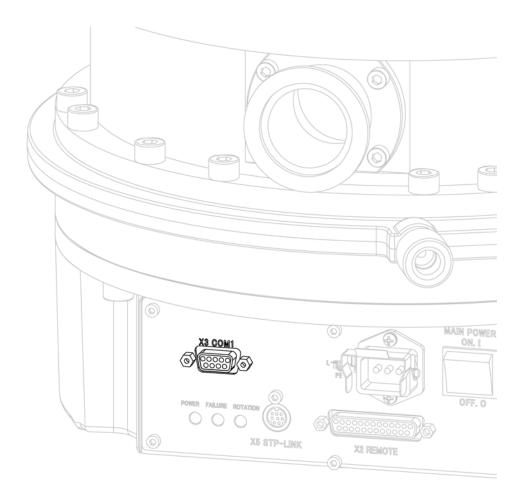


Profibus Interface for nEXT Maglev Pump INSTRUCTION MANUAL

edwardsvacuum.com



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Product warranty and limit of liability are dealt with in our standard terms and conditions of sale or negotiated contract under which this document is supplied.

You must use this product as described in this manual. Read the manual before you install, operate, or maintain the product. For manual enquiries, email *manuals@edwardsvacuum.com*.

Contents

1.	Safety and compliance	5
	1.1 Definition of Warnings and Cautions.	
	1.2 Trained personnel	
	1.3 Safety symbols.	
2.	Description	7
3.	Start-up	8
4.	Software format.	9
	4.1 Parameterisation.	9
	4.2 Configuration.	
	4.3 Parameterisation failure.	10
	4.4 Configuration failure.	10
	4.5 Diagnostics description.	
	4.6 Update rate/timing	10
5.	Software modules	12
	5.1 Software modules with output bytes	12
	5.2 Software modules with input bytes.	14
	5.2.1 Module 04 - Failure flags Input bytes (to Master)	16
	5.3 Software modules with output & input bytes	18

List of Figures

Figure 1: View of the integrated frequency converter.	7
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1. Safety and compliance

For safe operation from the start, read these instructions carefully before you install or commission the equipment and keep them safe for future use. Read all the safety instructions in this section and the rest of this manual carefully and make sure that you obey these instructions.

The instruction manual is an important safety document that we often deliver digitally. It is your responsibility to keep the instruction manual available and visible while working with the equipment. Please download the digital version of the instruction manual for use on your device or print it if a device will not be available.

1.1 Definition of Warnings and Cautions

Important safety information is highlighted as warning and caution instructions which are defined as follows. Different symbols are used according to the type of hazard.

WARNING:

If you do not obey a warning, there is a risk of injury or death.

CAUTION:

If you do not obey a caution, there is a risk of minor injury, damage to equipment, related equipment or process.

NOTICE:

Information about properties or instructions for an action which, if ignored, will cause damage to the equipment.

We reserve the right to change the design and the stated data. The illustrations are not binding.

1.2 Trained personnel

For the operation of this equipment "trained personnel" are:

- skilled workers with knowledge in the fields of mechanics, electrical engineering, pollution abatement and vacuum technology and
- personnel specially trained for the operation of vacuum pumps

1.3 Safety symbols

The safety symbols on the products show the areas where care and attention is necessary.

The safety symbols that we use on the product or in the product documentation have the following meanings:



Warning/Caution

Risk of injury and/or damage to equipment. An appropriate safety instruction must be followed or a potential hazard exists.

2. Description

The nEXT Maglev pump is a VO slave unit and thus responds to requests from the master, and supplies data exclusively after having received a request to do so from the master.

The required performance is described in standard EN50170. The Profibus master requires a GSD file for each slave and these are provided on *https://www.edwardsvacuum.com/en-uk/vacuum-pumps/our-products/software/*. The GSD file required for this unit is "EDSV0B32.GSD". When configuring the system, the "ID" number will be 0B32 and the unit's description will be "nEXT Maglev".

16-bit values are transmitted with the MSB first and the LSB last.

At both ends of the bus a terminating resistor is required. Such a terminator must be incorporated in an external plug. The connections for this plug are provided through the interface connector. For this also see the standards.

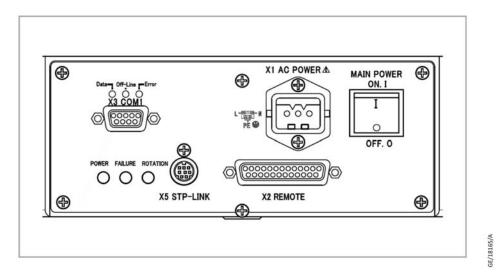
/· · · · · · · · · · · · · · · · · · ·						
9.6 k Baud	19.2 k Baud	45.45 k Baud				
93.75 k Baud	187.5 k Baud	500 k Baud				
1.5 M Baud	3 M Baud	6 M Baud	12 M Baud			

The **baud rate** is set automatically. The following baud rates are supported:

Front panel LEDs for Profibus

Description	Function
Data	Slave is in data exchange as defined by the Profibus standard.
Off-Line	Slave is not in data exchange as defined by the Profibus standard.
Error	ON at the same time as Offline LED = Configuration or parameteri- sation error.
	Flashing at 1 Hz = Invalid address selected.

Figure 1 View of the integrated frequency converter



3. Start-up

Connection

Note:

Before making any connections, switch the pump off and wait until it turns no longer. Then de-energise the pump.

Connect the Profibus to the Profibus interface connector on the front of the frequency converter (X3 COM1). Both bus ends must be terminated. This must be done externally using a special plug. The connections required for this are provided in the interface connector.

Load the GDS file "EDSV0B32.GSD" into the Profibus system configurator.

Select module "Mod01 Pump Command, 1 Out". This will allow start/stop control of the pump.

Switch on the power to the pump.

Set the Profibus master output data to 0x01 to start the pump or 0x02 to stop the pump.

Address Setup for Profibus

Default setting is 0. The address can be changed using the "nEXT Maglev Communication Configurator" (also available on *https://www.edwardsvacuum.com/en-uk/vacuum-pumps/our-products/software/*).

After changing the Profibus address, power off the nEXT Maglev pump (turn the MAIN POWER "OFF"), and then power on (turn the MAIN POWER "ON") again to enable the new setting.

4. Software format

The slave software is based upon a modular configurable architecture so the user has considerable control of the contents of the data exchange messages. The software modules are defined in the GSD file.

When the unit is linked onto the Profibus it will be configured and may be parameterised before entering data exchange. The parameterisation and configuration choices are in the GSD file, and its comments describe the data content of the input, output and parameterisation bytes. These choices will often be made using a third party configurator that presents a user-friendly interface.

16-bit values are transmitted with the MSB first and the LSB last.

4.1 Parameterisation

There is one parameterisation - speed setpoint - which is contained in Module 18 -"Speed Setpoint". This parameter will only be sent if the module is selected in the configuration. The parameterisation is remembered during power down so if you require to alter the parameterisation you must send it (include it in the configuration list). Parameter settings do not return to default during a power down.

4.2 Configuration

During configuration the user can define which modules are required and in which order the data is transferred. The unit simply adds the input and output data bytes to the message maps in the order that they are defined in the configuration message.

Example:

Module = Mod_A: 3 bytes in (Ai1, Ai2, Ai3), 1 byte out (Ao1)

Module = Mod_B: 2 bytes in (Bi1, Bi2), 2 bytes out (Bo1, Bo2)

A) Configure Mod_A, Mod_B gives

Output map

Byte 1	Byte 2	Byte 3
Ao1	Bo1	Bo2

Input map

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
Ai1	Ai2	Ai3	Bi1	Bi2

B) Configure Mod_B, Mod_A gives

Output map

Byte 1	Byte 2	Byte 3
Bo1	Bo2	Ao1

Input map

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
Bi1	Bi2	Ai1	Ai2	Ai3

Data is always referred to the Master so output data is control data from Master to Slave and input data is feedback data from Slave to Master.

There are many software modules and many bytes of data so care must be taken in correctly selecting and aligning the data into your system.

Configuration may take up to 5 seconds to occur. During this period the Profibus Slave will signal to the Master that it is "not-ready" for data exchange.

4.3 Parameterisation failure

If an error occurs during parameterisation the slave will not enter data exchange. The number of the first failed module will be placed in the extended diagnostic data. This is not flagged as a critical diagnostic in the mandatory diagnostics (octet1 bit 3). In practice this failure will not occur since there is a specific program and GSD file for the pump.

4.4 Configuration failure

An inappropriate configuration will lead to parameterisation or configuration failure and the slave will not enter data exchange. The number of the first failed module will be placed in the extended diagnostic data. See below for description of the extended diagnostics. In practice this failure will not occur since there is a specific program and GSD file for the pump.

4.5 Diagnostics description

The module uses extended diagnostics in the form at below. Max_Diag_Data_Len = 12.

Bytes	1-6	7	8 and 9	10 and 11	12
Description	Mandatory	No of bytes	Module failed	Module failed	Internal serial
	(refer to	of extended	parameterisation	configuration	comms lost
	Profibus	diagnostics	MSB in 8,	MSB in 10, LSB	(0=OK, 1=lost)
	standard)	(always 6)	LSB in 9	in 11	

If the internal serial link fails then byte 12 will be set to 0x01 and the input data bytes from all modules will be set to 0x00. The Frame Control_Byte will not be set.

4.6 Update rate/timing

Pump data update time is dominated not by the Profibus system but by the pump's internal data communications. The serial communication commands differ with each module. The serial communication commands used by each module are divided into eight groups. However, only a module 12 does not use a serial communication command.

A faster update time will be achieved by only selecting the modules required, particularly if this avoids the use of plural serial commands. Refer to the table below for the serial commands group used by the Profibus modules.

For Example if module 2 is selected then also selecting module 3 will have little effect on the response time as both modules use the same serial command. However if module 15 is added then this will require an additional serial command and this will have a more significant effect on response time.

Moreover, immediately after 10 seconds of powering ON the pump, the correct data may not be transmitted because of new data acquisition. Design the communication on the host side in consideration of the item.

Serial command group	Module No.	Module Description
1	01	Pump Command
	02	Pump State
2	03	Warning Flags
	04	Failure Flags
	05	Pump Speed
3	06	Motor Current
5	07	Motor Temperature
	08	Control Unit Temperature
	09	Supervisor Software Version
4	10	Motor Drive Software Version
	11	AMB Software Version
	13	Pump Serial Number
5	14	Control Unit Serial Number
5	15	Pump Run Time
	16	Control Unit Run Time
6	17	Damage Limit Counter
7	18	Speed Setpoint
	22	Speed Demand
	19	Xh Vibration
8	20	Xb Vibration
	21	Z Vibration
None	12	Profibus Software Version

5. Software modules

Overview

Module No	Module description	No of output bytes	No of input bytes	No of parameter bytes
01	Pump Command	1	0	0
02	Pump State	0	1	0
03	Warning Flags	0	2	0
04	Failure Flags	0	16	0
05	Pump Speed	0	2	0
06	Motor Current	0	1	0
07	Motor Temperature	0	2	0
08	Control Unit Temperature	0	2	0
09	Supervisor Software Version	0	16	0
10	Motor Drive Software Version	0	4	0
11	AMB Software Version	0	4	0
12	Profibus Software Version	0	2	0
13	Pump Serial Number	0	10	0
14	Control Unit Serial Number	0	10	0
15	Pump Run Time	0	4	0
16	Control Unit Run Time	0	4	0
17	Damage Limit Counter	0	2	0
18	Speed Setpoint	0	2	4
19	Xh Vibration	0	2	0
20	Xb Vibration	0	2	0
21	Z Vibration	0	2	0
22	Speed Demand	2	2	0

AMB = Active Magnetic Bearing.

Xh = *Indication for the upper (high) radial magnetic bearing; X axis.*

Xb = *Indication for the lower (bottom) radial magnetic bearing; X axis.*

5.1 Software modules with output bytes

Input bytes (to Master) = none

Module No	Module description	Module Identifier	General Description	Output bytes (from Master)		om Master)	
01	Pump	Mod01 Pump	Pump control module.	Byte	Value	Function	
	command	command, 1	1 Used to start / stop / reset the pump.	· · · ·	1	0x01	Start
		Out			0x02	Stop	
				0x04	Reset		

5.2 Software modules with input bytes

Module	Module	Module	General Description	Input bytes (to master)				
No	description	Identifier		Byte	Value	Meaning		
02	Pump State	Mod02	Read current status of	1	0x01	Levitation		
		Pump State,	pump.		0x02	No Levitation		
		1 In			0x03	Acceleration		
					0x04	Normal		
					0x05	Deceleration (Braking)		
					0x06	Autotest		
					0x07	Tuning		
					0x08	Tuning Complete		
03	Warning	Mod03	Read warning flags from	1 and 2	bit 0	reserved		
	Flags	Warning flags, 2 In	pump. 16 flags are sent as 2 bytes MSB first.		bit 1	Second damage limit		
			Each warning is represen- ted by a single bit in		bit 2	First damage limit		
			the message. Value = 0		bit 3	Imbalance X H		
			if warning not detected, value = 1 if warning de-		bit 4	Imbalance X B		
					bit 5	Imbalance Z		
			tected.		bit 6	Pump runtime over		
					bit 7	Pump overload		
					bits 8 to 15	reserved		
04	Failure Flags	Mod04 Failure flags, 16 In	Read failure flags from pump. Each failure is rep- resented by a single bit in the message. Value = 0 if failure not detected, value = 1 if failure detec- ted.	see separate table				
05	Pump Speed	Mod05 Pump Speed, 2 In	Read pump speed	1 and 2	16-bit unsigned number	Pump speed in Hz		
06	Motor Current	Mod06 Motor Current, 1 In	Read motor current. For example 0xFF represents 25.5 A.	1	8-bit unsigned number	Motor current in 1/10th amp		
07	Motor Temperature	Mod07 Motor Temp, 2 In	Read motor temperature.	1 and 2	16-bit unsigned number	Motor tempera- ture in °C		

Output bytes (to Master) = none

Module	Module	Module	General Description	Input bytes (to master)				
No	description	Identifier		Byte	Value	Meaning		
08	Control Unit Temperature	Mod08 Cont Temp, 2 In	Read control unit temper- ature.	1 and 2	16-bit unsigned number	Control unit temperature in °C		
09	Supervisor Software Version	Mod09 Supervisor s/w vers, 16 In	Read supervisor software version.	1 to 16	ASCII charac- ters	Software version number as text string		
10	Motor Drive Software Version	Mod10 Motor Drive s/w vers, 4 In	Read motor driver soft- ware version. 4 ASCII characters with implied "." For example revision 0.1 is represented as 0x30, 0x30, 0x31, 0x30 ("0010").	1 to 4	ASCII charac- ters	Software version number as text string		
11	AMB Soft- ware Version AMagBear- ing s/w vers, 4 In		Read AMB software version. 4 ASCII charac- ters with implied "." For example revision 14. 15 is represented as 0x30, 0x45, 0x46, 0x30 ("0EF0").	1 to 4 ASCII charac- ters		Software version number as text string		
12	Profibus Software	Mod12 Pro- fibus s/w	Read Profibus software version. 2 ASCII charac-	1	ASCII character	Revision status		
	Version	vers, 2 In	ters representing revision status and issue letter.	2	ASCII character	Issue letter		
13	Pump Serial Number	Mod13 Pump Serial No., 10 In	Read pump serial number.	1 to 10	ASCII charac- ters	Serial number of pump		
14	Control Unit Serial Number	Mod14 Cont Serial No., 10 In	Read control unit serial number.	1 to 10	ASCII charac- ters	Serial number of control unit		
15	Pump Run Time	Mod15 Pump run time, 4 In	Read run time of pump rotation. Value returned is minutes counter.	1 to 4	Unsigned 32-bit number	Run time of pump in minutes		
16	Control Unit Run Time	Mod16 Cont run time, 4 In	Read run time during power ON of control unit. Value returned is minutes counter.	1 to 4	Unsigned 32-bit number	Run time of control unit in minutes		
17	Damage Limit Counter	Mod17 Damage limit counter, 2 In	Read damage limit counter from pump.	1 to 2	Unsigned 16-bit number	Damage limit counter		

Module	Module	Module	General Description	Input bytes (to master)				
No	description	Identifier		Byte	Value	Meaning		
18	Speed Setpoint	Mod18 Speed setpoint, 2 In	Read or write speed set- point. The speed setpoint is written to the pump during parameterisation if this module is selec- ted. The maximum and minimum values allowed for setpoint depend on pump type - refer to pump manual.	1 to 2	Unsigned 16-bit number	Speed setpoint in Hz		
				Associated Parameters				
				1 and 2	Always 0x00, 0x12	Module number (=18 ₁₀)		
				1 and 2	Unsigned 16-bit number	Speed setpoint in Hz		
19	Xh Vibration	Mod19 Xh vibration, 2 In	Read Xh vibration.	1 and 2	Unsigned 16-bit number	Xh vibration in ìm		
20	Xb Vibration	Mod20 Xb vibration, 2 In	Read Xb vibration.	1 and 2	Unsigned 16-bit number	Xb vibration in ìm		
21	Z Vibration	Mod21 Z vibration, 2 In	Read Z vibration.	1 and 2	Unsigned 16-bit number	Z vibration in µm		

5.2.1 Module 04 - Failure flags Input bytes (to Master)

Byte	Value	Meaning	Value	Meaning
1	bit 0	RAM error	bit 4	not used
	bit 1	EEPROM error	bit 5	Mains Failure / Power Failure
	bit 2	not used	bit 6	Power Supply Failure
	bit 3	not used	bit 7	Overspeed 1
2	bit 0	Driver Overvoltage	bit 4	Driver Overload
	bit 1	CAUTION: Controller heat 1	bit 5	Disturbance X_H
	bit 2	Controller Overheat 1	bit 6	Disturbance Y_H
	bit 3	Driver Overcurrent	bit 7	Disturbance X_B
3	bit 0	Disturbance Y_B	bit 4	Controller Overheat 2
	bit 1	Disturbance Z	bit 5	not used
	bit 2	Motor Overheat	bit 6	Pump Cable Disconnected
	bit 3	CAUTION: Controller Heat 2	bit 7	Emergency Leak Valve Disconnect
4	bit 0	Driver Com. Failure	bit 4	Speed Pulse Lost
	bit 1	First Damage Limit	bit 5	Overspeed 2
	bit 2	Second Damage Limit	bit 6	Overspeed 3
	bit 3	START NOT ALLOWED	bit 7	M_Temp Sensor Lost
5	bit 0	not used	bit 4	Tuning Error 1

Byte	Value	Meaning	Value	Meaning	
	bit 1	Active Magnetic Bearing Com. Failure	bit 5	Tuning Error 2	
	bit 2	Printed Circuit Board -> Digital Signal Processor Communication Failure	bit 6	Tuning Error 3	
	bit 3	not used	bit 7	Tuning Error 4	
6	bit 0	Tuning Error 5	bit 4	Imbalance X_B	
	bit 1	A board temperature Failure	bit 5	Imbalance Z	
	bit 2	Rotor temperature Failure	bit 6	Tuning Error 6	
	bit 3	Imbalance X_H	bit 7	Tuning Error 7	
7	bit 0	Tuning Error 8	bit 4	Motor Resistor Lost	
	bit 1	Tuning Error 9	bit 5	Driver PWM Trouble	
	bit 2	Driver Failure	bit 6	Driver FAN Failure	
	bit 3	R-Unit Failure	bit 7	Driver CPU Error	
8	bit 0	R-Unit Com. Failure	bit 4	Pump Record Failure	
	bit 1	Amp Overcurrent	bit 5	Printed Circuit Board Record Failure	
	bit 2	Digital Signal Processor Initialize Fail	bit 6	Tuning Error 10	
	bit 3	Accel Malfunction	bit 7	Tuning Error 11	
9	bit 0	Tuning Error 12	bit 4	Tuning Error 16	
	bit 1	Tuning Error 13	bit 5	Tuning Error 17	
	bit 2	Tuning Error 14	bit 6	Tuning Error 18	
	bit 3	Tuning Error 15	bit 7	Tuning Error 19	
10	bit 0	Aberrant Brake	bit 4	Inordinate Current	
	bit 1	Aberrant Accel	bit 5	FAN trouble	
	bit 2	not used	bit 6	Serial Com. Fail	
	bit 3	Insufficient Supply	bit 7	not used	
11	bit 0	Tuning Error 20	bit 4	Tuning Error 24	
	bit 1	Tuning Error 21	bit 5	Tuning Error 25	
	bit 2	Tuning Error 22	bit 6	Tuning Error 26	
	bit 3	Tuning Error 23	bit 7	Tuning Error 27	
12	bit 0	Overspeed 4	bit 4	reserved	
	bit 1	CAUTION: Controller heat 3	bit 5	reserved	
	bit 2	Controller Overheat 3	bit 6	reserved	
	bit 3	reserved	bit 7	reserved	
13 to 16	All bits r	reserved			

5.3 Software modules with output & input bytes

Module No	Module description	Module Identifi-	General Description	Output bytes (from Master)			Input bytes (to master)			
		er		Bytes	Value	Meaning	Bytes	Value	Meaning	
22	Speed Demand	Mod22 Speed demand, 2out 2In	This module allows speed setpoint to be changed (and read) during Data Exchange, unlike module 18 which writes setpoint only during Parame- terisation. Setpoint is written to control- ler only at start of data exchange and on change of value. Notice - Setpoint is written to controller EEPROM. To avoid early controller failure this value should not be changed more than twice per hour on	minim for set depen type - manua range. value i pump' point v maxim pump. demar pump'	signed 16-bit number aximum ar um values point d on pump refer to pu al for allow If setpoint s greater t s maximur will be set s maximur similarly i nd value is s minimun	allowed omp vable value t demand han n the set- to ed for that f setpoint less than n the set-	1 to 2	Un- signed 16-bit number	Actual Speed Setpoint in Hz	
			EEPROM. To avoid early controller failure this value should not	maxim pump. demar pump' point v	ium allowe Similarly i nd value is	ed for that f setpoint less than n the set- minimum				

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