that the direction-dependent prestop is at least the length of the configured ShutDown_Distance (ShutDown_Distance <= Prestop).

The following examples utilize the CurrentControl_ON control bit. It can be set, or reset, at any time during the moving cycle; however, it is only effective during phase P3.

Example 19, "Approach with CurrentControl_PWM = f(Control.CurrentControl_ON), Version 1":

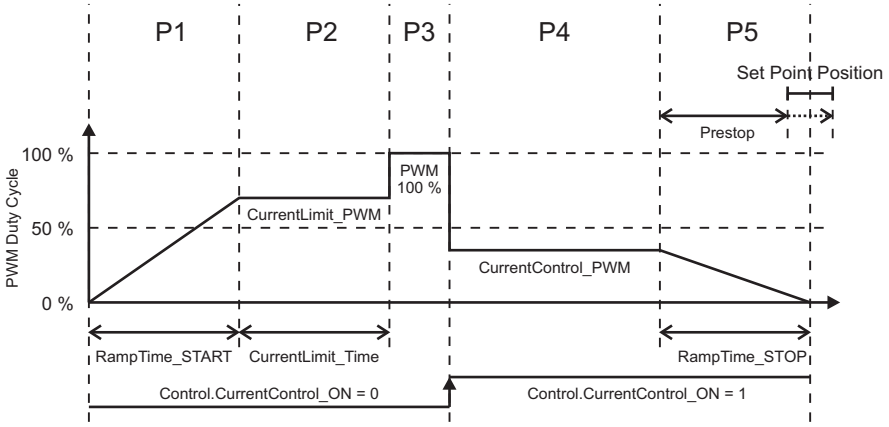


Fig. 5.11.2-5: Example 19, "Approach with CurrentControl_PWM = f(Control.CurrentControl_ON), Version 1" g063628e

The CurrentControl_ON can switch on CurrentControl_PWM after the start of phase P3, as well as switch it off again.

Example 20, "Approach with CurrentControl_PWM = f(CurrentControl_ON), Version 2":

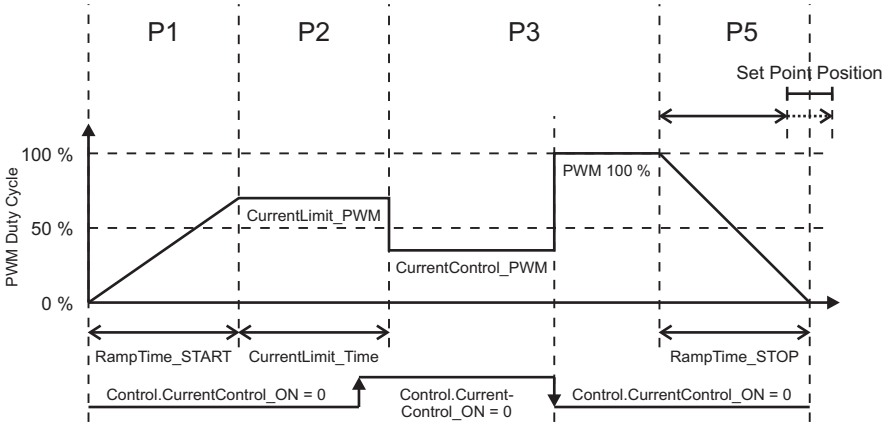


Fig. 5.11.2-6: Example 19, "Approach with CurrentControl_PWM = f(CurrentControl_ON), Version 2" g063629e

CurrentControl_ON=1 is already set during phase P2. Phase P2 must not be interrupted prematurely, just as shown in the example figure 3 10 (ShutDown_Distance in P2). Using CurrentControl_ON, it is possible to start phase P3 with CurrentControl_PWM after the elapse of CurrentLimit_Time. Please note that the PWM can be set to 100 % by resetting CurrentControl_ON during phase P3.

5.12 Swing-Back Drives with Subsequent Setpoint Position Drive

The module only starts a stop from the CurrentControl_PWM or the maximum speed, but never from the CurrentLimit_PWM. This should be taken into account when designing the project. The result is a positioning process optimized for time or distance. The swing-back drive takes into account both phase P1 and phase P2. For particularly slow loads, Increase_Swing_Back (swing-back extension) should be increased based on the factor. This causes an artificial extension of the swing-back drive, so that the drive can achieve its maximum speed or the configured CurrentControl_PWM speed before the setpoint position drive is introduced. If this is not taken into account in the project design, the positioning process may not be optimized for time and distance in all process situations.

Again here, if the acceleration distance is shorter than the braking distance, then the value of the braking distances is used for the acceleration distance.

Swing-back distance =
((acceleration distance + braking distance) * 110%) * (100% + X%)

NOTICE:
The swing-back distance is used as an indicator to determine whether the drive is far enough away from the setpoint position to be able to reach it. This involves the decision whether a setpoint position or swing-back drive has to be started.

5.12.1 Definition of the Swing-Back Drives

In the representation below, no CurrentControl_PWM is enabled because ShutDown_Distance is not enabled, and the drive is always stopped from 100% PWM with large setpoint position drives (red line). So that the 100% PWM phase is also reached for short distances during a positioning process, the represented swing-back drive is always executed at a minimum (blue line).

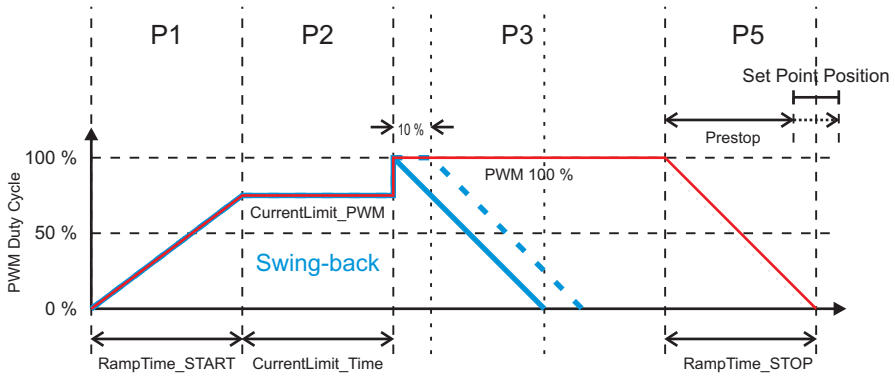


Fig. 5.12.1-1: Example 19, "Braking from 100% PWM" g063630e

A similar behavior appears when the phase P4 has to be driven with CurrentControl_PWM based on a configured ShutDown_Distance. In this case, it is not stopped from 100% PWM, but always from CurrentControl_PWM. The shortest executed swing-back drive is represented in the graphic below (blue line).

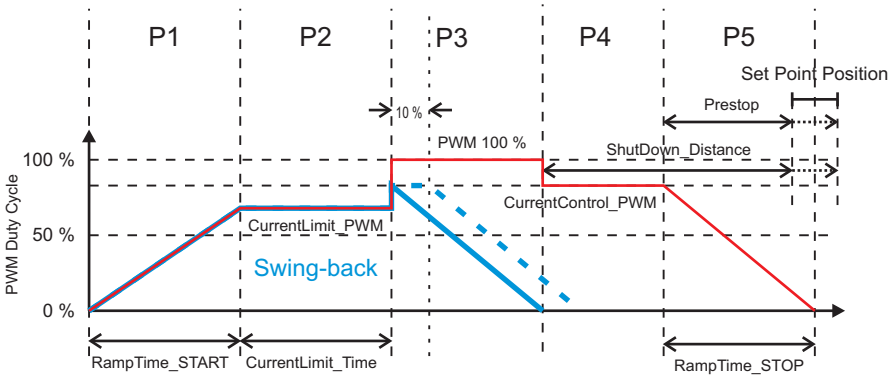


Fig. 5.12.1-2: Example 19, "Braking from CurrentControl_PWM (CurrentControl_PWM > CurrentLimit_PWM)"
g063631e

If CurrentControl_PWM is smaller than CurrentLimit_PWM, then the drive travels during the acceleration phase P2 with CurrentControl_PWM.

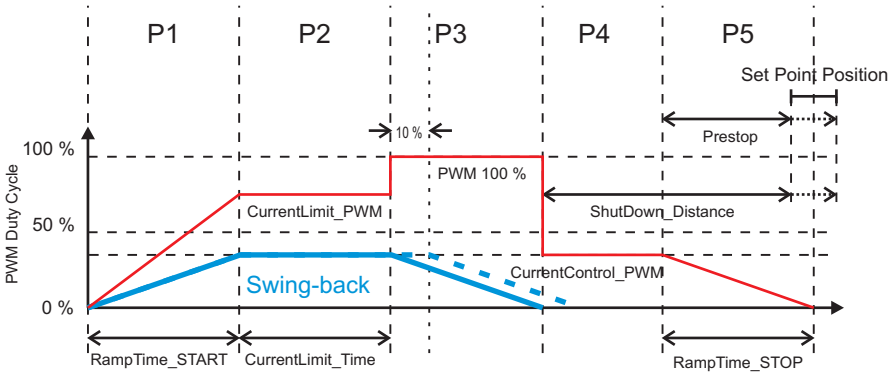


Fig. 5.12.1-3: Example 19, "Braking from CurrentControl_PWM (CurrentControl_PWM < CurrentLimit_PWM)"
g063632e

5.12.2 Calculating the Acceleration Distance

The acceleration distance is only defined for a setpoint position drive.

The basis for calculating the acceleration distance depends on which phase or phase sequence is used to start a setpoint position drive.

The following table provides an overview of the possible acceleration variants:

Phase Phase sequence	X1	X2	Acceleration distance
P1 + P3	P1 Start	P1 end	X2 – X1
P2 + P3	P2 Start	P2 end	X2 – X1
P1 + P2 + P3	P1 Start	P2 end	X2 – X1
P3	not available	not available	= braking distance

5.12.3 Calculating a Swing-Back Drive

The target position of a swing-back drive is determined relative to the setpoint position and the distance to the setpoint position is calculated from the sum of the acceleration and braking distance (plus 10% safety margin). The braking distance corresponds to the prestop and is determined separately for the negative and positive rotation direction for each braking process. For a subsequent setpoint position drive, it is always known at what distance the motor has to be shut down before the setpoint position to come to a stop in the immediate area or at the setpoint position exactly.

The swing-back drives to be used and described in Section 1.2.1, "Definition of the Swing-Back Drives" ensure that the braking distance and subsequently determined prestop stay nearly unchanged in the braking moment due to the ever-constant speed.

However, if the mechanical damping of the system changes, a new prestop then has to be determined. This situation is apparent by a swing-back drive occurring after unsuccessfully completing a setpoint position drive. Ideally, the subsequent drive should again hit the setpoint position. If the damping of the system changes constantly, then a new prestop also has to be constantly determined.

If you now consider the second summand, the acceleration distance which determines the total of a swing-back drive, then you have to proceed from the same considerations as in considering the braking distance. The acceleration distance is defined from the standstill to the end of the start ramp. It certainly does not correspond to the real mechanical acceleration distance and should be viewed as an acceptable compromise.

5.13 Standstill Condition

During the execution of the motion commands, the braking distance of the drive is determined at every stop. The braking distance is covered when the module detects the motor standstill via missing incremental encoder pulses. Observation of the standstill is also done during an inactive drive cycle. In both cases, the result is displayed in the module status of the process image.

Based on the information in section 5.14, “Maximum Pulse Frequency of the Incremental Encoder” regarding the maximum number of pulses of the DC

drive controller, the following illustration was created to depict the revolution speed in pulses for different incremental encoders.

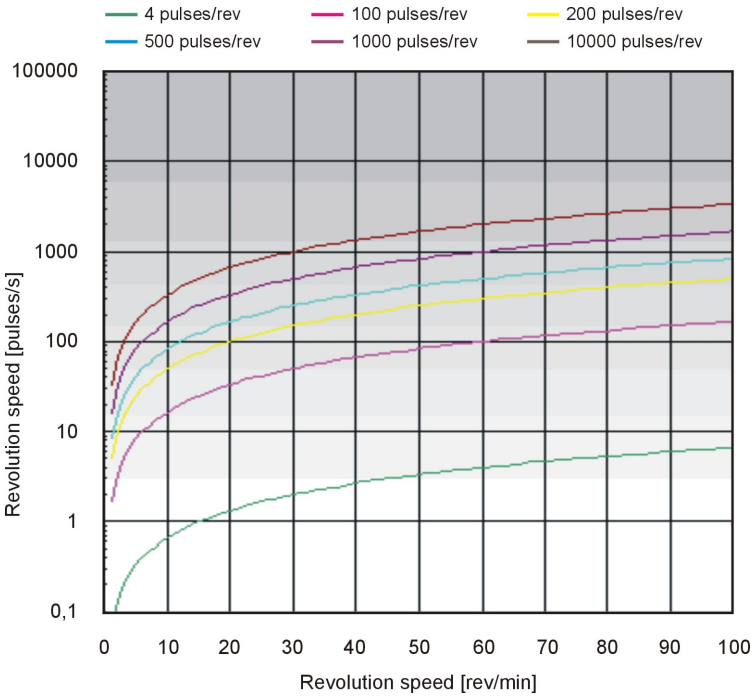


Fig. 5.12.3-1: Revolution speed in pulses p036305e

Example: 2 pulses per acquistion interval

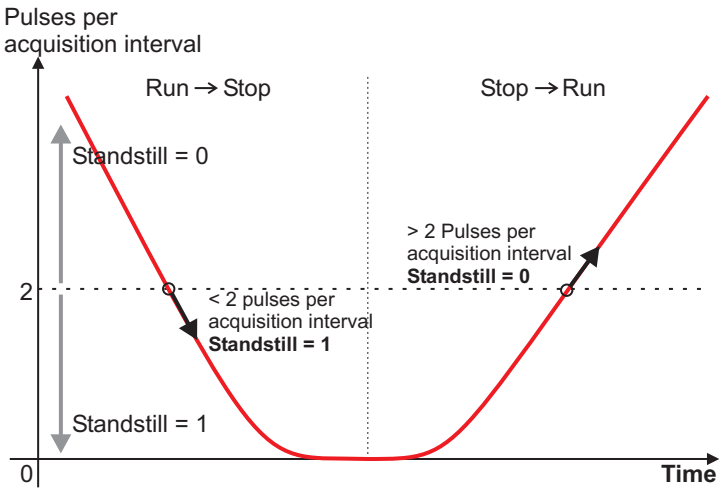


Fig. 5.12.3-2: Revolution speed in pulses g07500636_Standstill_en

Regarding positioning quality, smaller limit values lead to smaller positioning errors (especially with a large centrifugal mass or encoders that have a higher resolution), but also to a longer total time for the positioning operation.

5.14 Maximum Pulse Frequency of the Incremental Encoder

Common 24 V DC collector motors normally have a maximum revolution speed of approximately 4,600 min^{-1}. Common incremental encoders provide

1 … 10,000 pulses/rev max. The module's encoder inputs can capture a maximum of 50,000 pulses per second.

Assuming a revolution speed of 4,600 min^{-1} and 50,000 pulses per second, the incremental encoder should provide a maximum of 652 pulses/rev. Encoders with 512 pulses per second normally meet the requirements of DC motor applications.

The following diagram illustrates the connection between revolution speed and the maximum admissible number of pulses/rev of the incremental encoder.
To avoid overloading the quadrature decoder/counter, it is essential for the incremental encoder to function below the maximum value for pulses/rev.

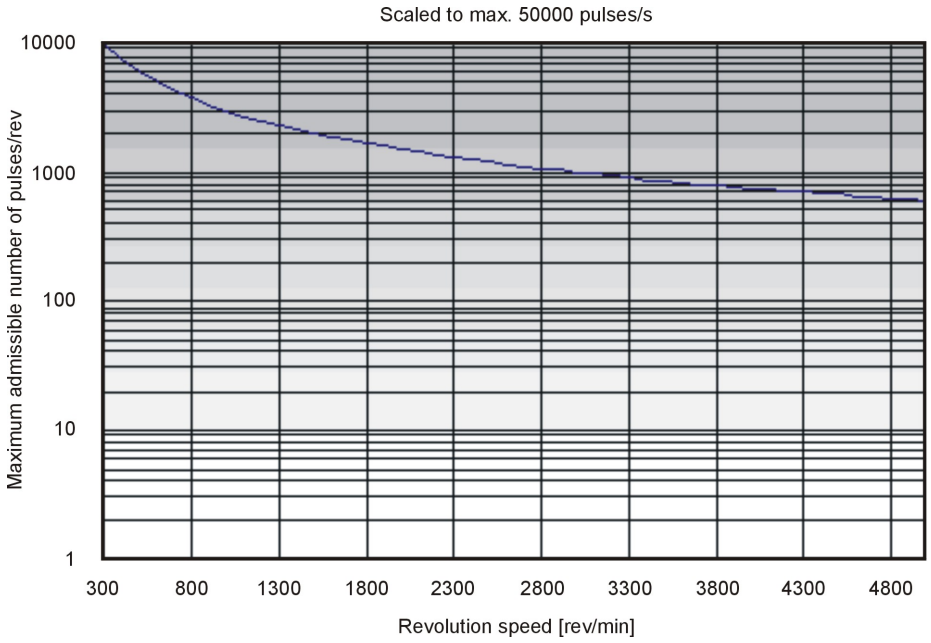


Fig. 5.12.3-1: Maximum number of pulses/revolution p036306e

6 Configuration of the I/O Module via the Parameter Channel

Defined parameters indexed via parameter addresses configure the I/O module with the parameter channel. General parameter addresses (system parameters) and I/O module-specific parameter addresses are differentiated.

6.1 General Parameter Data (System Parameter Range)

The following parameters/parameter addresses are defined to access the system parameters of the I/O module:

Parameter	Description	Parameter address	Access
RESERVED	Reserved for expansions	250...253	R/W
TIMEOUT	This parameter contains the maximum permissible time in milliseconds that can elapse for the transfer of the parameter set. If TIMEOUT = 0, the monitoring time is infinite.	254	R/W
NO_OF_PRMS	Number of words (parameter data) of the I/O module	255	R
SET_DEFAULT_PRMS	The I/O module is reset to factory settings		W

6.2 I/O module-specific Parameter Data

The following parameters and parameter addresses are defined for the DC drive controller:

Parameter	Description	Parameter address	Register
RampTime_START	Length of the start ramp	0	35
RampTime_STOP	Length of the stop ramp		
Prestop_Pos	Prestop value for approach in positive direction	1	36
Prestop_Neg	Prestop value for approach in negative direction	2	37
Target_Window	Tolerance range setpoint position	3	38
Standstill_Limit	Maximum revolution speed for standstill	4	39
EnginePowerSupply	Selection of motor voltage		
IncScale	1x, 2x or 4x evaluation of quadrature pulses		
Positioning_Retry	Maximum number of retries		
Z_Input_Enable	Enabling the Z input for the preset function		
Stopmode_PwrUp	Idle/Deceleration during supply voltage failure		
PresetValue	Preset value (HighWord)	5	40
	Preset value (LowWord)	6	41
Overtravel	Distance and direction for gearbox clearance compensation	7	42
Triggermode_Inputs	Input sensitivity of digital inputs	8	43
Stopmode	Change of braking characteristics		
DirectionReversal _Delay	Delay of rotating direction reversal		
Filter_Time	Debouncing times of digital inputs	9	44
ShutDown_Distance	Starting distance CurrentControl_PWM (HighWord)	10	45
	Starting distance CurrentControl_PWM (LowWord)	11	46
CurrentLimit_PWM	Pulse duty cycle for PWM signal	12	47
CurrentControl_PWM	Pulse duty cycle for PWM signal		
CurrentLimit_Time	On-time of CurrentLimit_PWM	13	48
MotionDetection Timeout	Maximum waiting time until the first incremental encoder pulse		

Parameter	Description	Parameter address	Register
Brakemode	Selection of Brake mode	14	49
Stopmode_Entry	Transition to Stop Mode		
Increase_Swing_Back	Extending a swing-back drive	15	50
Extended_Infos	Reflection of information given in the expanded status bytes S2 and S3	16	51
Swing_Back_Distance	Display of current swing-back distance	17	52

The following tables show the assignment and the factory setting of the parameters.

6.2.1 RampTime_START, RampTime_STOP

Parameter address	Function	Access	Factory setting
0	RampTime_START, RampTime_STOP	R/W	0x4040
Bit 0 ... 7: Duration of the start ramp [0 ... 255] This value defines the duration of the start ramp to limit the current or “jerky” movements during the start-up phase. The duration of the start ramp determines the standard start behavior, enabling the start of the motor with or without soft start. For a soft start, the implemented ramp function is used, taking the configured ramp duration into account. The ramp is executed when the configured value is not equal to 0. The format of the parameter is an 8-bit wide unsigned integer in the value range of 0 to 255.			
0:	No ramp		
1 ... 255:	Ramp duration 25 ms ... 6375 ms		
64:*	Default ramp duration 1600 ms		
Bit 8 ... 15: Duration of the stop ramp [0...255] This value defines the duration of the stop ramp to limit the current or “jerky” movements during the deceleration phase. The parameterized ramp duration also determines the behavior of the exception stop. The ramp is executed when the configured value is not equal to 0. The format of the parameter is an 8-bit wide unsigned integer in the value range of 0 to 255.			
0:	No ramp		
1 ... 255:	Ramp duration 25 ms ... 6375 ms		
64:*	Default ramp duration 1600 ms		
* Factory setting			

6.2.2 Prestop_Pos

Parameter address	Function	Access	Factory setting
1	Prestop_Pos	R/W	0x0064
Prestop value positive direction [0 ... 65535] The configured value determines the prestop value to be used for optimization during a positioning operation in a positive direction if the option is enabled in the control byte of the process image. The format of the value is the one of a 16-bit wide unsigned integer in the value range of 0 to 65535.			
1 ... 65535:	Prestop value during positioning operations		
100:*	Default prestop value positive direction		
* Factory setting			

6.2.3 Prestop_Neg

Parameter address	Function	Access	Factory setting
2	Prestop_Neg	R/W	0x0064
Prestop value negative direction [0 ... 65535] The configured value determines the prestop value to be used for optimization during a positioning operation in negative direction if the option is enabled in the control byte of the process image. The format of the value is a 16-bit wide unsigned integer in the value range of 0 to 65535.			
1 ... 65535:	Prestop value during positioning operations		
100:*	Default prestop value negative direction		
* Factory setting			

6.2.4 Target_Window

Parameter address	Function	Access	Factory setting
3	Target_Window	R/W	0x000A
Tolerance range [0 ... 65535] The configured value determines the size of the tolerance range during a positioning operation. The range is defined with +/- around the setpoint position. The format of the value is a 16-bit wide unsigned integer in the value range of 0 to 65535.			
0:	Positioning must stop with setpoint position = actual position.		
1 ... 65535:	Positioning can stop within the tolerance range.		
10:*	Default tolerance range		
* Factory setting			

6.2.5 Standstill_Limit, Positioning_Retry, Stopmode_PwrUp

Parameter address	Function	Access	Factory setting
4	Standstill_Limit EnginePowerSupply IncScale Positioning_Retry Z_Input_Enable Stopmode_PwrUp	R/W	0x1405

Bit 0 ... 5: Standstill_Limit [0 ... 58]
This value determines what revolution speed (in pulses per second) is to be considered motor standstill. For more detailed information on the standstill conditions, see section 5.13, “Standstill Condition”.
The smallest acquisition interval is 17ms and corresponds to a value of 58. Lower values increase the acquisition interval. Detection of standstill may be unsteady for incremental encoders with very few pulses per revolution (e.g., 2) and brief acquisition intervals (i.e., Standstill_Limit with higher values). To remedy this, set a lower value for Standstill_Limit.

0:	< 1 pulses/s
1:	1 pulse/s
2 ... 58:	n pulses/s
5:*	5 pulses/s

Bit 6: Reserved

Bit 7: EnginePowerSupply (nur 750-636/000-700)
The module can be operated at motor operating voltage levels less than 24V when this bit is set. In this case, motor voltage monitoring is de-activated.

0:*	Motor voltage = 24 V
1:	Motor voltage < 24 V

Bit 8 … 9: IncScale [0 ... 3]
Evaluation of Quadrature Pulses

0:*	1x evaluation of quadrature pulses
1:	2x evaluation of quadrature pulses
2:	4x evaluation of quadrature pulses
3:	Invalid entry

Bit 10 ... 13: Positioning_Retry [0...15]
Before reporting mispositioning, the module can decide whether or not to initialize another positioning operation, consisting of loop travel and a following setpoint position approach. The parameter described here defines the maximum number of retries. A positioning error is identified if the precision (as defined by the tolerance range) is not achieved.

0:*	No new positioning in case of positioning error
1 ... 15:	Max. number of positioning retries in case of positioning error
5:*	Max. of 5 positioning retries in case of positioning error

Bit 14: Z_Input_Enable (only 750-636) Use this bit to set the parameters such that the preset function is initiated as a function of the Z input. A further prerequisite for automatic execution of the Preset function is that the PresetInput_Enable control bit is set.	
0:*	Preset function via the Preset input. When an edge is detected at the Preset input, the Preset value is assumed at the actual position.
1:	Preset function via the Preset input and the Z input. During the active signal for the Preset input, the Preset value is assumed at the actual position when an edge is detected at the Z input.
Bit 15: Stopmode_PwrUp This bit is used to configure whether the motor final stage will set the motor at idle after module power-up or if it will short circuit the motor coils to 24 V for deceleration.	
0:*	Motor final stage sets motor at idle
1:	Motor final stage decelerates
* Factory setting	

6.2.6 PresetValue

Parameter address	Function	Access	Factory setting
5	PresetValue (HighWord)	R/W	0x0000
6	PresetValue (LowWord)	R/W	0x0000
If the terminal detects the preset condition at the digital preset input during a preset motion, the positioning interface will initialize the actual position with the preset value. The format of this value corresponds to a 32-bit wide integer value (with sign) ranging from: -2147483648 (0x80000000) to +2147483647 (0x7FFFFFFF).			
0x00000000* ... 0xFFFFFFFF	Value range PresetValue		
* Factory setting			

6.2.7 Overtravel

Parameter address	Function	Access	Factory setting
7	Overtravel	R/W	0x0000
The overtravel value (counter increments) determines the distance needed for gearbox clearance compensation and differentiates the travel direction toward the setpoint position during a positioning operation by its sign. The format of the value is a 16-bit wide signed integer in the value range of: -32768 (0x8000) to +32767 (0x7FFF). Overtravel position is setpoint position + overtravel. - Overtravel positive: overtravel position is overtravelled from larger actual values. - Overtravel negative: overtravel position is overtravelled from smaller actual values.			
0:*	Move without overtravel		
-32768 ... -1:	Setpoint position is always approached from below		
+1 ... +32767:	Setpoint position is always approached from above		
* Factory setting			

6.2.8 TriggerMode_Inputs, Stopmode, DirectionReversal_Delay

Parameter address	Function	Access	Factory setting
8	TriggerMode_Inputs Stopmode DirectionReversal_Delay	R/W	0x0A37

Bit 0 ... 3: TriggerMode_Inputs Input sensitivity of the digital inputs	
Bit 0: Input sensitivity digital input E+, level sensitive	
0:*	Enabled LOW (break contact)
1:	Active HIGH (make contact)
Bit 1: Input sensitivity digital input E-, level sensitive	
0:*	Enabled LOW (break contact)
1:	Active HIGH (make contact)
Bit 2: Input sensitivity digital input P, edge sensitive	
0:*	Response to falling edge (break contact)
1:	Response to rising edge (make contact)
Bit 3: Reserved	
Bit 4 ... 7: Stopmode Use these bits to configure whether the motor final stage sets the motor to idle after STANDARD, EXCEPTION or EMERGENCY braking, or whether it short-circuits the motor windings to initiate braking and switches to 24V (750-636) or to the motor voltage potential UA (750-636/000-700). This action is only carried out when a ramp has been selected in the corresponding Brake mode, otherwise the Stop mode is specified by the configured brake properties (mode).	
Bit 4: Stopmode_STANDARD	
0:	Motor final stage sets motor at idle
1:*	Motor final stage decelerates
Bit 5: Stopmode_EXCEPTION	
0:	Motor final stage sets motor at idle
1:*	Motor final stage decelerates
Bit 6: Stopmode_EMERGENCY	
0:*	Motor final stage sets motor at idle
1:	Motor final stage decelerates
Bit 7: Reserved	

Bit 8 ... 15: DirectionReversal_Delay [0 ... 255] The motor interface delays the power-up procedure for n times 10 ms in case of rotation direction reversal.	
0:	No delay in case of rotation direction reversal
1 ... 255:	10 ms to 2550 ms
10:*	Default deceleration 100 ms
* Factory setting	

6.2.9 Filter_Time

Parameter address	Function	Access	Factory setting
9	Filter_Time	R/W	0xAAAA
Filter_Time Debounce time of the digital inputs with n times 3ms.			
Bit 0 ... 3: Debounce time digital input E+ [0...15]			
0:	No software debouncing		
1...15:	Debounce time of 3 ms to 45 ms		
10:*	Default debounce time 30 ms		
Bit 4 ... 7: Debounce time digital input E- [0...15]			
0:	No software debouncing		
1...15:	Debounce time of 3 ms to 45 ms		
10:*	Default debounce time 30 ms		
Bit 8 ... 11: Debounce time digital input P [0...15]			
0:	No software debouncing		
1...15:	Debounce time of 3 ms to 45 ms		
10:*	Default debounce time 30 ms		
Bit 12 ... 13: Debounce time diagnosis signal for final stage (overload) [0 … 3] Extremely short pulses (shorter than the filter period) are counted. The diagnosis signal is also issued if more than 3 pulses occur within one minute.			
0:*	0 ms (no filter)		
1:	0,5 ms		
2:	1 ms		
3:	3 ms		
Bit 14 ... 15: Reserved			
* Factory setting			

6.2.10 ShutDown_Distance

Parameter address	Function	Access	Factory setting
10	ShutDown_Distance (HighWord)	R/W	0x0000
11	ShutDown_Distance (LowWord)	R/W	0x0000
ShutDown_Distance During a positioning operation, it is possible to induce CurrentControl_PWM at the motor final stage n increments before reaching the setpoint position. This value determines the distance to the setpoint position The CurrentControl_PWM function will not be executed should the distance that is configured be smaller than the rotation direction-dependent prestop or 0. Please find more information on CurrentControl_PWM in section 5.11, “PWM Control during Positioning”. The format of the value is a 32-bit wide unsigned integer in the value range of 0 (0x00000000) to +2147483647 (0x7FFFFFFF). Negative values are converted by means of a two's complement before they are processed by the module application.			
0x00000000* ... 0xFFFFFFFF	Value range ShutDown_Distance		
* Factory setting			

6.2.11 CurrentLimit_PWM, CurrentControl_PWM

Parameter address	Function	Access	Factory setting
12	CurrentLimit_PWM CurrentControl_PWM	R/W	0xC8C8

Bit 0 ... 7: CurrentLimit_PWM [0 ... 200]
CurrentLimit_PWM configures a pulse duty cycle for the motor control PWM signal.
The DC drive controller sets the CurrentLimit_PWM for a duty cycle at the motor final stage during the start phase of a positioning operation. The PWM on-time relies on the appropriate CurrentLimit_Time parameter and basically begins at the end of the start ramp. In order to enable the CurrentLimit_PWM function, it is required that the pulse duty cycle is greater than 0 and that CurrentLimit_Time has a value greater than 0.
Please find more information on CurrentLimit_PWM in section 5.11, “PWM Control during Positioning”.

0:	CurrentLimit_PWM function is disabled.
1 ... 200*:	PWM pulse duty cycle 0.5 %...100 % with a resolution of 0.5 %.
201 ... 255:	PWM pulse duty cycle 100 %.

Bit 8 ... 15: CurrentControl_PWM [0 ... 200]
CurrentControl_PWM configures a pulse duty cycle for the motor control PWM signal.
CurrentControl_PWM is set at the motor final stage on two conditions. First, during a ‘MovePos’ or ‘MoveNeg’ positioning operation, the ‘CurrentControl_ON’ control bit is set to high or on certain conditions during a positioning operation.
With the common MovePos and MoveNeg move commands, it is possible to change the CurrentControl_PWM during the positioning operation within the range of 1 %...99 %. To stop the drive safely, it is necessary to cancel the move command and for 100 %, the CurrentControl_ON bit must be reset.
The CurrentControl_PWM reduces the power for the creep feed.
Please find more information on CurrentControl_PWM in section 5.11, “PWM Control during Positioning”.

0:	CurrentControl_PWM function is disabled.
1 ... 200*:	PWM pulse duty cycle 0.5 %...100 % with a resolution 0.5 %
201 ... 255:	PWM pulse duty cycle 100 %

* Factory setting

6.2.12 CurrentLimit_Time, MotionDetectionTimeout

Parameter address	Function	Access	Factory setting
13	CurrentLimit_Time MotionDetectionTimeout	R/W	0x0000
Bit 0 ... 7: CurrentLimit_Time [0 ... 255] CurrentLimit_Time determines the CurrentLimit_PWM on-time during a positioning operation with PWM. Please find more information on CurrentLimit_PWM in section section 5.11, “PWM Control during Positioning”.			
0:*	CurrentLimit_PWM function is disabled		
1 ... 255:	CurrentLimit_PWM function is enabled		
Bit 8 ... 13: MotionDetectionTimeout [0 ... 63] MotionDetectionTimeout configures the maximum wait time until the first incremental encoder pulse. If no pulse is detected within this wait time after the start ramp, the moving cycle is terminated prematurely and the MotionDetectionTimeout message is generated in the status.			
0:*	Monitoring function disabled		
1 ... 63:	Timeout after start ramp 1 s ... 63 s		
Bit 14 ... 15: Reserved			
* Factory setting			

6.2.13 Brakemode, Stopmode_Entry

Parameter address	Function	Access	Factory setting
14	Brake Mode, Stopmode_Entry	R/W	0x0105
Bit 0 ... 5: Brake mode The brake mode determines the brake properties for the motor control. The brake mode distinguishes between Idle, PWM ramp and Brake. The configured action is executed when the turn-off position is reached and ends in the Stop mode.			
Bit 0 ... 1: Brakemode_STANDARD [0 ... 3]			
0:	Motor final stage sets motor at idle		
1:*	Motor final stage sets PWM ramp		
2:	Reserved		
3:	Motor final stage decelerates		
Bit 2 ... 3: Brakemode_EXCEPTION [0 ... 3]			
0:	Motor final stage sets motor at idle		
1:*	Motor final stage sets PWM ramp		
2:	Reserved		
3:	Motor final stage decelerates		
Bit 4 … 5: Brakemode_EMERGENCY [0 ... 3]			
0:*	Motor final stage sets motor at idle		
1:	Motor final stage sets PWM ramp		
2:	Reserved		
3:	Motor final stage decelerates		
Bit 6 ... 7: Reserved			
Bit 8: Stopmode_Entry This setting defines whether entry to the Stop mode is to take place unconditionally after reaching the end of the electrical ramp, or via the Standstill condition.			
0:	without standstill condition		
1:*	with standstill condition		

Bit 9 … 11: Sampling frequency for incremental encoder pulses	
0:*	2 MHz based on a cut-off frequency of 500 kHz
1:	500 kHz based on a cut-off frequency of 125 kHz
2:	250 kHz based on a cut-off frequency of 62,5 kHz
3:	100 kHz based on a cut-off frequency of 25 kHz
4:	50 kHz based on a cut-off frequency of 12,5 kHz
5:	25 kHz based on a cut-off frequency of 6,25 kHz
6:	10 kHz based on a cut-off frequency of 2,5 kHz
7:	5 kHz based on a cut-off frequency of 1,25 kHz
Bit 12 ... 15: Reserved	
* Factory setting	

6.2.14 Increase_Swing_Back

Parameter address	Function	Access	Factory setting
15	Increase_Swing_Back	R/W	0x0000
Bit 0 ... 7: Increase_Swing_Back [0 ... 255] This value is indicated as a percentage at a resolution of 10% within a range of 0 to 2550% for extending a swing-back drive during positioning.			
0 ... 255:	0 % ... 2550% - Percentage of extension of the swing-back drive at a resolution of 10 %		
0:*	Extending the swing-back drive by 0 %		
Bit 7 ... 15: Reserved			
* Factory setting			

6.2.15 Extended_Infos

Parameter address	Function	Access	Factory setting
16	Extended_Infos	R	0x0000
Bit 0 ... 8: Mirroring of informations from extended status bytes S2 and S3. (See section 3.8.3, “Extended Status Bytes” or 4.8.3, “Extended Status Bytes”)			
Bit 0: Overtemperature_Warning			
0:	The temperature is below the warning threshold.		
1:	The temperature has exceeded the warning threshold		
Bit 1: Overtemperature			
0:	The temperature is below the turn-off threshold.		
1:	The temperature has exceeded the turn-off threshold.		
Bit 2: Overflow_Warning			
0:	The actual position is within the limit values.		
1:	The actual position is not within the limit values.		
Bit 3: 24V_OK (depending on the I/O module being used)			
0:	The 24V field power supply has failed. (only for 750-636) A 24V power supply system has failed. (only for 750-636/000-700)		
1:	The 24V field power supply is available. (only for 750-636) Both 24V power supply systems are available. (only for 750-636/000-700)		
Bit 4: Overload			
0:*	No overload error.		
1:	No overload error.		
Bit 5: MotionDetectionTimeout			
0:	Pulses were received within the configured time period.		
1:	No pulses were received within the configured time period.		
Bit 6: Param_Write_Failed			
0:	Parameterization successfully completed.		
1:	Wrong parameters.		
Bit 7: 24V_motor_OK (only 750-636/000-700)			
0:	The24V motor supply voltage has failed.		
1:	The 24V motor supply voltage is available.		
Bit 8: 24V_field_OK (only 750-636/000-700)			
0:	The 24V field power supply has failed.		
1:	The 24V field power supply is available.		
Bit 9 ... 15: Reserved			

6.2.16 Swing_Back_Distance

Parameter address	Function	Access	Factory setting
17	Swing_Back_Distance	R	0x0000
Display of current swing-back distance. The format for this value is one of a 16-bit wide signed integer in the value range of -32768 (0x8000) to +32767 (0x7FFF).			
0x0000 ... 0xFFFF	Value range for Swing_Back_Distance		

6.3 Data channel for parameter exchange

6.3.1 Introduction

A common data channel between the application and the I/O module is used to exchange parameter sets acyclically and have them checked by the complex I/O module. In order to access to all available interfaces of a fieldbus coupler or fieldbus controller, the parameter channel is mapped to the existing register model. Currently, the parameter channel can be operated with the following interfaces:

- control/status byte during the process data exchange
- asynchronous serial interface of the fieldbus coupler/controller (e.g., for **WAGO-I/O-*CHECK***, **WAGO-I/O-*PRO***).

The parameter channel is mapped via registers 56 and 57 of the appropriate table or the appropriate channel. The parameter data is stored word by word in register 56, communication control is done via register 57. The structure for registers 56 and 57 is described in the following sections.

6.3.2 Register Structure

6.3.2.1 Parameter data (register 56)

Register 56 contains the parameter data to be read or written. Depending on the access type, either the I/O module (read parameters) or the fieldbus coupler (write parameters) will write data to the register.

Register 56, parameter channel register 0								
Bit	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Parameter	PRM7	PRM6	PRM5	PRM4	PRM3	PRM2	PRM1	PRM0
Bit	**15**	**14**	**13**	**12**	**11**	**10**	**9**	**8**
Parameter	PRM15	PRM14	PRM13	PRM12	PRM11	PRM10	PRM9	PRM8
PRM0 ... PRM15	Parameter data bit 0 to bit 15							

6.3.2.2 Communication control (register 57)

Parameter channel control and diagnostics are done via register 57.

The following data is written by the application and read by the module:

Register 57, parameter channel register 1								
Bit	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Request parameter	A7	A6	A5	A4	A3	A2	A1	A0
Bit	**15**	**14**	**13**	**12**	**11**	**10**	**9**	**8**
Request parameter	TGL_MS	PRM_RW	MORE_PRM	RES	RES	RES	RES	RES

A0 … A7	0 ... 255:	Word address of the parameter to be read/written.
TGL_MS	0/1:	Toggle bit to release new instructions from the application to the module. If TGL_SM and TGL_MS have the same status, no new instruction has been released yet. If the flags have different statuses, a new instruction has been released and is currently being processed.
PRM_RW	0:	Parameter data of A7...A0 is read
	1:	Parameter data is written to A7...A0
MORE_PRM	0:	End of parameter transmission
	1:	More parameter data to follow
RES	Reserved for expansions	

The following data is written by the module and read by the application

Register 57, parameter channel register 1								
Bit	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Response parameter	A7	A6	A5	A4	A3	A2	A1	A0
Bit	**15**	**14**	**13**	**12**	**11**	**10**	**9**	**8**
Response parameter	TGL_SM	TIMEOUT	BUF_OVF	PRM_ERR	RES	RES	RES	RES

A0 … A7	0 ... 255:	Word address of the parameter to be read/written.
TGL_SM	0/1:	Toggle bit indicating that a parameter sent by the module has been transferred. If TGL_SM and TGL_MS have different statuses, the corresponding instruction is processed by the module. If both flags have the same status, the instruction for the parameter that was sent or requested is completed.
TIMEOUT	0:	The transmission of the parameters has been completed within the stipulated time (parameter address 0).
	1:	The maximum time for the transmission of the parameters between I/O module and application was exceeded.
BUF_OVF	0:	Access of the write or read buffer for the module was permitted.
	1:	Parameters outside the write or read buffer have been accessed.
PRM_ERR	0:	The parameter/all parameters previously transmitted are valid.
	1:	At least one transmitted parameter was defective. The flag can be either set after each parameter is received or after the transmission of the parameters is completed.
RES	Reserved for expansions	

6.4 Register communication

The values are set via control and status bytes C0/S0 for addressing and via control and status bytes C1/S1 and data bytes D0 for the transmission of the values to be set.

NOTICE:
Before writing data to the registers, "0x1235" needs to be written to the password register 31.

The bits 0...5 of the control byte contain the register number.
Bit 6 (R/W) of the control byte sets the access direction (read/write).
To start the register communication, bit 7 (REG_COM) of the control byte is set to "1".

The values to be set are written to the control byte C1 and the output data byte D0 and can be read via the status byte S1 and the input data byte D0.

NOTICE:
After writing to the registers, the set values should be verified by reading the registers.

The corresponding bits of the control byte are mirrored in bits 0...5 and 7 of the status byte.

NOTICE:
After writing to the registers, password register 31 must be reset with "0x0000". Otherwise, write access to these registers is possible until the supply voltage is disconnected.

6.4.1 Control and Status Byte for Register Communication

The following tables show the assignment of the control bytes and status bytes for register communication.

Control byte C0							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
REG_ COM	R/W	Register number					
Register number	Register number of selected function (see Table "Setting Parameters")						
R/W	0: Read access 1: Write access						
REG_ COM	1: Register communication						

The I/O module uses bit 7 (REG_COM) of the status byte S0 to acknowledge the register communication.

Status byte S0							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
REG_ COM	X	Register number					
Register number	Register number for selected function (see Table "Setting Parameters"), mirrored from control byte 0						
REG_ COM	1: Register communication (mirrored from control byte C0)						
X	Reserved						

6.5 Process of Parameter Transmission

The parameter data exchange between the application and module is made via a request/response process. The application initiates an instruction using the toggle bit (TGL_MS != TGL_SM). Afterward, the application polls the communication control register (R57) of the module until the module acknowledges the execution of the instruction (TGL_SM == TGL_MS).

6.5.1 Read/Write Parameters (Module Specific)

Request (application)

Parameter	Value	Indicates:
TGL_MS	!= TGL_SM	Initiate instruction
PRM_RW	= FALSE	Read access
	= TRUE	Write access
MORE_PRM	= FALSE	Parameter data transmission is completed
	= TRUE	More parameter data to follow
A0 ... A7	0 ... (n-1)	Parameter address
PRM0 ... PRM15	0 ... 65535	Parameter data write access

Response (I/O module)

Parameter	Value	Indicates
TGL_SM	== TGL_MS	Instruction completed
A0...A7	0...(n-1)	Address parameter data mirrored
TIMEOUT	FALSE, TRUE	Monitoring time expired
BUF_OFL	FALSE, TRUE	Access outside the module parameter range
PRM_ERR	FALSE, TRUE	Parameter/parameter set error
PRM0 ... PRM15	0 ... 65535	Parameter data read access

The module uses the error flags TIMEOUT, BUF_OV and PRM_ERR to report errors during the parameter data exchange.

After the last parameter data has been sent to the module (MORE_PRM = FALSE), the module checks the entire parameter set and accepts it if everything is correct. Otherwise, the module returns a parameter error (PRM_ERR = TRUE).

6.6 Parameter Data Sets

6.6.1 Available Parameter Data Sets

The module provides three different parameter data sets.

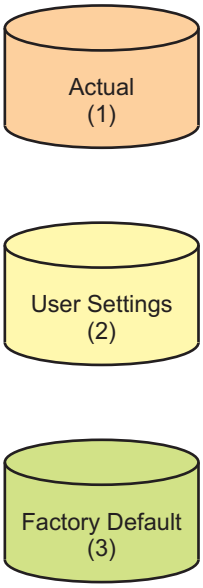


Fig. 6.6.1-1: Parameter data sets 1...3 g063604x

The parameter data sets have the following functions:

Data set number	Description	Description
1	Actual	Current parameters used by the module
2	User Settings	Custom-specific parameter settings
3	Factory Default	Manufacturer-specific parameter settings

6.6.1.1 Actual (1)

The Actual (1) parameter data set contains the parameters the module uses. The parameter data set Actual (1) is copied 1:1 from the parameter data set User Settings (2) upon module system start; i.e., after power-up or after a module reset.

6.6.1.2 User Settings (2)

The parameter data set User Settings (2) offers the user the possibility to permanently store runtime parameters in the module and to reload them, if necessary.

6.6.1.3 Factory Default (3)

The parameter data set Factory Default (3) offers users the possibility to load a parameter set that allows for a well-defined operating state of the module, if necessary.

6.6.2 Password Protection

In order to save the parameter data set User Settings (2), enter password 0x1235 into register 31.

NOTICE:
The module does not automatically reset passwords. Without another write command to register 31, they will remain valid until the power down.

The parameter data set Factory Default (3) may be only modified (written/changed) by WAGO Kontakttechnik GmbH & Co. KG.

6.6.3 Changing the Parameter Data Sets

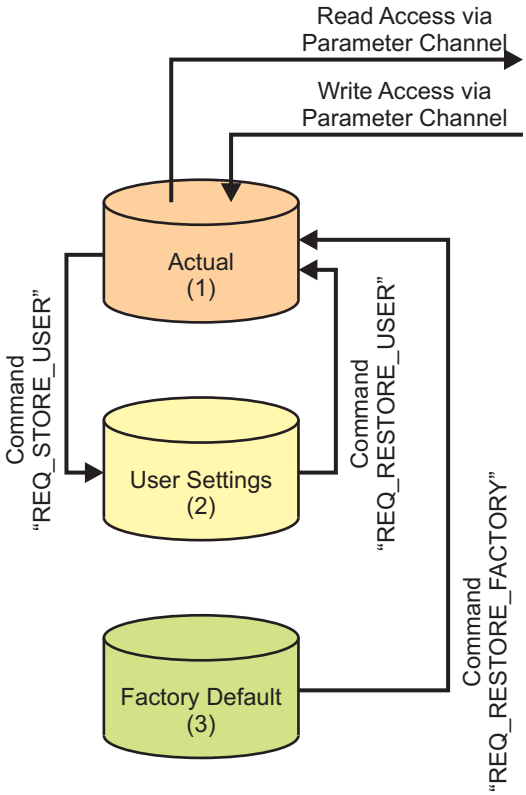


Fig. 6.6.3-1: Accessing the parameter data sets g063605e

6.6.3.1 Actual (1)

The parameter data set Actual (1) is changed by a write access via module parameter channel (registers 56 and 57).

After writing the parameter data set; i.e., closing the parameter channel, the module validates the received parameters. An additional checksum verification; e.g., via data backup by CRC, is not made in the module.

Upon a successful validity check, the module accepts the new parameters and uses them.

The module loses the parameter data set Actual (1) after a power failure. After a system restart, the module functions as described in section 6.6.1.1, “Actual (1).”

6.6.3.2 User Settings (2)

The parameter data set Actual (1) will be transferred as parameter data set User Settings (2) to a non-volatile memory area of the module via REQ_STORE_USER command, which will be entered into register 3 of the module. Prior to this, the entry 0x1235 must be made in register 31.

The user parameter set can overwrite the current parameter set Actual (1) after a user inquiry; i.e., the REQ_RESTORE_USER command.

6.6.3.3 Factory Default (3)

The parameter data set Factory Default (3) may be only modified (written/changed, etc.) by WAGO Kontakttechnik GmbH & Co. KG.

The parameter data set Factory Default (3) will be transferred to the volatile memory area of the module; i.e., to the parameter set Actual (1), via REQ_RESTORE_FACTORY command, which will then be entered into register 3 of the module.

6.6.4 Transfer of the Parameter Data Sets

6.6.4.1 Request/Response Mechanism

In register 3, the commands are transferred from the fieldbus coupler/controller to the module. This determines how the parameter data transferred via parameter channel; i.e., using registers 56 and 57 will be processed in the module.
Register 3 can be read and written (R/W) and is used for a command request.

Register 4 can only be read and indicates the command response. The logical structure of both registers is identical.

6.6.4.2 Session Counter

The high byte of the registers contains a session counter. To request a command, the value of this byte is incremented in register 3 (with overflow); the execution is acknowledged by both the module and an identical value in the high byte of register 4. The low byte contains an application-specific command or the response code.

Register	Bit 8 ... 15	Bit 0 ... 7
3	Session	Request
4	Session	Response

6.6.4.3 Command Overview

The following tables show the relevant commands for register 3 and the expected corresponding acknowledgement data in register 4, for both a positive and negative acknowledgement.

Command (request reg. 3)	Value	Description
REQ_RESTORE_USER	0x02	The module accepts the user parameter set (2) (NV Mem) as Actual (1).
REQ_STORE_USER	0x03	The module stores Actual (1) as user settings (2).
REQ_RESTORE_FACTORY	0x04	The module accepts the factory settings (3) as Actual (1).

Response (acknowledgement reg. 4)	Value	Description
RES_RESTORE_USER_OK	0x08	Positive acknowledgement for data transfer after REQ_RESTORE_USER command
RES_RESTORE_USER_NOK	0x09	Negative (in case of invalid data) acknowledgement for data transfer after REQ_RESTORE_USER command
RES_STORE_USER_OK	0x0A	Positive acknowledgement for data transfer after REQ_STORE_USER command
RES_STORE_USER_NOK	0x0B	Negative (in case of invalid data) acknowledgement for data transfer after REQ_STORE_USER command
RES_RESTORE_FACTORY_OK	0x0C	Positive acknowledgement for data transfer after REQ_RESTORE_FACTORY command
RES_RESTORE_FACTORY_NOK	0x0D	Negative (in case of invalid data) acknowledgement for data transfer after REQ_RESTORE_FACTORY command

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