

User's guide

RD5

RD53



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Typographic and iconographic conventions

In this guide, to make it easier to understand and read the text the following typographic and iconographic conventions are used:

- parameters and objects both of Lika device and interface are coloured in **ORANGE**;
- alarms are coloured in **RED**;
- states are coloured in **FUCSIA**.

When scrolling through the text some icons can be found on the side of the page: they are expressly designed to highlight the parts of the text which are of great interest and significance for the user. Sometimes they are used to warn against dangers or potential sources of danger arising from the use of the device. You are advised to follow strictly the instructions given in this guide in order to guarantee the safety of the user and ensure the performance of the device. In this guide the following symbols are used:

	This icon, followed by the word WARNING , is meant to highlight the parts of the text where information of great significance for the user can be found: user must pay the greatest attention to them! Instructions must be followed strictly in order to guarantee the safety of the user and a correct use of the device. Failure to heed a warning or comply with instructions could lead to personal injury and/or damage to the unit or other equipment.
	This icon, followed by the word NOTE , is meant to highlight the parts of the text where important notes needful for a correct and reliable use of the device can be found. User must pay attention to them! Failure to comply with instructions could cause the equipment to be set wrongly: hence a faulty and improper working of the device could be the consequence.
	This icon is meant to highlight the parts of the text where suggestions useful for making it easier to set the device and optimize performance and reliability can be found. Sometimes this symbol is followed by the word EXAMPLE when instructions for setting parameters are accompanied by examples to clarify the explanation.

Preliminary information

This guide is designed to provide the most complete information the operator needs to correctly and safely install and operate the **ROTADrive positioning units RD5 and RD53 models**.

RD5 and RD53 units are positioning devices which integrate into one system a brushless motor fitted with gearbox, a drive, a multiturn absolute encoder and a position controller. They can be used in a variety of applications in any industrial sector and are suitable to drive secondary axes such as in mold changers, mobile stops, tools changers, suction cups motion units, conveyor and spindle positioning devices on packaging & woodworking machineries, among others.

An integrated brake differentiates RD53 model from RD5 model. The brake is designed to activate as soon as the motor comes to a stop in order to prevent it from moving even slightly.

The available interfaces for fieldbus communication are: **Modbus RTU, Profibus-DP and CANopen DS 301**.

In the Modbus version the configuration of the ROTADrive unit can be done through a software expressly developed and released by Lika Electronic in order to allow an easy set up of the device. The program is supplied for free and can be installed in any PC fitted with a Windows operating system (Windows XP or later). It allows the operator to set the working parameters of the device; control manually some movements and functions; and monitor whether the device is running properly.

To make it easier to read the text, this guide can be divided into two main sections.

In the first section general information concerning the safety, the mechanical installation and the electrical connection as well as tips for setting up and running properly and efficiently the unit are provided.

While in the second section, entitled **Profibus Interface**, both general and specific information is given on the Profibus interface. In this section the interface features and the parameters implemented in the unit are fully described.



WARNING

When you install **Lika RD5x-T50** module, the value of each parameter is uploaded at power on from the GSD file which has been loaded in the PLC. Thus any new setting made locally through **Parameter number (Byte 8)** and **Parameter value (Bytes 9 ... 12)** items of the Data Exchange message will be temporary: when you turn off the power supply, the set value is lost (except the preset value which is the only variable not included in the GSD file; or unless you set the preset value previously which causes all parameters values to be saved automatically, see on page 69) and the value saved in the PLC will be uploaded at next power on (thus all values, even if previously saved because of a preset setting, will be overwritten anyway).

This unit also allows to install the **Lika RD5x-no param** module. Using this module, the unit does not read the parameters from the PLC when the power is switched on (they are read from the flash memory) and allows the operator to save any new setting made locally through **Parameter number (Byte 8)** and **Parameter value (Bytes 9 ... 12)** items of the Data Exchange message on the non-volatile memory (by means of the bit 9 **Save parameters** in the **Control Word (Bytes 0 and 1)**). When the **Lika RD5x-no param**

module is installed, it is NOT possible to read and change the values of the **configuration data** parameters in the **Parameter Assignment** page of the STEP 7 **Properties - DP slave** window (see "5.1.3 Setting "configuration data" parameters" section on page 26). Thus you are allowed to enter new parameter values only through **Parameter number (Byte 8)** and **Parameter value (Bytes 9 ... 12)** items of the Data Exchange message. The **Lika RD5x-no param** module has no relevance to the reduction gear ratio and can be used for whatever unit and independently from its reduction gear. Anyway it is obvious that the parameters you set must be compatible with the mechanical and electrical characteristics of the unit you are going to configure.

On the other hand using Siemens STEP7 it is possible to alter any value and then save it permanently in the PLC (except in the -no param module). To save values permanently the operator has to enter the **Properties - DP slave** window of STEP7 and then alter the desired item (see section "5.1.3 Setting "configuration data" parameters" on page 26). Values altered in the variables table of STEP7 (see section "5.3 Setting and reading parameter values" on page 30) are temporary only.

1 Safety summary



1.1 Safety

- Always adhere to the professional safety and accident prevention regulations applicable to your country during device installation and operation;
- installation and maintenance operations have to be carried out by qualified personnel only, with power supply disconnected and stationary mechanical parts;
- device must be used only for the purpose appropriate to its design: use for purposes other than those for which it has been designed could result in serious personal and/or the environment damage;
- high current, voltage and moving mechanical parts can cause serious or fatal injury;
- warning ! Do not use in explosive or flammable areas;
- failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the equipment;
- Lika Electronic s.r.l. assumes no liability for the customer's failure to comply with these requirements.



1.2 Electrical safety

- Turn OFF power supply before connecting the device;
- connect according to explanation in section "Electrical connections";
- a safety push-button for emergency power off has to be installed to shut off motor power supply in case of emergency situations;
- in compliance with 2004/108/EC norm on electromagnetic compatibility, following precautions must be taken:
 - before handling and installing the equipment, discharge electrical charge from your body and tools which may come in touch with the device;
 - power supply must be stabilized without noise; install EMC filters on device power supply if needed;
 - always use shielded cables (twisted pair cables whenever possible);
 - avoid cables runs longer than necessary;
 - avoid running the signal cable near high voltage power cables;
 - mount the device as far as possible from any capacitive or inductive noise source; shield the device from noise source if needed;
 - to guarantee a correct working of the device, avoid using strong magnets on or near by the unit



- minimize noise by connecting the shield and/or the connector housing and/or the frame to ground. Make sure that ground is not affected by noise. The connection point to ground can be situated both on the device side and on user's side. The best solution to minimize the interference must be carried out by the user.



1.3 Mechanical safety

- Install the device following strictly the information in the section "Mounting instructions";
- mechanical installation has to be carried out with stationary mechanical parts;
- do not disassemble the unit;
- do not tool the unit or its shaft;
- delicate electronic equipment: handle with care; do not subject the device and the shaft to knocks or shocks;
- respect the environmental characteristics of the product;
- unit with hollow shaft: ROTADrive can be mounted directly onto a shaft whose diameter has to respect the technical characteristics specified in the purchase order and clamped by means of the collar and the hole into which an anti-rotation pin has to be inserted.



WARNING

The unit has been adjusted by performing a no-load mechanical running test; thence default values which has been set refer to an idle device, i.e. running disengaged from the load. Furthermore they are intended to ensure a standard and safe operation which not necessarily results in smooth running and optimum performance. Thus to suit the specific application requirements it may be advisable and even necessary to enter new parameters instead of the factory default settings; in particular it may be necessary to change velocity, acceleration, deceleration and gain values.



WARNING

The counter-electromotive force (back EMF) generated by the motor in case the shaft is forced to rotate due to a manual external force can cause irreparable damages to the internal circuitry.

2 Identification

Device can be identified through the **order code** and the **serial number** printed on the label applied to its body. Information is listed in the delivery document too. Please always quote the order code and the serial number when reaching Lika Electronic s.r.l. for purchasing spare parts or needing assistance. For any information on the technical characteristics of the product [refer to the technical catalogue](#).

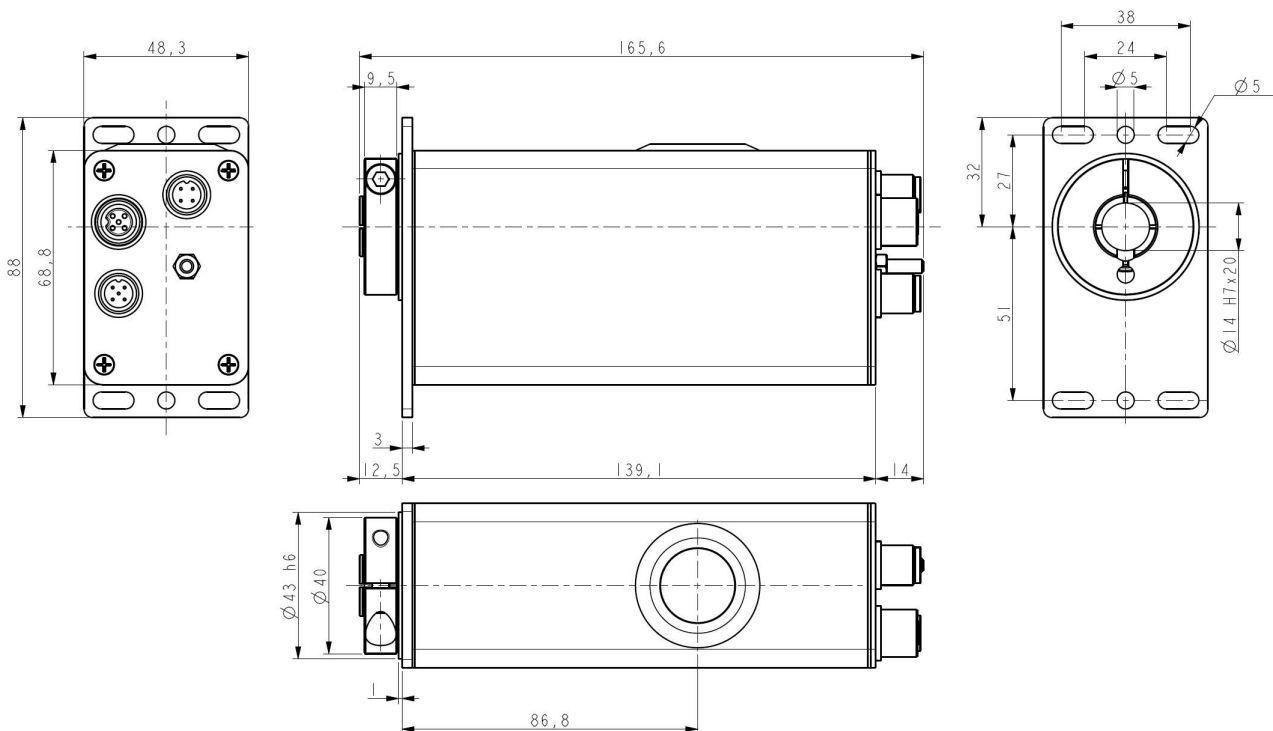


3 Mounting instructions



WARNING

Installation and maintenance operations have to be carried out by qualified personnel only, with power supply disconnected. Motor and shaft must be in stop.



ROTADrive unit must be secured firmly only to the user's shaft using the provided collar. ROTADrive unit is supplied with a screw insulation and an anti-rotation pin; the anti-rotation pin (TE M4 screw) has to be inserted into the screw insulation. This will provide to the unit both stability and the mobility needed to absorb the mechanical tensions produced during operation. Do not fasten firmly the anti-rotation pin to the motor flange or the fixed support on user's side without using the screw insulation! If this occurs, the mechanical tensions would be transmitted completely to the motor shaft and this would lead to bearings damages and mechanical breakdowns!

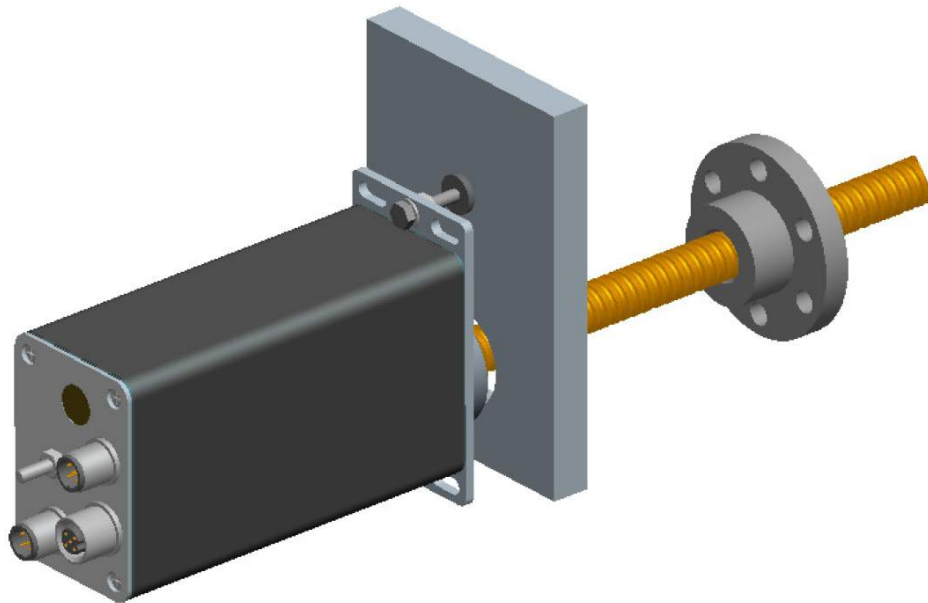
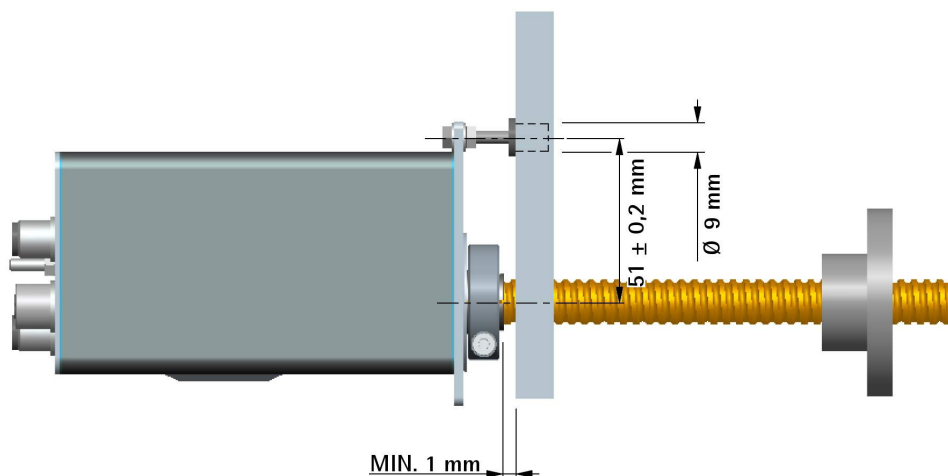


Figure 1 - Typical installation example of RD5-53 unit on worm screw

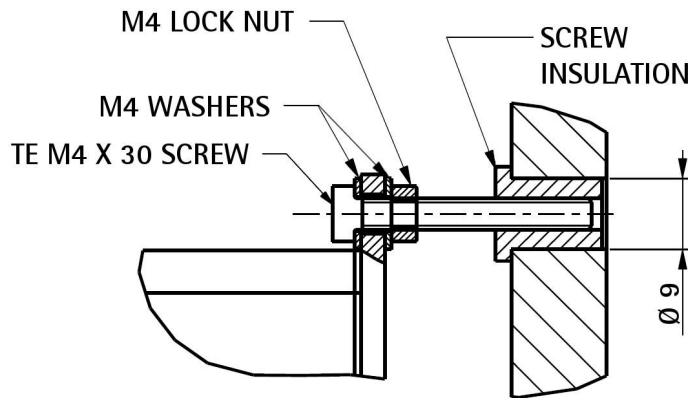
To install properly the ROTADRIIVE unit please read carefully and follow these instructions; anyway note that the unit can be installed in several manners and according to the specific user's application.

- Drill a 9 mm diameter hole in the motor flange or in the fixed support on user's side in order to insert the screw insulation and the anti-rotation pin. The distance between the axis of the shaft and the axis of the hole must be $51 \pm 0,2$ mm.





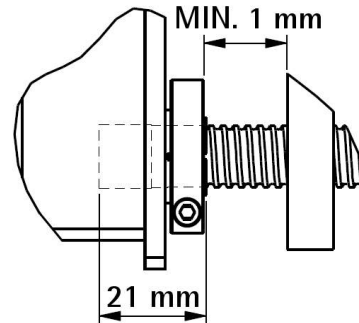
Make sure that the hole and the shaft are perfectly aligned on the vertical axis. If installation is not carried out properly, mechanical tensions would be produced on the motor shaft and this would lead to bearings damages and mechanical breakdowns!



- insert the screw insulation in the hole;
- insert the TE M4 x 30 screw and the two M4 washers in the middle hole designed in the flange of the ROTADrive unit; partially screw the M4

lock nut;

- insert the user's shaft in the hollow shaft of the ROTADrive unit; the maximum depth of the ROTADrive shaft is 21 mm; ascertain that the anti-rotation pin is inserted properly in the screw insulation; secure the user's shaft through the collar and the relevant fixing screw; the minimum distance between the collar and the fixed support on user's side must be not less than 1 mm in order to prevent the fixed parts from coming into contact;
- tighten the anti-rotation pin on the screw insulation;
- tighten the M4 lock nut in order to secure the anti-rotation pin to the flange of the ROTADrive unit.



ATTENTION

Never force manually the rotation of the shaft not to cause permanent damages! The counter-electromotive force (back EMF) generated by the motor in case the shaft is forced to rotate due to a manual external force can cause irreparable damages to the internal circuitry.

4 Electrical connections



WARNING

Power supply must be turned off before performing any operation!

When you send **Start**, **Jog +** or **Jog -** commands, the unit and the shaft start moving! Make sure there are no risks of personal injury and mechanical damages.

Each **Start** routine has to be checked carefully in advance!

Never force manually the rotation of the shaft not to cause permanent damages!

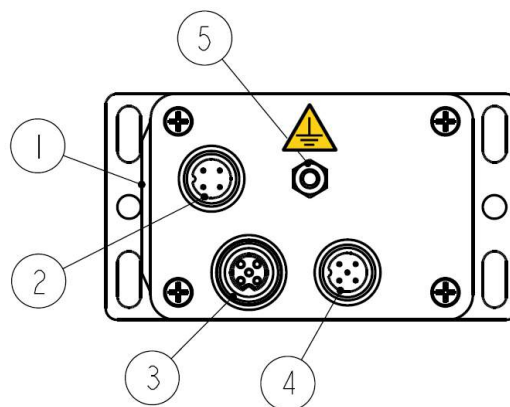


Figure 2: Electrical connections

Legend

1	Internal housing for dip-switches and diagnostic LEDs
2	M12 4-pin male connector for power supply
3	M12 5-pin female connector for BUS OUT
4	M12 5-pin male connector for BUS IN
5	Connection to earthing

4.1 Ground connection (Figure 2)

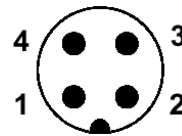
To minimize noise connect properly the frame to ground; we suggest using the ground screw provided in the frame (see Figure above). Connect properly the cable shield to ground on user's side. Connect the cable shield to the connector metal housing; see also note in the next paragraph. Anyway make sure that ground is not affected by noise. It is recommended to provide the ground connection as close as possible to the device.

4.2 M12 connectors (Figure 2)

Power supply

M12 4-pin male connector

A coding
(frontal side)

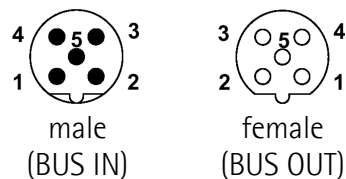


Pin	Description
1	+24VDC \pm 10% Motor power supply
2	+24VDC \pm 10% Controller power supply
3	0VDC Power supply
4	not connected

Profibus interface

M12 5-pin connector

B coding
(frontal side)



Pin	Description
1	not connected
2	Profibus A (Green)
3	not connected
4	Profibus B (Red)
5	not connected
Case	Shielding ¹

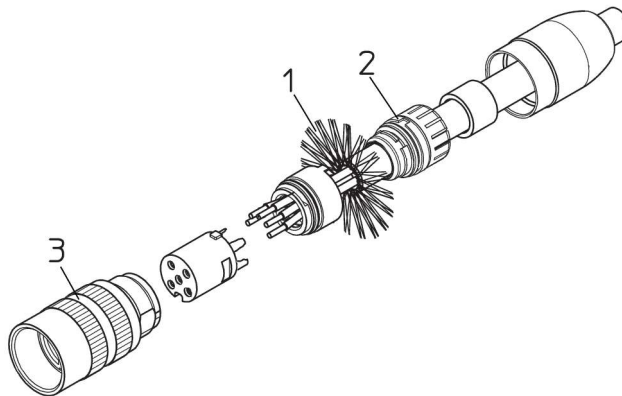
¹ Connect the cable shield to the cable gland of the metal connector

We recommend Profibus-DP certified connectors and cables to be used.



NOTE

It is of great importance that shielded cables are used for transmitting signals in the Profibus network; furthermore, shielding must be connected to the metal ring nut of the connector for a safe grounding through the frame of the device. So always disentangle and shorten the shielding 1 and then bend it over the part 2; finally place the ring nut 3 of the connector. Be sure that the shielding 1 is in tight contact with the ring nut 3.



4.3 Dip-Switches and diagnostic LEDs (Figure 3)



WARNING

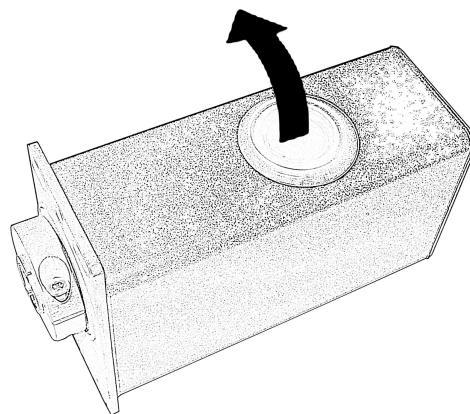
Power supply must be turned off before performing this operation!



NOTE

When performing this operation be careful not to damage the connection wires.

To access the DIP-Switches and the diagnostic LEDs remove the plastic cover fitted on one side of the device.



The DIP-switches and the diagnostic LEDs are located just beneath.

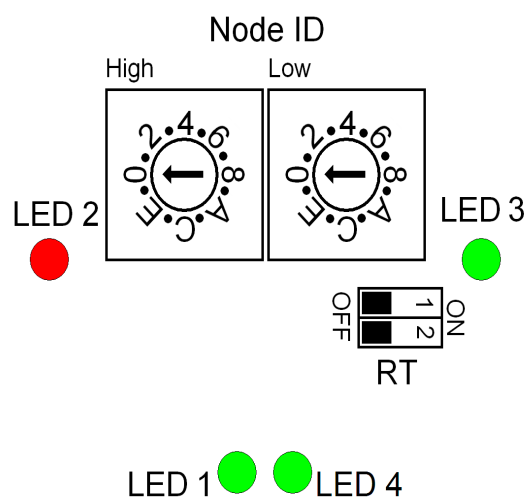


Figure 3: Dip-Switches and diagnostic LEDs

4.3.1 Diagnostic LEDs (Figure 3)

Four LEDs located in the inside of the device next to the provided switches and accessible by removing the plastic cover fitted on one side of the housing (see the previous page) are designed to show visually the operating or fault status of the Profibus interface and the unit as well. The meaning of each led is explained in the following table:

LED 1 VERDE		Description
ON		Indicates the controller power supply is turned on
OFF		Indicates the controller power supply is turned off
LED 2 RED	LED 3 GREEN	Description
FAULT	STATUS	Profibus network diagnostic LEDs
OFF	OFF	Power supply is turned off or hardware breakdown not recognized
OFF	ON	Normal operation in Data_Exchange mode
ON	Blinking	Indicates that an alarm is active (for the complete list of the alarm messages refer to page 55); or configuration parameters are not valid
Blinking	ON	Bus communication is cut off
Blinking	Blinking	Flash memory error, it cannot be restored
LED 4 GREEN		Description
ON		Indicates the motor is enabled (control loop activated)
OFF		Indicates the motor is disabled (control loop deactivated)

During initialisation, system checks the diagnostic LEDs for proper operation; therefore they blink for a while.

4.3.2 Setting the address node: Node ID (Figure 3)



WARNING

Power supply must be turned off before performing this operation!

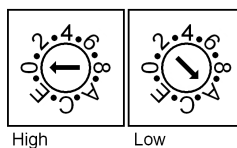
Set the node address expressed in hexadecimal notation.

The range of node addresses is between 1 and 125 (125 = 7D hex).

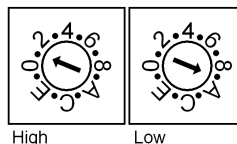


Example

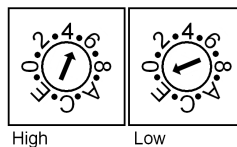
Address 10 = 0A hex:



Address 25 = 19 hex:



Address 95 = 5F hex:



NOTE

The default address is 1.

If you set the address to 0, device will be set to 1 automatically (address 0 is reserved for Master).

If you set an address higher than 125, device will be set to 125 automatically.

4.3.3 RT bus termination (Figure 3)

A bus termination resistor is provided and has to be activated as line termination in the last device of the transmission line.

Use RT Switch to activate or deactivate the bus termination.

RT	Description
1 = 2 = ON	Activated: when the device is at the end of the transmission line
1 = 2 = OFF	Deactivated: when the device is not at the end of the transmission line

5 Quick reference

5.1 Configuring the unit using Siemens STEP7

5.1.1 Installing the GSD file

RD5 – RD53 rotary actuators fitted with Profibus interface are supplied with their own GSD file **RD5x1655.GSD**, it can be downloaded from **www.lika.biz > PRODUCTS > ROTARY ACTUATORS > POSITIONING UNITS**.

GSD file is available in both English version (**RD5x1655.GSE**) and Italian version (**RD5x1655.GSI**).



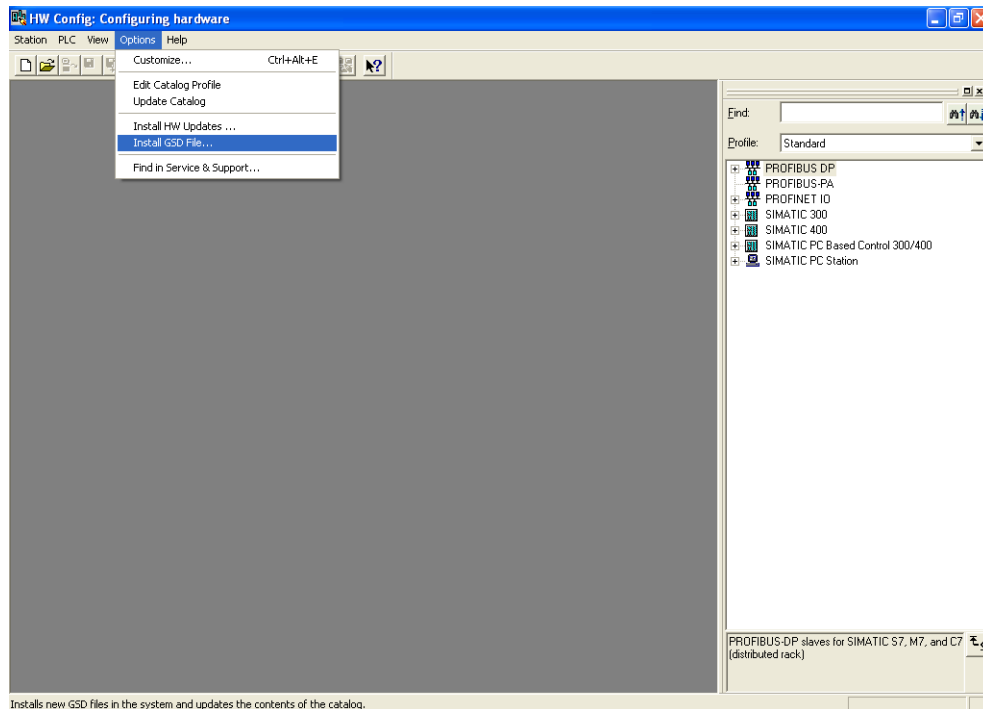
WARNING

RD5x-Profibus actuator can support the module -no param. Using this module, the unit does not read the parameters from the PLC when the power is switched on (they are read from the flash memory) and allows the operator to save any new setting made locally through **Parameter number (Byte 8)** and **Parameter value (Bytes 9 ... 12)** items of the Data Exchange message on the non-volatile memory (by means of the bit 9 **Save parameters** in the **Control Word (Bytes 0 and 1)**).

To install the RD5x unit on Siemens STEP7 proceed as follows.

In the main window **HW Config** of STEP7 select **Install GSD File...** command from **Options** menu bar.

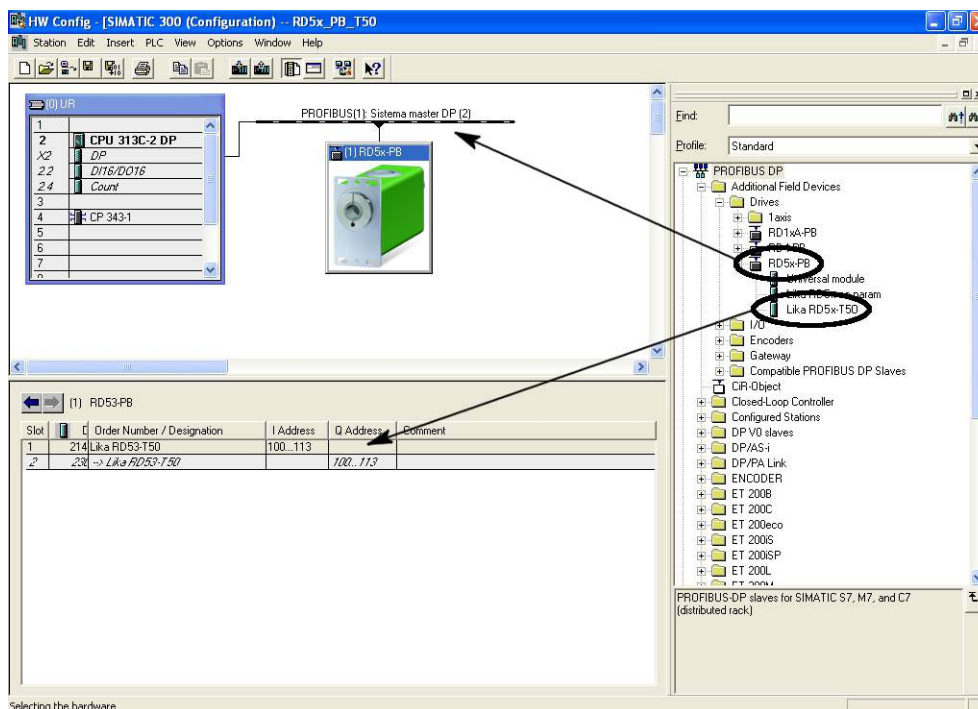
In the window that appears you can select the GSD file specific to the unit you need to install in your Siemens control system.



1.1.2 Adding a node to the project

To add a node to the project, extend the directory tree in the right pane of the STEP7 HW Config main window and select the **RD5x-PB** module available in **Catalog > PROFIBUS-DP > Additional Field Devices > Drives**; drag the module to the pane on the left and drop it on the "BUS".

Then drag the **Lika RD5x-no param** or **Lika RD5x-T50** module (according to the model you need to install) to the variables table in the bottom left; for instance, install the **Lika RD5x-T50** module.



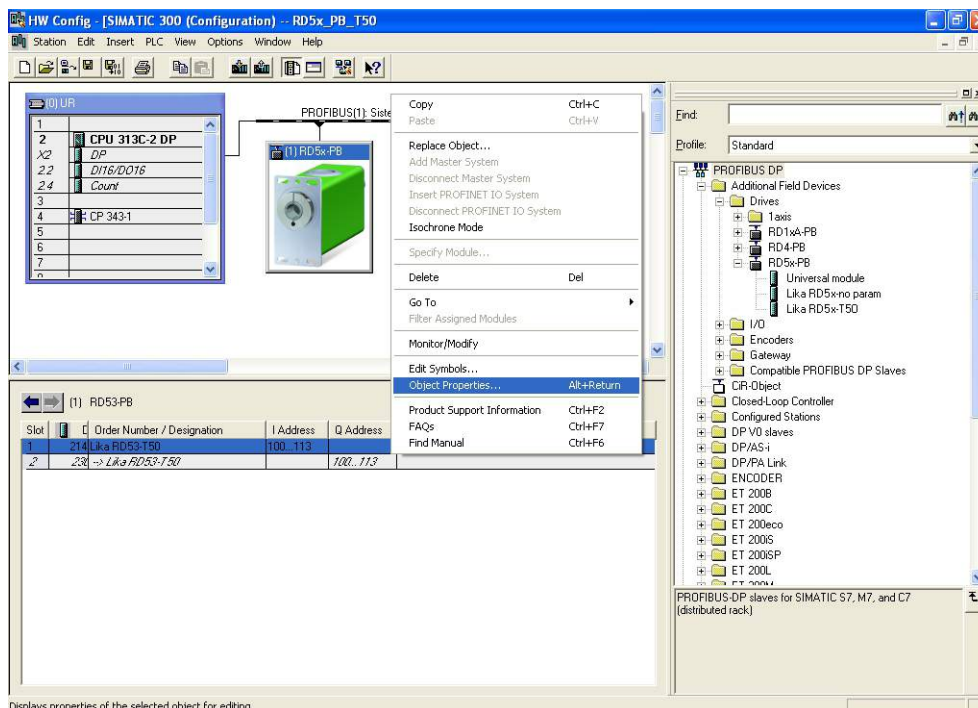
5.1.3 Setting "configuration data" parameters



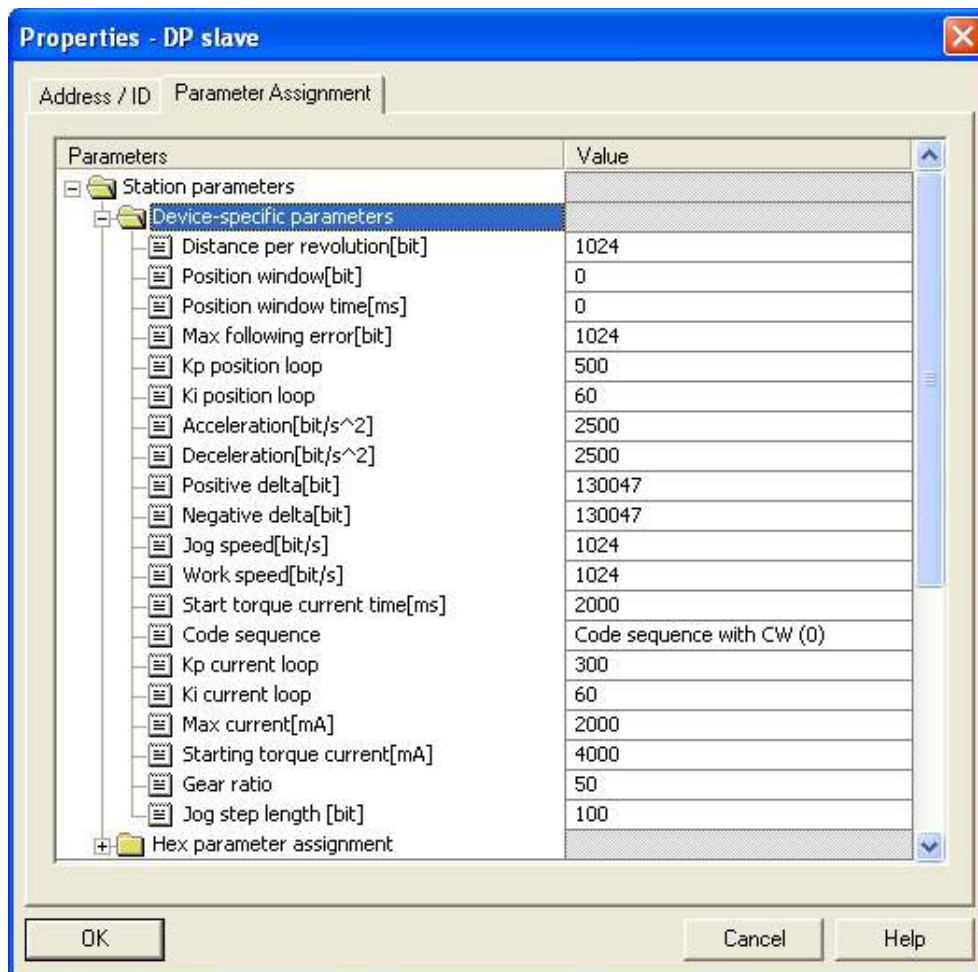
NOTE

The "configuration data" parameters setting page (**Parameter Assignment** page in the **Properties – DP slave** window) is hidden and thus not available when you install the **Lika RD5x-no param** module. Using this module, the unit does not read the parameters from the PLC when the power is switched on (they are read from the flash memory) and allows the operator to save any new setting made locally through **Parameter number (Byte 8)** and **Parameter value (Bytes 9 ... 12)** items of the Data Exchange message on the non-volatile memory (by means of the bit 9 **Save parameters** in the **Control Word (Bytes 0 and 1)**). When the **Lika RD5x-no param** module is installed, parameters can be saved only through **Parameter number (Byte 8)** and **Parameter value (Bytes 9 ... 12)** items of the Data Exchange message.

To access the parameters configuration window, first enter the STEP7 **HW Config** main window and select the **Lika RD5x** item just installed (**Lika RD5x-T50** model in the example), available in the variables table in the bottom left; then right-click the item and press the **Object Properties...** command in the shortcut menu.



The **Properties – DP slave** window will appear. In the **Parameter Assignment** page all **configuration data** parameters available for the device are listed. For a comprehensive description of the parameters and how to set them properly refer to the specific explanation in section “Profibus® programming parameters” on page 61.



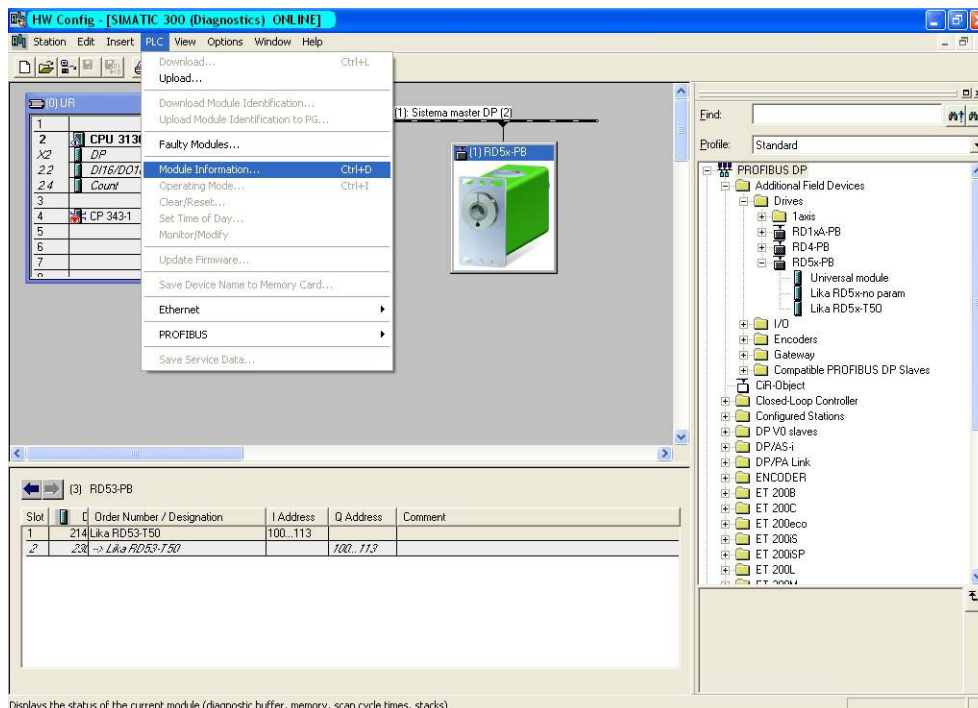
After having set the parameter values, press the **OK** button to close the **Properties – DP slave** window and then press the **Download to module** button (see icon on the left) in the toolbar of the **HW Config** main window to download the set values.

5.2 Reading diagnostic information

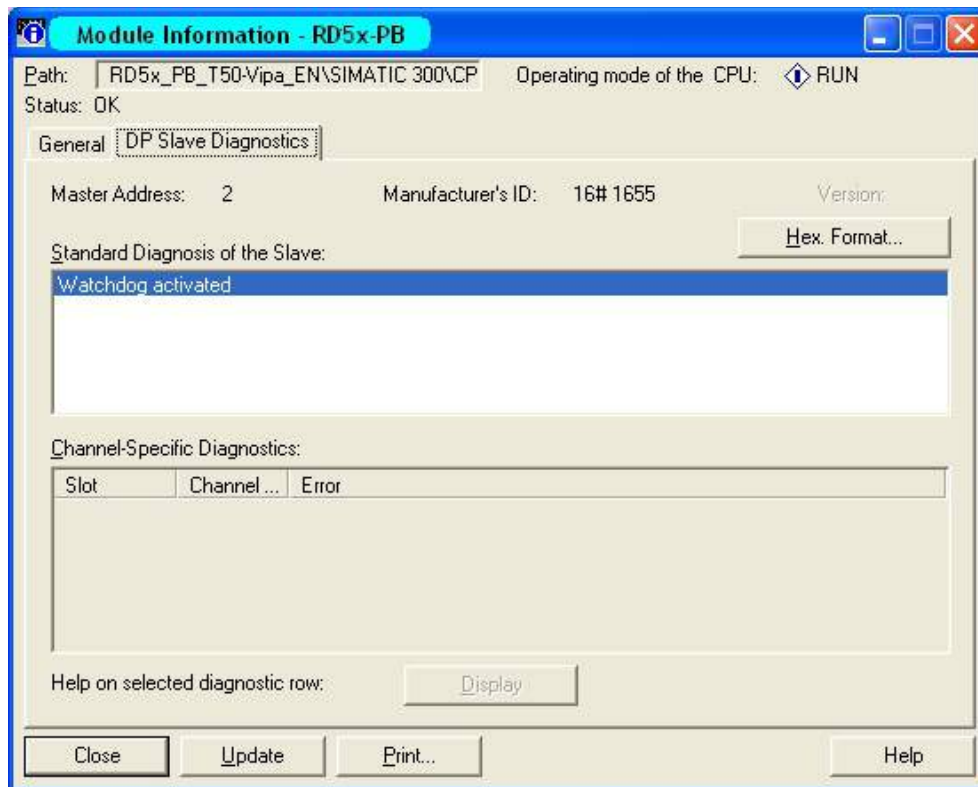


Before entering the diagnostic page, it is necessary to connect to the unit and go online. To do this, enter the **HW Config** main window and press the **Go online** command in the **Station** menu bar; or press the **Online / Offline** button in the toolbar of the same window (see icon on the left).

Select the RD5-PB module linked to the BUS and then the **Module Information...** command in the **PLC** menu bar to enter the **Module Information** window.

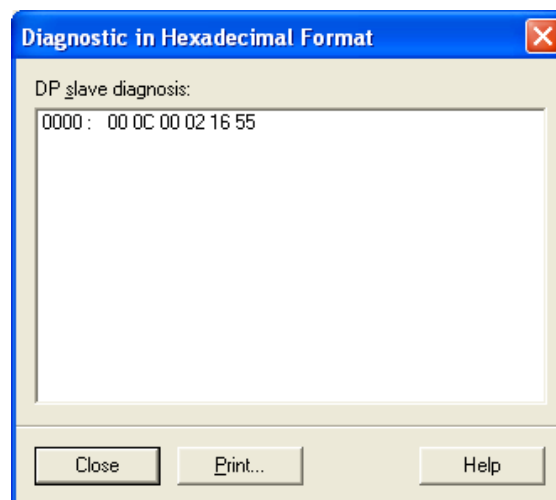


Finally open the **DP Slave Diagnostics** page in the **Module Information** window.



Click the **Hex. Format...** button to display diagnostic information.

6-byte diagnostic:



5.3 Setting and reading parameter values

When the device is in **Data_Exchange** mode, setting and reading of both **configuration data** and **operating parameters** are allowed; the meaning of the messages transmitted between Master and Slave is explained in the section "7.6 DDLM_Data_Exchange" on page 46.

To set a new parameter value please refer to the example described in the section "**Setting parameter 28 Preset**" just below.

To read a parameter value please refer to the example described in the section "**Reading parameter 29 Current velocity value**" further below.



5.3.1 Setting parameter 28 Preset

In the following example device having node address 3 transmits its position to the Master through variable at address ED 104...107 -**Position (Bytes 4 ... 7)**- and receives the preset value through variables AB 108 (**Parameter number (Byte 8)**) and AD 109...112 (**Parameter value (Bytes 9 ... 12)**).

	Address	Symbol	Displa	Status value	Modify value
1		// ===== DATA EXCHANGE =====			
2					
3		// ===== FUNCTION SLAVE ==> MASTER =====			
4					
5		// STATUS WORD (16 bits)			
6	EW 100	"STATUS WORD"	BIN	2#0000_0000_0010_0010	
7		// ALARMS (16 bits)			
8	EW 102	"ALARMS"	BIN	2#0010_0000_0100_0000	
9		// REAL POSITION (32 bits)			
10	ED 104	"REAL POSITION"	DEC	L#33934	
11		// PARAMETER NUM. (8 bits)			
12	EB 108	"Parameter num"	HEX	B#16#00	
13		// PARAMETER VALUE (32 bits)			
14	ED 109	"Parameter value"	DEC	L#0	
15		// not used (8 bits)			
16		// ===== FUNCTION MASTER ==> SLAVE =====			
17					
18		// CONTROL WORD (16 bits)			
19	AW 100	"CTRL_WRD"	BIN	2#0000_0000_1000_0100	
20		// TARGET POSITION (32 bits)			
21	AD 104	"TARGET POSITION"	DEC	L#0	L#0
22		// PARAMETER NUM. (8 bits)			
23	AB 108	"Parameter num."	HEX	B#16#A8	B#16#A8
24		// PARAMETER VALUE (32 bits)			
25	AD 109	"Parameter value."	DEC	L#10000	L#10000
26		// not used (8 bits)			
27					
28					
29					
30					

Parameter number = A8hex index of parameter **28 Preset** is 28h (see on page 69); then command 80h for writing values must be added (28h + 80h = A8h).

Parameter value = 10000 (Preset value, by way of example).



To download the preset value press the **Modify variable** button in the toolbar (see icon on the left, on the right of the **Monitor Variable** button symbolized by the glasses).

Now device can send the preset value "10000".

To carry out the preset procedure, switch bit 7 of the same variable to 0 and then press again the **Modify variable** button (**Parameter number** 28h).



5.3.2 Reading parameter 29 Current velocity value

In the following example device having node address 3 transmits to the Master its position through the variable at address ED 104...107 (**Position (Bytes 4 ... 7)**) and its speed through the variable at address ED 109...112 (**Parameter value (Bytes 9 ... 12)**).

	Address	Symbol	Displa	Status value	Modify value
1		// ===== DATA EXCHANGE =====			
2					
3		// ===== FUNCTION SLAVE ==> MASTER =====			
4					
5		// STATUS WORD (16 bits)			
6	EW 100	"STATUS WORD"	BIN	2#0000_0010_1100_0110	
7		// ALARMS (16 bits)			
8	EW 102	"ALARMS"	BIN	2#0000_0000_0000_0000	
9		// REAL POSITION (32 bits)			
10	ED 104	"REAL POSITION"	DEC	L#11352	
11		// PARAMETER NUM. (8 bits)			
12	EB 108	"Parameter num"	HEX	B#16#29	
13		// PARAMETER VALUE (32 bits)			
14	ED 109	"Parameter value"	DEC	L#1024	
15		// not used(8 bits)			
16		//			
17		// ===== FUNCTION MASTER ==> SLAVE =====			
18					
19		// CONTROL WORD (16 bits)			
20	AWV 100	"CTRL_WRD"	BIN	2#0000_0000_1000_0100	
21		// TARGET POSITION (32 bits)			
22	AD 104	"TARGET POSITION"	DEC	L#0	L#0
23		// PARAMETER NUM. (8 bits)			
24	AB 108	"Parameter num."	HEX	B#16#29	B#16#29
25		// PARAMETER VALUE (32 bits)			
26	AD 109	"Parameter value."	DEC	L#0	L#0
27		// not used(8 bits)			
28		//			
29					
30					

Parameter index = 29hex index of parameter **29 Current velocity value** (see on page 70).

Parameter value = 1024 speed = 1024 pulses per second.



To read the speed value, press the **Modify variable** button in the toolbar (see icon on the left, on the right of the **Monitor Variable** button symbolized by the glasses).

Now device transmits the speed value: "1024" pulses per second.



NOTE

It may occur that data variables having index higher than 127 or data greater than 4 bytes are not treated properly in STEP7 software. Should this happen, we recommend the "MD" reference operators (pointers) for managing variables transmitted between Master and Slave to be used.

5.4 Getting started

The following instructions are given to allow the operator to set up the device for standard operation in a quick and safe manner.

- Mechanically install the device;
- execute electrical connections;
- if required, set the node address (node ID; see on page 21); the default value set by Lika Electronic at factory set-up is "1";
- switch +24VDC power supply on (in both motor and controller);
- set a proper value next to the **01 Distance per revolution** item (see on page 63);
- set a proper value next to the **0B Jog speed** item (see on page 66);
- set a proper value next to the **0C Work speed** item (see on page 66);
- set a proper value next to the **28 Preset** item (see on page 69);
- set the limit switch values next to the **09 Positive delta** and **0A Negative delta** items; see on page 65).



WARNING

When you install **Lika RD5x-T50** module, the value of each parameter is uploaded at power on from the GSD file which has been loaded in the PLC. Thus any new setting made locally through **Parameter number (Byte 8)** and **Parameter value (Bytes 9 ... 12)** items of the Data Exchange message will be temporary: when you turn off the power supply, the set value is lost (except the preset value which is the only variable not included in the GSD file; or unless you set the preset value previously which causes all parameters values to be saved automatically, see on page 69) and the value saved in the PLC will be

uploaded at next power on (thus all values, even if previously saved because of a preset setting, will be overwritten anyway).

This unit also allows to install the **Lika RD5x-no param** module. Using this module, the unit does not read the parameters from the PLC when the power is switched on (they are read from the flash memory) and allows the operator to save any new setting made locally through **Parameter number (Byte 8)** and **Parameter value (Bytes 9 ... 12)** items of the Data Exchange message on the non-volatile memory (by means of the bit 9 **Save parameters** in the **Control Word (Bytes 0 and 1)**). When the **Lika RD5x-no param** module is installed, it is NOT possible to read and change the values of the **configuration data** parameters in the **Parameter Assignment** page of the STEP 7 **Properties – DP slave** window (see "5.1.3 Setting "configuration data" parameters" section on page 26). Thus you are allowed to enter new parameter values only through **Parameter number (Byte 8)** and **Parameter value (Bytes 9 ... 12)** items of the Data Exchange message. The **Lika RD5x-no param** module has no relevance to the reduction gear ratio and can be used for whatever unit and independently from its reduction gear. Anyway it is obvious that the parameters you set must be compatible with the mechanical and electrical characteristics of the unit you are going to configure.

On the other hand using Siemens STEP7 it is possible to alter any value and then save it permanently in the PLC (except in the -no param module). To save values permanently the operator has to enter the **Properties – DP slave** window of STEP7 and then alter the desired item (see section "5.1.3 Setting "configuration data" parameters" on page 26). Values altered in the variables table of STEP7 (see section "5.3 Setting and reading parameter values" on page 30) are temporary only.



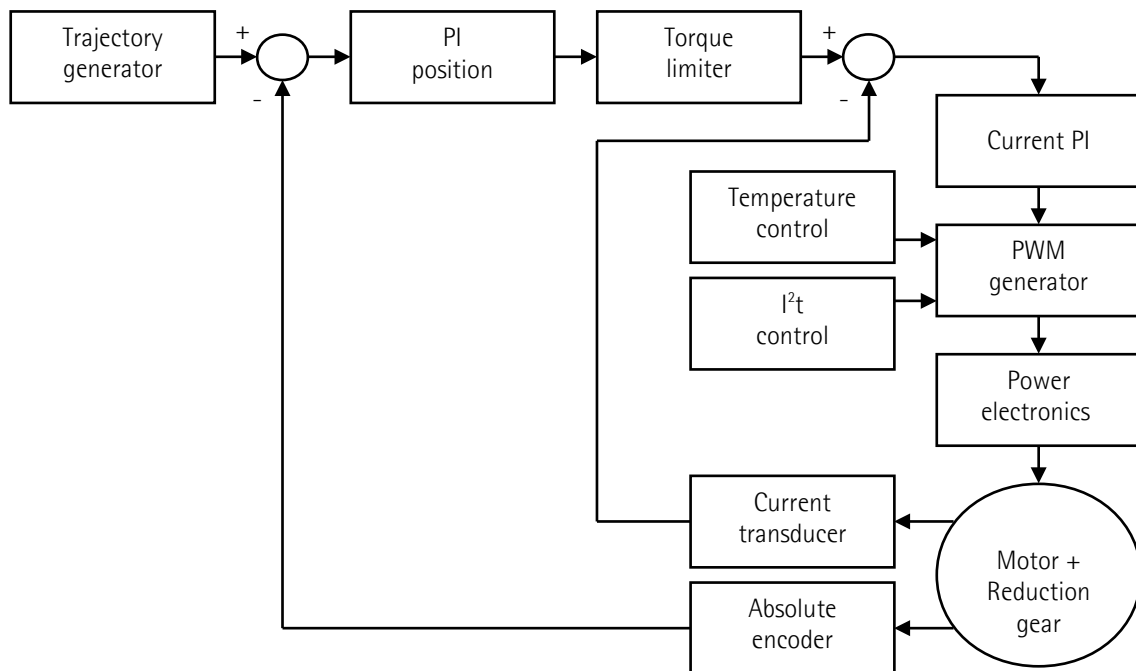
NOTE

Parameters **01 Distance per revolution**, **0B Jog speed**, **0C Work speed** and **28 Preset** as well as the **09 Positive delta** and **0A Negative delta** limit switch values are closely related, hence you have to be very attentive when you need to change the value in one of them. For any further information please refer to page 37.

6 Functions

6.1 Working principle

The following scheme is intended to show schematically the working principle of system control logic.



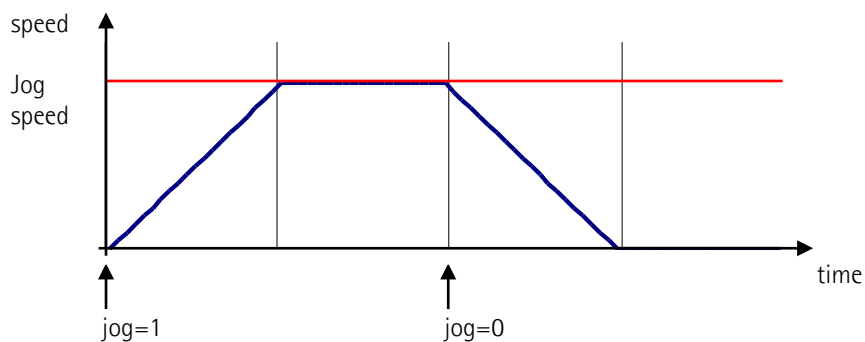
6.2 Movements: jog and positioning

Two kinds of movement are available in the ROTADRIVE positioning unit, they are:

- Jog: speed control;
- Positioning: position and speed control.

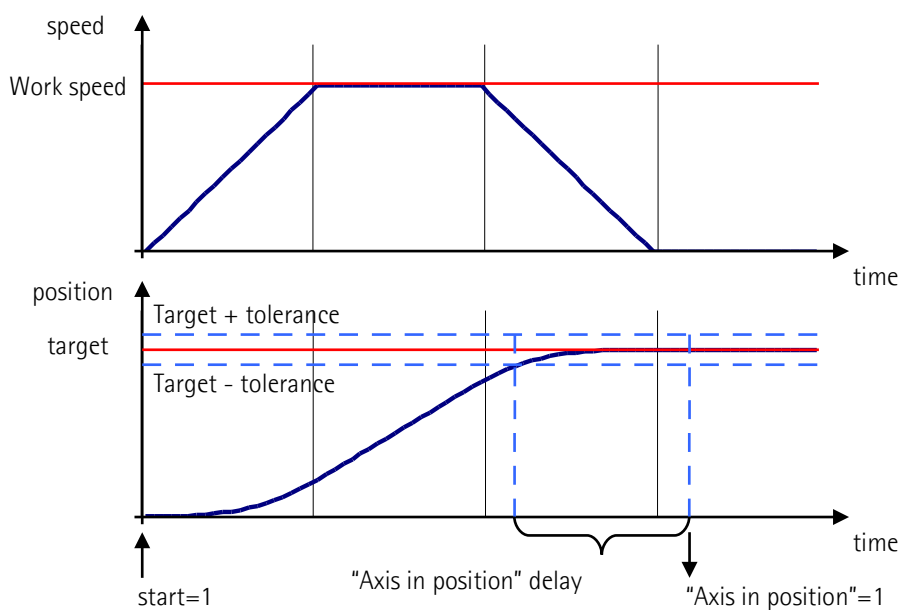
Jog: speed control

This kind of control is intended to generate a speed trajectory which is able to make the maximum rotation speed of the ROTADRIVE unit shaft to be equal to the value set in **OB Jog speed** (see on page 66).



Positioning: position and speed control

This kind of control is a point-to-point movement and the maximum reachable speed is equal to the value set in **OC Work speed** (see on page 66); set speed can be reached only if space is long enough.



6.3 01 Distance per revolution, 0B Jog speed, 0C Work speed, 28 Preset, 09 Positive delta and 0A Negative delta

Variables **01 Distance per revolution**, **0B Jog speed**, **0C Work speed**, **28 Preset**, **09 Positive delta** and **0A Negative delta** are closely related, hence you have to be very attentive every time you need to change the value in any of them.

Should it be necessary, you have to operate in compliance with the following procedure:

- set a proper value next to the **01 Distance per revolution** item (parameter 01h, see on page 63);
- set a proper value next to the **0B Jog speed** item (parameter 0Bh, see on page 66);
- set a proper value next to the **0C Work speed** item (parameter 0Ch, see on page 66);
- set a proper value next to the **28 Preset** item (parameter 28h, see on page 69);
- set a proper value next to the **09 Positive delta** item (parameter 09h, see on page 65);
- set a proper value next to the **0A Negative delta** item (parameter 0Ah, see on page 65).



WARNING

Each time you change the value in **01 Distance per revolution** you must then set new values also in **0B Jog speed** and **0C Work speed** as speed values are expressed in pulses per second (PPS). To calculate the speed values you have always to adhere to the following ratio:

$$\frac{\text{Min. Speed} * \mathbf{01 \text{ Distance per revolution}}}{1024} \leq \text{Speed} \leq \frac{\text{Max. speed} * \mathbf{01 \text{ Distance per revolution}}}{1024}$$

where:

- **01 Distance per revolution**: this is the new value you want to set next to the **01 Distance per revolution** item, expressed in pulses
- **Min. speed**: minimum speed 1 [PPS]
- **Max. speed**: maximum speed 1024 [PPS]
- **1024**: this is the maximum value you can set next to the **01 Distance per revolution** item (expressed in pulses).

Each time you change the value in **01 Distance per revolution** you must then set a new value also in **28 Preset** in order to define the zero of the shaft as the system reference has now changed.

After having changed the parameter in **28 Preset** it is not necessary to set new values for travel limits as the Preset function then calculates them automatically and initializes again the positive and negative limits according to the values set in **09 Positive delta** and **0A Negative delta**.

The number of revolutions managed by the system is 127 in negative direction and 127 in positive direction assuming **28 Preset** as reference.

Value set next to the **09 Positive delta** item plus value set in parameter **28 Preset** is the maximum forward travel (positive travel) starting from the preset (value is expressed in pulses).

Value set next to the **0A Negative delta** item subtracted from value set in parameter **28 Preset** is the maximum backward travel (negative travel) starting from the preset (value is expressed in pulses).



WARNING

Please note that the parameters listed hereafter are closely related to the **01 Distance per revolution** parameter; hence when you change the value in **01 Distance per revolution** also the value expressed by each one is necessarily redefined. They are: **02 Position window**, **04 Max following error**, **07 Acceleration**, **08 Deceleration**, **09 Positive delta**, **0A Negative delta**, **29 Current velocity value**, **30 Positive absolute limit switch**, **31 Negative absolute limit switch**, **Target position (Bytes 4 ... 7)** and **Position (Bytes 4 ... 7)**. See for instance the relationship between **01 Distance per revolution** and the speed values, explained in the previous page.



Example 1

Default values:

01 Distance per revolution = 1024 steps per revolution

Max. **0C Work speed**: 1024 pulses per second ($1024 \cdot 1024 / 1024 = 1024$)

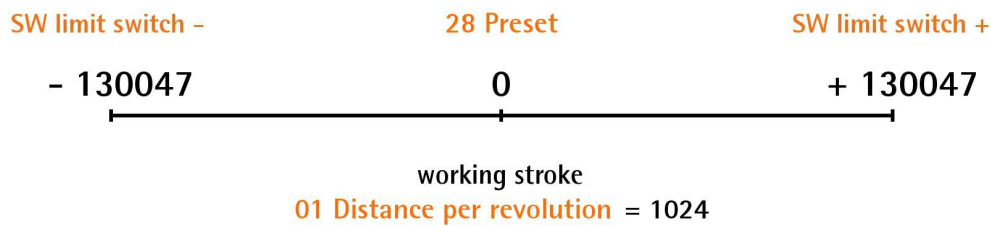
28 Preset = 0

09 Positive delta and **0A Negative delta** max. values = $130047 = (1024 \text{ steps per revolution} \times 127 \text{ revolutions}) - 1$ when **28 Preset** = 0

Max. **SW limit switch +** = $0 + 130047 = + 130047$ pulses (forward travel)

Max. **SW limit switch -** = $0 - 130047 = - 130047$ pulses (backward travel)

Therefore, when **28 Preset** = 0, the working stroke of the axis will span the maximum positive and negative limits range, that is max. **SW limit switch +** + 130047 and max. **SW limit switch -** - 130047.



Example 2

ROTADrive positioning unit is joined to a worm screw having a 5 mm pitch and you need to have a hundredth of a millimetre resolution.

01 Distance per revolution = 500 steps per revolution

Max. 0C Work speed: 500 pulses per second ($1024 \times 500 / 1024 = 500$)

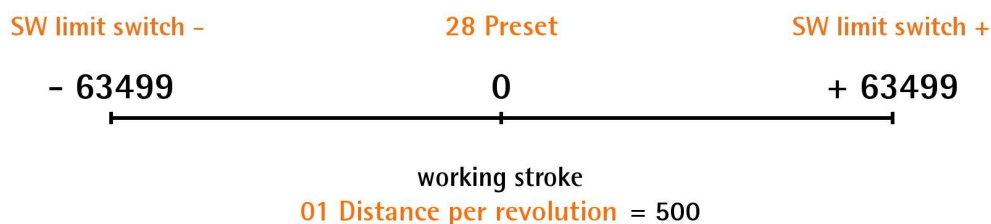
28 Preset = 0

09 Positive delta and 0A Negative delta max. values = (500 steps per revolution \times 127 revolutions) - 1 = 63499

Max. SW limit switch + = 0 + 63499 = + 63499 pulses (forward travel)

Max. SW limit switch - = 0 - 63499 = - 63499 pulses (backward travel)

Therefore, when 28 Preset = 0, the working stroke of the axis will span the maximum positive and negative limits range, that is max. SW limit switch + + 63499 and max. SW limit switch - - 63499.



Example 3

ROTADrive positioning unit is joined to a worm screw having a 1 mm pitch and you need to have a hundredth of a millimetre resolution.

01 Distance per revolution = 100 steps per revolution

Max. 0C Work speed: 100 pulses per second ($1024 \times 100 / 1024 = 100$)

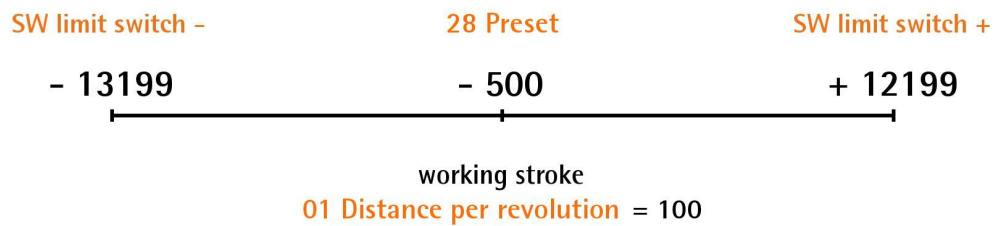
28 Preset = -500 (ex. thickness of the tool)

09 Positive delta and **0A Negative delta** max. values = (100 steps per revolution x 127 revolutions) - 1 = 12699

Max. **SW limit switch +** = (-500) + 12699 = + 12199 pulses (forward travel)

Max. **SW limit switch -** = (-500) - 12699 = - 13199 pulses (backward travel)

Therefore, when **28 Preset** = -500, the working stroke of the axis will span the maximum positive and negative limits range, that is max. **SW limit switch +** + 12199 and max. **SW limit switch -** - 13199.



7 Profibus® interface

Lika ROTADrive positioning units with Profibus interface are Slave devices and are designed in compliance with "PROFIBUS-DP Profile".

For any further information or omitted specifications please refer to documentation issued by Profibus International and available at www.profibus.com.

7.1 GSD file

RD5-RD53 devices fitted with Profibus interface are supplied with their own GSD file **RD5x1655.GSD**, it can be downloaded from **www.lika.biz > PRODUCTS > ROTARY ACTUATORS > POSITIONING UNITS**. GSD file has to be installed in the Profibus Master device.

GSD file is available in both English version (**RD5x1655.GSE**) and Italian version (**RD5x1655.GSI**).



WARNING

RD5x-Profibus actuator can support the module -no param. Using this module, the unit does not read the parameters from the PLC when the power is switched on (they are read from the flash memory) and allows the operator to save any new setting made locally through **Parameter number (Byte 8)** and **Parameter value (Bytes 9 ... 12)** items of the Data Exchange message on the non-volatile memory (by means of the bit 9 **Save parameters** in the **Control Word (Bytes 0 and 1)**).



WARNING

When you install **Lika RD5x-T50** module, the value of each parameter is uploaded at power on from the GSD file which has been loaded in the PLC. Thus any new setting made locally through **Parameter number (Byte 8)** and **Parameter value (Bytes 9 ... 12)** items of the Data Exchange message will be temporary: when you turn off the power supply, the set value is lost (except the preset value which is the only variable not included in the GSD file; or unless you set the preset value previously which causes all parameters values to be saved automatically, see on page 69) and the value saved in the PLC will be uploaded at next power on (thus all values, even if previously saved because of a preset setting, will be overwritten anyway).

This unit also allows to install the **Lika RD5x-no param** module. Using this module, the unit does not read the parameters from the PLC when the power is switched on (they are read from the flash memory) and allows the operator to save any new setting made locally through **Parameter number (Byte 8)** and

Parameter value (Bytes 9 ... 12) items of the Data Exchange message on the non-volatile memory (by means of the bit 9 **Save parameters** in the **Control Word (Bytes 0 and 1)**). When the **Lika RD5x-no param** module is installed, it is NOT possible to read and change the values of the **configuration data** parameters in the **Parameter Assignment** page of the STEP 7 **Properties – DP slave** window (see "5.1.3 Setting "configuration data" parameters" section on page 26). Thus you are allowed to enter new parameter values only through **Parameter number (Byte 8)** and **Parameter value (Bytes 9 ... 12)** items of the Data Exchange message. The **Lika RD5x-no param** module has no relevance to the reduction gear ratio and can be used for whatever unit and independently from its reduction gear. Anyway it is obvious that the parameters you set must be compatible with the mechanical and electrical characteristics of the unit you are going to configure.

On the other hand using Siemens STEP7 it is possible to alter any value and then save it permanently in the PLC (except in the -no param module). To save values permanently the operator has to enter the **Properties – DP slave** window of STEP7 and then alter the desired item (see section "5.1.3 Setting "configuration data" parameters" on page 26). Values altered in the variables table of STEP7 (see section "5.3 Setting and reading parameter values" on page 30) are temporary only.

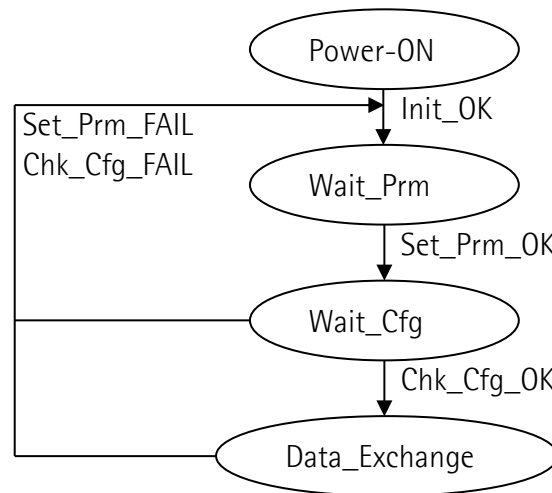
7.2 Baud rate

RD5 - RD53 ROTADrive rotary actuators with Profibus interface are able to recognize automatically the data transmission rate of the Profibus-DP Master. The same baud rate is set by the Master for all devices in the network. The supported baud rates are as follows:

9.6Kbps – 19.2Kbps – 93.75Kbps – 187.5Kbps – 500Kbps – 1.5Mbps – 3Mbps – 6Mbps – 12Mbps.

7.3 Operating states

Profibus devices are designed to operate according to different states, see the Figure below.



NOTE

Configuration data parameters are sent when Set_Prm phase is active and device is in **Data_Exchange** mode; operational parameters are sent when the device is in **Data_Exchange** mode.

Communication messages

A basic differentiation is made between the following statuses when exchanging data between Master and Slave:

- **DDL_M_Set_Prm**: configuring and parametrizing phase. This is active when the system is turned on; in this phase configuration data is sent to the Slave device. For any further information refer to section "7.4 DDL_M_Set_Prm" on page 44.
- **DDL_M_Chk_Cfg**: using this function the Master defines the number of bytes needed for data transmission in **Data_Exchange** mode. For any further information refer to section "7.5 DDL_M_Chk_Cfg" on page 45.
- **DDL_M_Data_Exchange**: "Standard operation". In this work mode the Master can send a preset value to the Slave, while the Slave can respond sending the actual position (and velocity, as well). For any further information refer to section "7.6 DDL_M_Data_Exchange" on page 46.
- **DDL_M_Slave_Diag**: This is used when the system is turned on and every time the Master needs to acquire diagnostic information from the Slave: in this status the Slave sends diagnostic data to the Master. For any further information refer to section "7.7 DDL_M_Slave_Diag" on page 60.

7.4 DDLM_Set_Prm

When the system is turned on, configuration data set by the operator is sent to the Slave by the controller. Parameters transmission depends on the configuration chosen by the operator. Customarily data is sent automatically while data setting is carried out via the user's interface available in the controller's software (for instance, STEP7, see on page 23).

A detailed description of the available parameters can be found in section "Profibus® programming parameters" on page 61.

Data transmission is carried out respecting the structure shown in the following table.

Bytes	Parameter
0...6	Reserved for PROFIBUS network
7...9	Reserved for PROFIBUS network
10...13	01 Distance per revolution
14...17	02 Position window
18...21	03 Position window time
22...25	04 Max following error
26...29	05 Kp position loop
30...33	06 Ki position loop
34...37	07 Acceleration
38...41	08 Deceleration
42...45	09 Positive delta
46...49	0A Negative delta
50...53	0B Jog speed
54...57	0C Work speed
58...61	0D Start Torque current time
62...65	0E Code sequence
66...69	0F Kp current loop
70...73	10 Ki current loop
74...77	11 Max current
78...81	12 Starting Torque current
82...85	13 Gear ratio
86...89	14 Jog step length

7.5 DDLM_Chk_Cfg

Configuration function allows the Master to define the number of bytes used for data transmission in **Data_Exchange** mode; transmission and receipt are viewed from Master device.

Chk_Cfg message structure (1 byte):

bit 7 = Consistency ("1")

bit 6 = Word format ("0"=byte, "1"=word=2bytes)

bit 5 ... 4 = In/out data ("01"=Input, "10"=output)

bit 3 ... 0 = Code length

Allowed values:

bit	7	6	5	4	3	2	1	0	
Data	1	1	0	1	0	1	1	0	D6h
	1	1	1	0	0	1	1	0	E6h

D6hex = 14 byte input

E6hex = 14 byte output

7.6 DDLM_Data_Exchange

This is the normal operation status of the system.

Using **Data_Exchange messages** system manages all available parameters and operates the movements of the axis.

Data_Exchange messages structure:

Byte	Master → Slave function	Slave → Master function
0	Control Word (Bytes 0 and 1)	Status word (Bytes 0 and 1)
1		
2	Not used	Alarms (Bytes 2 and 3)
3		
4	Target position (Bytes 4 ... 7)	Position (Bytes 4 ... 7)
5		
6		
7		
8	Parameter number (Byte 8)	Parameter number (Byte 8)
9	Parameter value (Bytes 9 ... 12)	Parameter value (Bytes 9...12)
10		
11		
12		
13	Not used	Not used

7.6.1 Master → Slave function

In this section Data_Exchange messages sent by the Master to the Slave are described.

Control Word (Bytes 0 and 1)

It contains the commands to be sent in real time to the Slave in order to manage it.

Byte 0

Jog +

bit 0

If bit 4 **Incremental jog** = 0, as long as **Jog +** = 1, then the Slave moves toward positive direction; otherwise if bit 4 **Incremental jog** = 1, the activation of this bit causes at rising edge the execution of a single step toward positive direction having the length, expressed in pulses, set next to

the **14 Jog step length** item; then the slave stops and waits for another issue. Velocity, acceleration and deceleration are set in parameters **0B Jog speed**, **07 Acceleration** and **08 Deceleration** respectively. For a detailed description of jog control see on page 36.

Jog - bit 1

If bit 4 **Incremental jog** = 0, as long as **Jog -** = 1, then the Slave moves toward negative direction; otherwise if bit 4 **Incremental jog** = 1, the activation of this bit causes at rising edge the execution of a single step toward negative direction having the length, expressed in pulses, set next to the **14 Jog step length** item; then the slave stops and waits for another issue. Velocity, acceleration and deceleration are set in parameters **0B Jog speed**, **07 Acceleration** and **08 Deceleration** respectively. For a detailed description of jog control see on page 36.

Stop bit 2

If set to "1" the Slave is allowed to execute the movements as commanded. If, while the unit is running, this bit switches to "0" then the Slave must stop and execute the deceleration procedure set in **08 Deceleration**. For an immediate stop of the movement, use bit 7 **Emergency**.

Alarm reset bit 3

In a normal work condition this bit is set to "0". Setting this bit to "1" causes the normal work status of the device to be restored. Normal work status is resumed by switching this bit from "0" to "1". This command is used to reset an alarm condition of the Slave but only if the fault condition has ceased.



Please note that should the alarm be caused by wrong parameter values (see **Machine data not valid** and **32 Wrong parameters list**), normal work status can be restored only after having set proper values. **Flash memory error** and **Axis not synchronized** alarms cannot be reset.

Incremental jog bit 4

If set to "0", the activation of bits **Jog +** and **Jog -** causes the slave to move as long as **Jog + / Jog -** = 1. Setting this bit to 1 the incremental jog function is enabled, that is: the activation of bits **Jog +** and **Jog -** causes at rising edge the execution of a single step toward positive or negative direction having the length, expressed in pulses, set next to

the **14 Jog step length** item; then the slave stops and waits for another issue.

bit 5 Not used.

Start

bit 6 When bit value switches from "0" to "1" device moves in order to reach the set target position. For a complete description of the position control see on page 35. For any information on the target position refer to **Target position (Bytes 4 ... 7)** on page 50. This bit has to be switched to "0" after the device has started.

Emergency

bit 7 This bit has to be normally high ("=1") otherwise it will cause the device to stop immediately. For a normal stop (not immediate) respecting the set deceleration see above bit 2 **Stop**.

Byte 1

bit 8 Not used.

Save parameters

bit 9 The function of this bit is available only when you install the **Lika RD5x-no param** module (see "1.1.2 Adding a node to the project" section on page 25). You must NOT set this bit if you do not use the -no param module. Data are saved on non-volatile memory at each rising edge of the bit; in other words, save is performed each time this bit is switched from logic level low ("0") to logic level high ("1"). For detailed information on the **Lika RD5x-no param** module please refer to the "Preliminary information" section on page 8.

Load default parameters

bit 10 The function of this bit is available only when you install the **Lika RD5x-no param** module (see "1.1.2 Adding a node to the project" section on page 25). You must NOT set this bit if you do not use the -no param module. Default parameters (they are set at the factory by Lika Electronic engineers to allow the operator to run the device for standard operation in a safe mode) are restored at each rising edge of the bit; in other words, the default parameters loading operation is performed each time this bit is switched from logic level low ("0") to logic level high ("1"). The complete list of machine data and relevant default parameters preset by Lika Electronic engineers are available on page 74. When the default parameters loading operation

is carried out, system also triggers an automatic save of all settings on the flash memory. For detailed information on the **Lika RD5x-no param** module please refer to the "Preliminary information" section on page 8.

bit 11 Not used.

Axis torque

bit 12 When the axis has reached the commanded position, it keeps the torque. This function is available only in RD5 version (model without brake); in the RD53 version (model fitted with brake) bit 12 is not used.
If set to "=0", PWM is deactivated (if there are not jogs or positioning movements in progress).
If set to "=1", PWM becomes active: axis enters the space control condition (even if there are not jogs or positioning movements in progress).

bit 13 Not used.

Brake released

bit 14 This function is available only in RD53 version (model fitted with brake); in the RD5 version (model without brake) bit 14 is not used. RD53 model is fitted with a brake designed to activate as soon as the motor comes to a stop in order to prevent it from moving even slightly. Setting this bit to "=1" causes the brake to be disabled; setting this bit to "=0" causes the brake to be enabled and managed automatically by the system.



Please note that you can disengage the brake only when no alarm is active.

bit 15 Not used.

Bytes 2 and 3 Not used.

Target position (Bytes 4 ... 7)

This is the position to be reached, otherwise referred to as commanded position. When the **Start** command is sent while **Stop** and **Emergency** bits are "1" and the alarm condition is off, device moves in order to reach the target position.

Byte 4	byte 5	byte 6	byte 7
Low	High



Position override function

It is possible to change the target position value even while the device is still reaching it; to do this, send the **Start** command and the new value for **Target position (Bytes 4 ... 7)**.



NOTE

Jog +, **Jog -** and **Start** functions cannot be activated simultaneously. For instance: if a **Jog +** command is sent to the Slave while it is moving to target position, jog command will be ignored; if **Jog +** and **Jog -** commands are sent simultaneously, device does not move or, if already moving, it stops its movement.

Should the device be disconnected from Profibus network while it is moving (for instance because of a broken cable or faulty wiring), device stops moving immediately and enters the emergency status. As soon as the network communication is restored, the **Profibus communication not active** alarm message is invoked to appear.

Parameter number (Byte 8)

This is reserved for setting the index of the parameter whose value is set / read in the next four bytes.

For the complete list of the available parameters and their meaning please refer to section "Profibus® programming parameters" on page 61.

bit 7	bit 6	bit 5 ... 0
R/W	0	Parameter index

R/W = 0 reading the parameter

R/W = 1 writing the parameter



Example 1

You need to write a value next to the parameter **28 Preset** (index 28h), so set 0xA8 = 1010 1000:

	R/W	-	Parameter index					
bit	7	6	5	4	3	2	1	0
binary	1	0	1	0	1	0	0	0

where:

bit 7 = R/W = 1, i.e. "writing the parameter"

bit 6 = bit always set to 0

bit 5 ... 0 = parameter index = 101000 binary value = 28h = **28 Preset**

Value to be set must be typed in the next four bytes 9...12 - **Parameter value (Bytes 9 ... 12)**.



Example 2

You need to read the value next to the parameter **2A Temperature value** (index 2Ah), so set 0x2A = 0010 1010:

	R/W	-	Parameter index					
bit	7	6	5	4	3	2	1	0
binary	0	0	1	0	1	0	1	0

where:

bit 7 = R/W = 0, i.e. "reading the parameter"

bit 6 = bit always set to 0

bit 5 ... 0 = parameter index = 101010 binary value = 2Ah = **2A Temperature value**

The next four bytes 9...12 - **Parameter value (Bytes 9 ... 12)**- are ignored.

Parameter value (Bytes 9 ... 12)

These contain the value to be assigned to the parameter set in the previous byte. 4 data bytes are available for each parameter.

For the complete list of the available parameters and their meaning please refer to section "Profibus® programming parameters" on page 61.

byte 9	byte 10	byte 11	byte 12
Low	High



WARNING

When you install **Lika RD5x-T50** module, the value of each parameter is uploaded at power on from the GSD file which has been loaded in the PLC. Thus any new setting made locally through **Parameter number (Byte 8)** and **Parameter value (Bytes 9 ... 12)** items of the Data Exchange message will be temporary: when you turn off the power supply, the set value is lost (except the preset value which is the only variable not included in the GSD file; or unless you set the preset value previously which causes all parameters values to be saved automatically, see on page 69) and the value saved in the PLC will be uploaded at next power on (thus all values, even if previously saved because of a preset setting, will be overwritten anyway).

This unit also allows to install the **Lika RD5x-no param** module. Using this module, the unit does not read the parameters from the PLC when the power is switched on (they are read from the flash memory) and allows the operator to save any new setting made locally through **Parameter number (Byte 8)** and **Parameter value (Bytes 9 ... 12)** items of the Data Exchange message on the non-volatile memory (by means of the bit 9 **Save parameters** in the **Control Word (Bytes 0 and 1)**). When the **Lika RD5x-no param** module is installed, it is NOT possible to read and change the values of the **configuration data** parameters in the **Parameter Assignment** page of the **STEP 7 Properties - DP slave** window (see "5.1.3 Setting "configuration data" parameters" section on page 26). Thus you are allowed to enter new parameter values only through **Parameter number (Byte 8)** and **Parameter value (Bytes 9 ... 12)** items of the Data Exchange message. The **Lika RD5x-no param** module has no relevance to the reduction gear ratio and can be used for whatever unit and independently from its reduction gear. Anyway it is obvious that the parameters you set must be compatible with the mechanical and electrical characteristics of the unit you are going to configure.

On the other hand using Siemens STEP7 it is possible to alter any value and then save it permanently in the PLC (except in the -no param module). To save values permanently the operator has to enter the **Properties - DP slave** window of STEP7 and then alter the desired item (see section "5.1.3 Setting "configuration data" parameters" on page 26). Values altered in the variables table of STEP7

(see section "5.3 Setting and reading parameter values" on page 30) are temporary only.

Byte 13 Not used.

7.6.2 Slave → Master functions

In this section Data_Exchange messages sent by the Slave to the Master are described.

Status word (Bytes 0 and 1)

In this byte the status of the PI controller when the unit is in Data_Exchange operating state is shown.

Byte 0

Axis in position

bit 0

If value is "1" device has reached the commanded position for the time set in 03 Position window time. This is kept active until the position error is lower than 02 Position window.

bit 1

Not used.

Axis enabled

bit 2

It shows the enabling status of the motor. This bit is "1" when the motor is enabled, that is: PWM is active and the axis is under closed-loop control (while reaching a target position or using a jog, for instance). It is "0" when the motor is disabled, that is when the controller is off after a positioning or jog movement or because of an alarm condition.

SW limit switch +

bit 3

If value is "1" device has reached the maximum positive limit (positive limit switch). See parameter 09 Positive delta.

SW limit switch -

bit 4

If value is "1" device has reached the maximum negative limit (negative limit switch). See parameter 0A Negative delta.

Alarm

bit 5

If value is "1" an alarm has occurred, see details in Alarms (Bytes 2 and 3).

Axis running

bit 6

Theoretical state of the axis.

If value is "0" device is in stop (not moving).

If value is "1" device is currently moving.

Executing a command

bit 7 If value is "0" controller is not executing any command.
 If value is "1" controller is executing a command.

Byte 1

Target position reached

bit 8 If value is "1" device has reached the target position set in **Target position (Bytes 4 ... 7)**. Bit is kept active until new **Target position (Bytes 4 ... 7)** or **Alarm reset** commands are sent.

bit 9 ... bit 11 Not used.

DAC saturation

Bit 12 The current supplied by the power electronic for controlling the motor has reached the maximum value and cannot be increased further.

bit 13 ... bit 15 Not used.

Alarms (Bytes 2 and 3)

These bytes are meant to show the alarms currently active in the device.

Byte 2

Machine data not valid

bit 0 0001h: One or more parameters are not valid, set proper values to restore normal work condition. See the list of wrong parameters in **32 Wrong parameters list**.

Flash memory error

bit 1 0002h: Internal error, it cannot be restored.

bit 2 Not used.

Following error

bit 3 0008h: The difference between the real position and the theoretical position calculated by the system is greater than the value set in parameter **04 Max following error**; we suggest reducing the work speed.

Axis not synchronized

bit 4 0010h Internal error, it cannot be restored.

Target not valid

bit 5 0020h: Target position is over maximum travel limits.

Emergency

bit 6 0040h Bit 7 **Emergency** in **Control Word (Bytes 0 and 1)** has been forced to low value (0); or alarms are active in the unit.

Overcurrent

bit 7 0080h The power supply current is exceeding maximum ratings.

Byte 3

Overtemperature

bit 8 0100h: The internal temperature of the device as sensed by a probe is exceeding maximum ratings (see parameter **2A Temperature value**).

Address not valid

bit 9 0200h: Parameter number (address) not valid.

Undervoltage

bit 10 0400h The power supply voltage is under minimum ratings.

bit 11 Not used.

Read-only

bit 12 1000h This is a read-only parameter (ro parameter) and cannot be written to.

Profibus communication not active

bit 13 2000h This bit is intended to warn (value 1) that the communication in the Profibus network has broken (cable disconnected? Voltage drop? ...). Alarm is invoked to appear immediately after the communication has been restored.

bits 14 and 15 Not used.

To reset an alarm condition of the Slave use **Alarm reset** command, **Control Word (Bytes 0 and 1)** bit 3. In a normal work condition the **Alarm reset** bit is set to "0". Setting the bit to "1" causes the normal work status of the device to be restored. Normal work status is resumed by switching this bit from "0" to "1". This command resets the alarm but only if the fault condition has ceased.



Please note that should the alarm be caused by wrong parameter values (see **Machine data not valid** and **32 Wrong parameters list**), normal work status can be restored only after having set proper values. **Flash memory error** and **Axis not synchronized** alarms cannot be reset.

Position (Bytes 4 ... 7)

Absolute position of the device in the moment when the message is sent.

Parameter number (Byte 8)

This contains the index of the parameter whose value is shown in the four following bytes.

Indexes are listed in section "Profibus® programming parameters" on page 61.

Parameter value (Bytes 9...12)

These contain the value assigned to the parameter whose number is shown in the previous byte. 4 data bytes are available for each parameter.

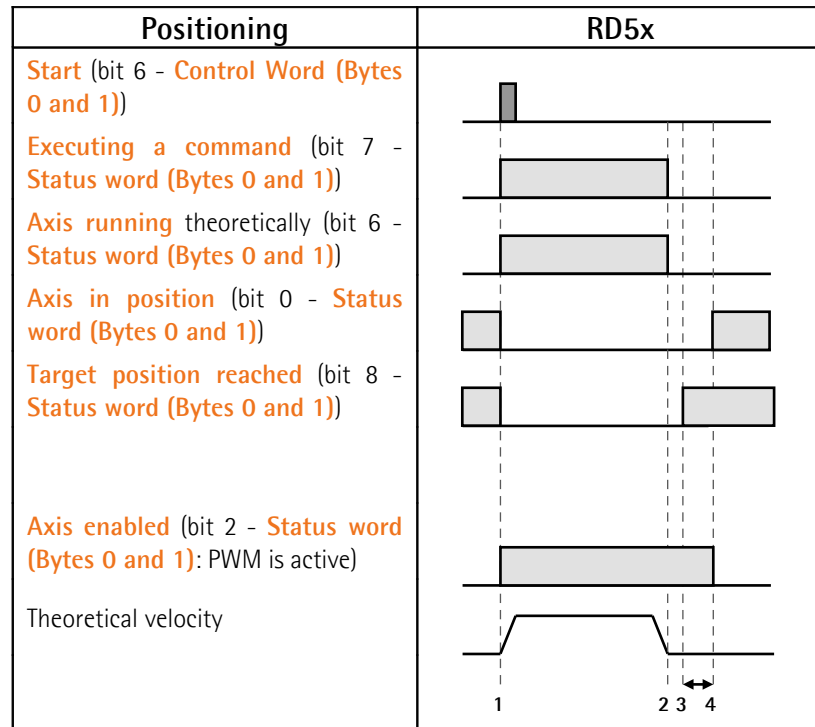
For the complete list of the available parameters and their meaning please refer to section "Profibus® programming parameters" on page 61.

byte 9	byte 10	byte 11	byte 12
Low	High

Byte 13 Not used.



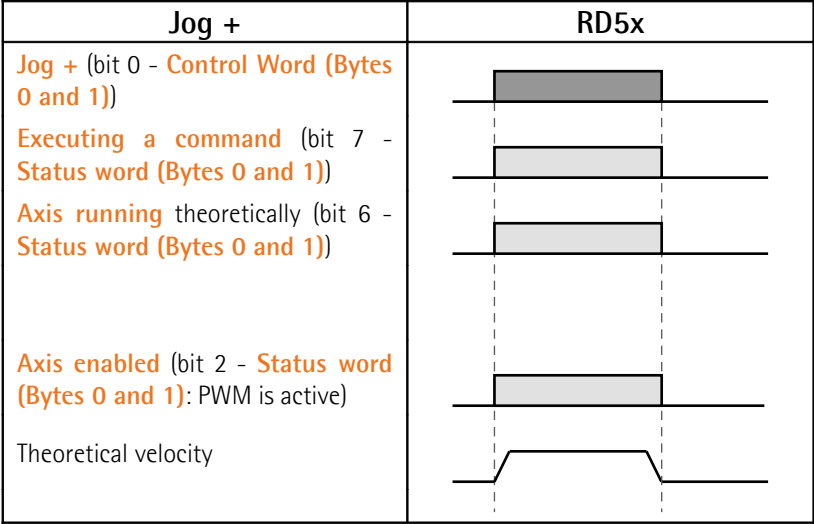
Example 1



- Point 1: **Start** command is issued to device; controller activates the internal PWM and generates the velocity profile; **Executing a command** and **Axis running** bits have value "1".
- Point 2: controller has theoretically reached the target position.
- Point 3: axis has actually reached the position within the tolerance window limits set in parameter **02 Position window**.
- Point 4: time set in parameter **03 Position window time** has expired and therefore the **Axis in position** bit is set to "1".



Example 2



7.7 DDLM_Slave_Diag

Master device can send a request for diagnostic information to the Slave device at any time.

RD5x devices provide the 6-byte reduced diagnostic.

6-byte diagnostic:

Byte	Description
0	Status 1
1	Status 2
2	Status 3
3	Master ID
4	Manufacturer ID
5	

8 Profibus® programming parameters

In the following pages parameters implemented are listed and described as follows:

Index Parameter name

[data types, attribute]

- Index is expressed in hexadecimal notation.
- Attribute:
 - ro = read only access
 - rw = read and write access

Unsigned32 data type:

Data byte			
byte 9	byte 10	byte 11	byte 12
2^{31} to 2^{24}	2^{23} to 2^{16}	2^{15} to 2^8	2^7 to 2^0
MSByte	LSByte



WARNING

When you install **Lika RD5x-T50** module, the value of each parameter is uploaded at power on from the GSD file which has been loaded in the PLC. Thus any new setting made locally through **Parameter number (Byte 8)** and **Parameter value (Bytes 9 ... 12)** items of the Data Exchange message will be temporary: when you turn off the power supply, the set value is lost (except the preset value which is the only variable not included in the GSD file; or unless you set the preset value previously which causes all parameters values to be saved automatically, see on page 69) and the value saved in the PLC will be uploaded at next power on (thus all values, even if previously saved because of a preset setting, will be overwritten anyway).

This unit also allows to install the **Lika RD5x-no param** module. Using this module, the unit does not read the parameters from the PLC when the power is switched on (they are read from the flash memory) and allows the operator to save any new setting made locally through **Parameter number (Byte 8)** and **Parameter value (Bytes 9 ... 12)** items of the Data Exchange message on the non-volatile memory (by means of the bit 9 **Save parameters** in the **Control Word (Bytes 0 and 1)**). When the **Lika RD5x-no param** module is installed, it is NOT possible to read and change the values of the **configuration data** parameters in the **Parameter Assignment** page of the **STEP 7 Properties – DP slave** window (see "5.1.3 Setting "configuration data" parameters" section on

page 26). Thus you are allowed to enter new parameter values only through **Parameter number (Byte 8)** and **Parameter value (Bytes 9 ... 12)** items of the Data Exchange message. The **Lika RD5x-no param** module has no relevance to the reduction gear ratio and can be used for whatever unit and independently from its reduction gear. Anyway it is obvious that the parameters you set must be compatible with the mechanical and electrical characteristics of the unit you are going to configure.

On the other hand using Siemens STEP7 it is possible to alter any value and then save it permanently in the PLC (except in the -no param module). To save values permanently the operator has to enter the **Properties - DP slave** window of STEP7 and then alter the desired item (see section "5.1.3 Setting "configuration data" parameters" on page 26). Values altered in the variables table of STEP7 (see section "5.3 Setting and reading parameter values" on page 30) are temporary only.

Configuration data parameters

01 Distance per revolution

[Unsigned32, rw]

01 Distance per revolution sets the number of pulses per each complete revolution of the shaft. This parameter is useful to relate the revolution of the shaft and a linear measurement. For example: unit is joined to a worm screw having a 5 mm pitch; by setting **01 Distance per revolution** = 500, at each shaft revolution system performs a 5 mm pitch with one-hundredth of a millimetre resolution.

Default = 1024 (min. = 1, max. = 1024).



WARNING

After having changed this parameter you must then set new values also in parameters **0B Jog speed**, **0C Work speed** and **28 Preset**. For a detailed explanation see on page 37 and relevant parameters.

Please note that the parameters listed hereafter are closely related to the **01 Distance per revolution** parameter; hence when you change the value in **01 Distance per revolution** also the value expressed by each one is necessarily redefined. They are: **02 Position window**, **04 Max following error**, **07 Acceleration**, **08 Deceleration**, **09 Positive delta**, **0A Negative delta**, **29 Current velocity value**, **30 Positive absolute limit switch**, **31 Negative absolute limit switch**, **Target position (Bytes 4 ... 7)** and **Position (Bytes 4 ... 7)**. See for instance the relationship between **01 Distance per revolution** and the speed values, explained on page 37.



NOTE

If **01 Distance per revolution** is not a power of 2 (2, ..., 512, 1024), at position control a positioning error could occur having a value equal to one pulse.

02 Position window

[Unsigned32, rw]

This parameter defines the tolerance window for the **Target position (Bytes 4 ... 7)** value. When the axis is within the tolerance window limits for the time set in parameter **03 Position window time**, then the state is signalled through the **Axis in position** status bit. Parameter is expressed in pulses.

Default = 0 (min. = 0, max. = 100000).

03 Position window time

[Unsigned32, rw]

It represents the time for which the axis has to be within the tolerance window limits set in the previous parameter **02 Position window** before the state is signalled through the **Axis in position** status bit. Parameter is expressed in milliseconds.

Default = 0 (min. = 0, max. = 10000).

04 Max following error

[Unsigned32, rw]

This parameter defines the maximum allowable difference between the real position and the theoretical position of the device calculated moment by moment. If the device detects a value higher than the one set in this parameter, the alarm **Following error** is triggered and the unit stops. Parameter is expressed in pulses.

Default = 1024 (min. = 0, max. = 100000).

05 Kp position loop

[Unsigned32, rw]

This parameter contains the proportional gain used by the PI controller for the position loop. Value has been optimized by Lika Electronic according to the technical characteristics of the device.

Default = 500 (min. = 0, max. = 1000).

06 Ki position loop

[Unsigned32, rw]

This parameter contains the integral gain used by the PI controller for the position loop. Value has been optimized by Lika Electronic according to the technical characteristics of the device.

Default = 60 (min. = 0, max. = 1000).

07 Acceleration

[Unsigned32, rw]

This parameter defines the acceleration value that has to be used by the device. Parameter is expressed in pulses per second² [PPS²].

Default = 2500 (min.=100, max.=10000)

08 Deceleration

[Unsigned32, rw]

This parameter defines the deceleration value that has to be used by the device. Parameter is expressed in pulses per second² [PPS²].

Default = 2500 (min.=100, max.=10000)

09 Positive delta

[Unsigned32, rw]

This value is used to calculate the maximum forward (positive) limit the device is allowed to reach starting from the preset value. When the maximum forward limit is reached, a signalling is activated through the **SW limit switch +** status bit. Parameter is expressed in encoder pulses.

SW limit switch + = 28 Preset + 09 Positive delta.

Default = 130047 (min.=0, max.=130047).

0A Negative delta

[Unsigned32, rw]

This value is used to calculate the maximum backward (negative) limit the device is allowed to reach starting from the preset value. When the maximum backward limit is reached, a signalling is activated through the **SW limit switch -** status bit. Parameter is expressed in encoder pulses.

SW limit switch - = 28 Preset - 0A Negative delta.

Default = 130047 (min.=0, max.=130047).



WARNING

Every time **01 Distance per revolution** and **28 Preset** parameters are changed, **09 Positive delta** and **0A Negative delta** values has to be checked carefully. Each time you change the value in **01 Distance per revolution** you must then update the value in **28 Preset** in order to define the zero of the shaft as the system reference has now changed.

After having changed the parameter in **28 Preset** it is not necessary to set new values for travel limits as the Preset function then calculates them automatically and initializes again the positive and negative limits according to the values set in **09 Positive delta** and **0A Negative delta** items. For a detailed explanation see on page 37.

0B Jog speed

[Unsigned32, rw]

This parameter allows to set the maximum speed of the unit when using **Jog +** and **Jog -** functions. Parameter is expressed in pulses per second.

Default = 1024 (min. = 1, max. = 1024)

0C Work speed

[Unsigned32, rw]

This parameter is meant to set the maximum speed the unit can reach in automatic work mode (movements are controlled using **Start** and **Target position (Bytes 4 ... 7)** commands). Parameter is expressed in pulses per second.

Default = 1024 (min. = 1, max. = 1024)



WARNING

Each time you change the value in **01 Distance per revolution** you must then set new values also in **0B Jog speed** and **0C Work speed** as speed values are expressed in pulses per second. To calculate the speed values you have always to adhere to the following ratio:

$$\frac{\text{Min. Speed} * \mathbf{01 \text{ Distance per revolution}}}{1024} \leq \text{Speed} \leq \frac{\text{Max. speed} * \mathbf{01 \text{ Distance per revolution}}}{1024}$$

For detailed information please refer to page 37.

0D Start Torque current time

[Unsigned32, rw]

This parameter defines the maximum time for which the motor is supplied with starting torque current when it starts its movement (see parameter **12 Starting Torque current**). Parameter is expressed in milliseconds.

Default = 2000 (min. = 0, max. = 3000).

0E Code sequence

[Boolean, rw]

It sets the rotation direction of the encoder shaft and consequently defines whether the position value output by the encoder increases when the encoder shaft rotates clockwise (0) or counter-clockwise (1). Clockwise and counter-clockwise rotations are viewed from shaft.

0 = clockwise rotation (default)

1 = counter-clockwise rotation



WARNING

Changing this value causes also the position calculated by the controller to be necessarily affected. Therefore it is compulsory to set a new value in parameter **28 Preset** and then check parameters **09 Positive delta** and **0A Negative delta**.

0F Kp current loop

[Unsigned32, rw]

This parameter contains the proportional gain used by the PI controller for the current loop. Value has been optimized by Lika Electronic according to the technical characteristics of the device.

Default = 300 (min. = 0, max. = 1000).

10 Ki current loop

[Unsigned32, rw]

This parameter contains the integral gain used by the PI controller for the current loop. Value has been optimized by Lika Electronic according to the technical characteristics of the device.

Default = 60 (min. = 0, max. = 1000).

11 Max current

[Unsigned32, rw]

This parameter defines the maximum current supplied by the power electronic for controlling the motor. Parameter is expressed in mA (milliamperes). This value cannot be greater than the one in parameter **12 Starting Torque current**.

Default = 2000 (min. = 10, max. = 2000).

12 Starting Torque current

[Unsigned32, rw]

This parameter defines the maximum current supplied to the motor only when it starts its movement and for the maximum time set in parameter **0D Start Torque current time**. Parameter is expressed in mA (milliamperes).

Default = 4000 (min. = 10, max. = 4000).

13 Gear ratio

[Unsigned32, ro]

It displays the gear ratio of the reduction gear installed between the motor and the encoder shaft of the unit. This is a read-only parameter.

Default = 50

14 Jog step length

[Unsigned32, rw]

If the incremental jog function is enabled (bit 4 **Incremental jog** in **Control Word (Bytes 0 and 1)** = 1), the activation of bits **Jog +** and **Jog -** causes at rising edge the execution of a single step toward positive or negative direction having the length, expressed in pulses, set next to this item; then the slave stops and waits for another issue.

Default = 100 (min. = 1, max. = 10000).

Operational data parameters

28 Preset

[Integer32, rw]

Use this parameter to set the Preset value. Preset function is meant to assign a certain value to a desired physical position of the encoder shaft. Value is expressed in pulses. The chosen physical position will get the value set next to this item and all the previous and following positions will get a value according to it. The preset value will be set for the position of the axis in the moment when the preset value is activated. The preset value is activated at the rising edge of the bit 7 in the byte 8 **Parameter number (Byte 8)** of the Data_Exchange message sent by the Master to the Slave; in other words, the preset value is entered and activated when the bit 7 in the byte 8 **Parameter number (Byte 8)** is switched from logic level low ("0") to logic level high ("1"). The value to be set must be typed in the next four bytes 9...12 - **Parameter value (Bytes 9 ... 12)** of the Data_Exchange message. When the preset setting operation is carried out, system also triggers an automatic save of all settings on the flash memory.

Default = 0 (min. = -262143, max. = 262143).



Example

You need to write a value next to the **28 Preset** parameter (index 28h), so set 0xA8 = 1010 1000 in the byte 8 **Parameter number (Byte 8)** of the Data_Exchange message sent by the Master to the Slave:

	R/W	-	Parameter index					
bit	7	6	5	4	3	2	1	0
binary	1	0	1	0	1	0	0	0

where:

bit 7 = R/W = 1, i.e. "writing the parameter"

bit 6 = bit always set to 0

bit 5 ... 0 = parameter index = 101000 binary value = 28h = **28 Preset**



WARNING

A new value has to be set in **28 Preset** every time **01 Distance per revolution** value is changed. After having entered a new value in **28 Preset** it is not necessary to set new values for travel limits as the Preset function then calculates them automatically and initializes again the positive and negative limits according to the values set in **09 Positive delta** and **0A Negative delta**. For a detailed explanation see on page 37.

29 Current velocity value

[Integer32, ro]

This parameter shows the value of the current speed calculated every second. Parameter is expressed in pulses per second.

2A Temperature value

[Integer32, ro]

This parameter shows the value of the internal temperature of the device as sensed by a probe. Parameter is expressed in °C (Celsius degrees). The minimum detectable temperature is -20°C.

2B Current value [mA]

[Integer32, ro]

This parameter shows the value of the current absorbed by the motor (rated current). Parameter is expressed in mA (milliamperes).

2C Position following error

[Integer32, ro]

This object contains the difference between the target position and the current position step by step. If this value is greater than the one set in parameter **04 Max following error**, then the alarm **Following error** is triggered and the unit stops.

2D Software version

[Unsigned16, ro]

It contains the software version of the device.

The meaning of the 16 bits in the index is as follows:

15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Ms bit								Ls bit							
Major number								Minor number							

Value 258 in decimal notation corresponds to the binary representation 00000001 00000010 and has to be interpreted as: 01 02 hex, i.e. version 1.2.

2E Hardware version

[Unsigned16, ro]

It contains the hardware version of the device.

The meaning of the 16 bits in the index is as follows:

15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
ROTADrive model				Interface			Brake	-			Hardware version				

where:

00 ... 03	= hardware version
04 ... 06	= unused bits
07	= brake (0 = without brake; 1 = with brake)
08 .. 11	= interface (00 = Modbus; 01 = Profibus; 02 = CANopen; 03 ... 0F = unused bits)
12 ... 15	= ROTADrive model (00 = RD4; 01 = RD1xA; 02 = RD5; 03 ... 0F = unused bits)

Value 4481 in decimal notation corresponds to the binary representation 00010001 10000001 and has to be interpreted as follows: hardware version 1 (bit 0 = 1); device fitted with brake (bit 7 = 1); Profibus interface (bit 8 = 1); RD1xA model (bit 12 = 1).

2F Offset

[Integer32, ro]

This parameter defines the difference between the position value transmitted by the device and the real position: real position – preset. Value is expressed in pulses.

30 Positive absolute limit switch

[Unsigned32, ro]

This is the **SW limit switch +** value (maximum positive limit) calculated according to values set in parameters **28 Preset** and **09 Positive delta**. When the maximum forward limit is reached, a signalling is activated through the **SW limit switch +** status bit.

SW limit switch + = 28 Preset + 09 Positive delta.

Value is expressed in encoder pulses.

31 Negative absolute limit switch

[Unsigned32, ro]

This is the **SW limit switch** – value (maximum negative limit) calculated according to values set in parameters **28 Preset** and **0A Negative delta**. When the maximum backward limit is reached, a signalling is activated through the **SW limit switch** – status bit.

SW limit switch – = **28 Preset** – **0A Negative delta**.

Value is expressed in encoder pulses.

32 Wrong parameters list

[Unsigned32, ro]

The operator has set invalid data and the **Machine data not valid** alarm has been triggered. This variable is meant to show the list of the wrong parameters, respecting the structure shown in the following table.

Please note that normal work status can be restored only after having set proper values.



NOTE

Variable **32 Wrong parameters list** can be read by the PLC only if the RD unit goes online properly. On the other hand ROTADrive unit can go online only if the PLC sends correct parameters. If, for instance, you alter the value of index **01 Distance per revolution** directly in the GSD file without entering suitable values also next to the speed items, RD unit is not able to go online and thus it is not possible to enter this index and have information. Index **32 Wrong parameters list** can be read by the PLC only if you make changes, for instance, in the variables table. When you alter a parameter through **Parameter number (Byte 8)** and **Parameter value (Bytes 9 ... 12)**, ROTADrive unit is necessarily in **Data_Exchange** mode; so data exchange between Master and Slave is active and therefore it is possible to read this index. At power on, ROTADrive unit enters the **Data_Exchange** mode only after finalizing the SET_PRM phase: this means that configuration data has been sent properly to the Slave device.

Bit	Parameter
1	01 Distance per revolution
2	02 Position window
3	03 Position window time
4	04 Max following error
5	05 Kp position loop
6	06 Ki position loop

7	07 Acceleration
8	08 Deceleration
9	09 Positive delta
10	0A Negative delta
11	0B Jog speed
12	0C Work speed
13	0D Start Torque current time
14	0E Code sequence
15	0F Kp current loop
16	10 Ki current loop
17	11 Max current
18	12 Starting Torque current
19	13 Gear ratio
20	14 Jog step length
26	28 Preset

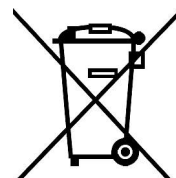
9 Default parameters list

Parameters list	Default value		
01 Distance per revolution PPR	1024		
02 Position window P	0		
03 Position window time ms	0		
04 Max following error P	1024		
05 Kp position loop	500		
06 Ki position loop	60		
07 Acceleration PPS ²	2500		
08 Deceleration PPS ²	2500		
09 Positive delta P	130047		
0A Negative delta P	130047		
0B Jog speed PPS	1024		
0C Work speed PPS	1024		
0D Start Torque current time ms	2000		
0E Code sequence	0		
0F Kp current loop	300		
10 Ki current loop	60		
11 Max current mA	2000		
12 Starting Torque current mA	4000		
28 Preset P	0		
14 Jog step length P	100		

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HW-SW release	Document release	Description
H1-S1	1.0	First issue
H1-S1	1.1	Warning against back EMF



Dispose separately

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