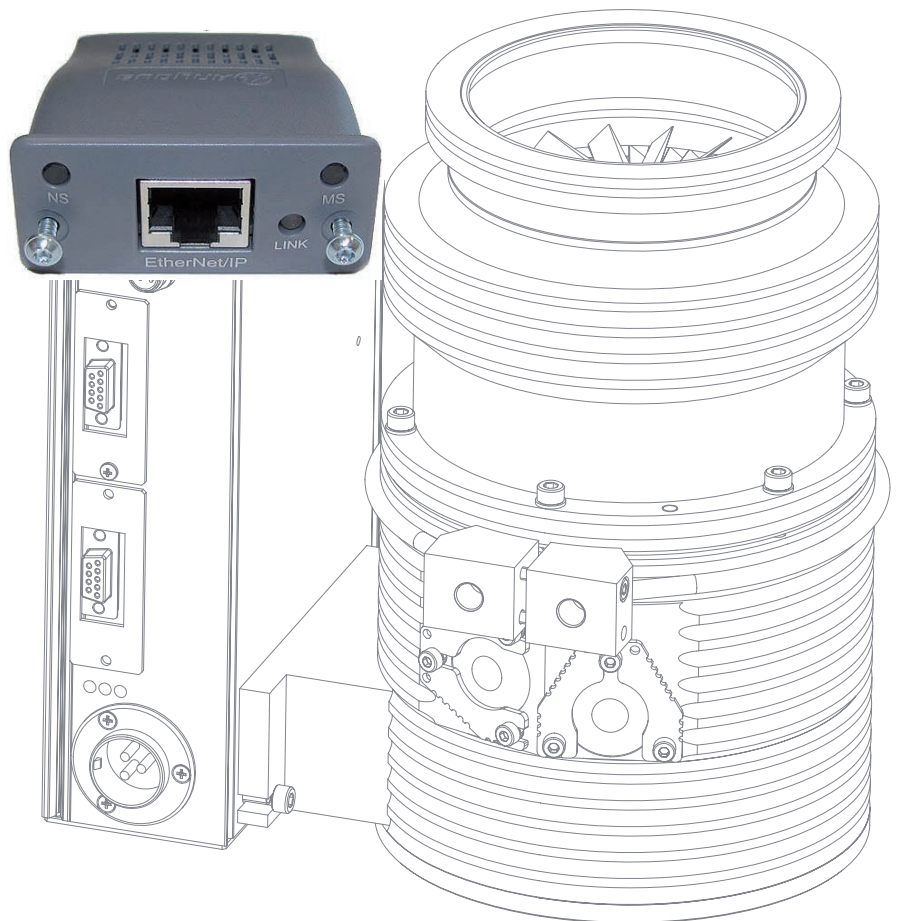


Ethernet/IP interface for MAG W 300-700

Operating Instructions 300470061_002_C0



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Original installation and operating instructions.

Obligation to Provide Information

Before installing and commissioning the MAG W 300-700 with EtherNet/IP interface, carefully read these Operating Instructions and follow the information so as to ensure optimum and safe working right from the start.

The Leybold **MAG W 300–700 with EtherNet/IP interface** has been designed for safe and efficient operation when used properly and in accordance with these Operating Instructions. It is the responsibility of the user to carefully read and strictly observe all safety precautions described in this section and throughout the Operating Instructions. The interface must only be operated in the proper condition and under the conditions described in the Operating Instructions. It must be operated and maintained by trained personnel only. Consult local, state, and national agencies regarding specific requirements and regulations. Address any further safety, operation and/or maintenance questions to our nearest office.

Before making any connections, deenergise the frequency converter and wait until the pump no longer turns. Since in spite of this dangerous voltages can remain present, the equipment must only be opened by a trained electrician.

We reserve the right to alter the design or any data given in these Operating Instructions. The illustrations are not binding.

Retain the Operating Instructions for further use.

NOTICE



Safety Information

Conventions used in this manual

The following conventions are used throughout this manual:

- The term 'module' is used when referring to the AnyBus-CC EtherNet/IP module
- The term 'application' is used when referring to the hardware that is connected to the Application Connector.
- Hexadecimal values are written in the format 0xNNNN, where NNNN is the hexadecimal value.
- Binary values are written in the format 0bNNNN, where NNNN is the binary value.

1 Description

The EtherNet/IP Interface integrates all functionality required to communicate on an Ethernet network.

Features / Specifications

Network

main protocol	EtherNet/IP; industrial protocol
common protocols	HTTP (HTML access); FTP (file transfer)
data rates	10 Mbps, 100 Mbps

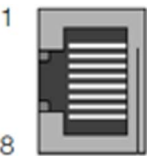
Device

profile	ODVA / CIP according to type 21h = 33d "Turbomolecular Vacuum Pump Device"
class 1 connections / max.	Point-to-point, Multicast / 4
class 3 connections / max.	Point-to-point / 16

1.1 Ethernet Connector

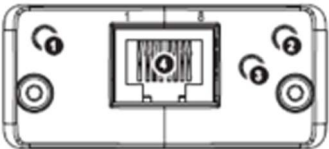
Pin numbers 13-20 on the application connector are used for fieldbus specific signals, see pin out below.

Pin	Signal
1	TX+
2	TX-
3	RX+
4	-
5	-
6	RX-
7	-
8	-
Housing	Bus Cable Shield (Shielded connector only)



View on the Ethernet/IP interface module:

#	Item
1	Network Status LED
2	Module Status LED
3	Link / Activity
4	Ethernet Interface



Description

1.2 LED states during operation

Network Status LED

LED State	Description
OFF	No power or no IP address
Green	On-line, one or more connections established (CIP Class 1 or 3)
Green, flashing	On-line, no connections established
Red	Duplicate IP address, FATAL error
Red, flashing	One or more connections timed out (CIP Class 1 or 3)

Module Status LED

Note: A test sequence is performed on this LED during startup.

LED State	Description
OFF	No power
Green	Controlled by a Scanner in Run state
Green, flashing	Not configured, or Scanner in Idle state
Red	Major fault (EXCEPTION-state, FATAL error etc.)
Red, flashing	Recoverable fault(s)

Link/Activity LED

LED State	Description
OFF	No link, no activity
Green	Link established
Green, flickering	Activity

Power up LED sequence

Duration [s]	Module Status [MS]	Network Status [NS]	Link activity [LINK]
ca. 30	Off	Off	Off
< 1	Green		
< 1	Red		
< 1	Green	Green	
< 1		Red	
ca. 3	Off	Off	

2 Network Configuration

Before the module can be used on the network, some basic network settings must be configured.

IP address

The IP address is used to identify each node on the TCP/IP network. Therefore, each node on the network must have a unique IP address. IP addresses are written as four decimal integers (0-255) separated by periods, where each integer represents the binary value of one byte in the IP address. This is called dotted-decimal notation.

Example:

Address 10000000 00001010 00000010 00011110 is written as 128.10.2.30

Subnet Mask

The subnet mask is a 32-bit binary pattern, where a set bit allocates a bit for network/subnet ID, and a cleared bit allocates a bit for the host ID. Like the IP address, the subnet mask is commonly written in dotted-decimal notation.

Example:

To make the IP address 128.10.2.30 belong to subnet 128.10.2, the subnet mask shall be set to 255.255.255.0. Subnet Mask: 11111111 11111111 11111111 00000000 (255.255.255.0)

Special case IP addresses

The following IP addresses are reserved and should not be used:

- 0.x.x.x - IP address where the first byte is zero
- 127.x.x.x - IP address where the first byte is 127
- 127.x.x.0 - IP address where the last byte is zero
- x.x.x.255 - IP address where the last byte is 255

2.1 Configuring the IP settings

The module offers several ways to set the IP settings (IP address, Subnet mask & Gateway address):

- DHCP
a DHCP server sets the address as user predefined or automatically
- HICP
the HMS Anybus IP Config program allows an easy adjustment of the IP settings

If DHCP is enabled, the module will attempt to retrieve the following information via DHCP:

- IP address
- Subnet mask
- Gateway address

The module supports DHCP Reboot, i.e. it will ask the DHCP server for the previous used IP address. If that address is free to use, it will be assigned to the module. If not, the module will be assigned a new IP address.

Network Configuration

HMS IP Configuration Protocol (HICP)

HICP is an acronym for 'HMS IP Configuration Protocol', and is used by the Windows-based application program 'AnyBus IPconfig' that is able to detect HMS modules on the network and configures their IP settings. Since the protocol is based on broadcast messages, it is possible to detect and configure modules that are outside of the host's subnet.

The Anybus IPconfig tool is used to set up or change the Ethernet configuration on an HMS Ethernet 10/100 Mbit module. Start with opening the program and press SCAN. All HMS Ethernet nodes will then be listed. To change a configuration, just perform a double click on the desired node. All settings will then be available.

For more information and downloading of the latest version of the AnyBus IPconfig program look at the HMS homepage: "www.anybus.com".

2.2 Ethernet/IP

The EtherNet/IP implementation follows as much as possible the Common Industrial Protocol (CIP) Specification, Chapter 6: Device Profiles, Part 4, 6-36 Turbomolecular Vacuum Pump Device, Type 0x21, which is also the application layer for DeviceNet and ControlNet to exchange data between bus nodes.

CIP makes use of abstract object modeling to describe the communications of a product. Objects are well defined subsets of the functionality of a device. This includes functions, called 'Services' and data variables called 'Attributes'. If more than one copy of an object is needed, each copy is called an 'Instance'.

Implemented Objects

Object Class	Class Identifier	Number of Instances
Identity	1	1
Message Router	2	1
EtherNet	3	1
I/O Assembly	4	4 Input / 5 Output
Discrete Input Point	8	9
Discrete Output Point	9	6
AC/DC Drive	42	1
S-Device Supervisor	48	1
S-Analog Sensor	49	3
Leybold Special Warning	100	1
Leybold Special Failure	101	1
Ethernet IP Host Object	248	1

Service Code	Name
14 (0x0E)	Get Attribute Single
16 (0x10)	Set Attribute Single

Network Configuration

2.2.1 Identity Object

Class Code: 1 (0x01)

Instance ID: 1 (0x01)

Attribute ID	Access Rule	Name	Data Type	Description
1 (0x01)	Get	Vendor Identification	UINT	Vendor Identification 144 dec = 90 00 hex \triangle Leybold
2 (0x02)	Get	Device type	UINT	Device Type 33 dec = 21 00 hex \triangle Turbo Molecular Pump
3 (0x03)	Get	Product Code	UINT	201 dec = C9 00 hex \triangle MAG.DRIVE (i)S
4 (0x04)	Get	Revision	STRUCT of:	Revision of the item the Identity Object represents
		Major Revision	USINT	02
		Minor Revision	USINT	01
5 (0x05)	Get	Status	USINT	Status of the entire device; Bit# Meaning 0 Moduled owned 1 Reserved 2 Configured 3 Reserved 4 to 6 Extended Device Status Values: 000 = unknown 001 = reserved 010 = Faulted IO Conn. 011 = No IO Connection 100 = Nonvol. Config. Bad 101 = reserved 110 = Connection in Run mode 111 = Connection in Idle mode 7 Reserved 8 minor recoverable faults 9 minor unrecoverable faults 10 major recoverable faults 11 major unrecoverable faults 12 – 15 Reserved
6 (0x06)	Get	Serial Number	UDINT	Serial number of the turbo pump controller truncated to 32 bit unsigned integer format. Sample: S.N. 30000987654 result = 987654
7 (0x07)	Get	Product Name	SHORT_ STRING	Name of the turbo pump controller “MAG.Drive (i)S”

Network Configuration

2.2.2 I/O Assembly Object

Input Assembly

Class Code: 4 (0x04)

Attribute ID: 3 (0x03)

Instance ID	Type	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1 (0x01)	Input	0	Exception Status							
		1	Speed Status (see the "Speed Control Attribute and Speed Status Attribute Bit Map" below)							
		2	0	0	0	0	0	0	0	Pump On Status
2 (0x02)	Input	0	Exception Status (see the "Exception Status Bit Map" below)							
		1	Speed Status (see the "Speed Control Attribute and Speed Status Attribute Bit Map" below)							
		2	0	0	0	0	0	0	0	Pump On Status
		3 – 4	Pump speed (revolutions per second)							
3 (0x03)	Input	0	Exception Status (see the "Exception Status Bit Map" below)							
		1	Speed Status (see the "Speed Control Attribute and Speed Status Attribute Bit Map" below)							
		2	0	0	0	0	0	0	0	Pump On Status
		3 – 4	Pump speed (revolutions per second)							
		5 – 6	Coil Temp [degree centigrade] (motor temperature)							
		7 – 8	Current [1/10 Amps] (actual motor current)							
100 (0x64) default predefined input connection set	Input	0	Exception Status (see the "Exception Status Bit Map" below)							
		1	Speed Status (see the "Speed Control Attribute and Speed Status Attribute Bit Map" below)							
		2					General Alarm	General Warning	Pump On Status	
		3 – 4	Pump speed; actual (revolutions per second)							
		5 – 6	Coil Temp; actual [degree centigrade] (motor temperature)							
		7 – 8	Current [1/10 Amps] (actual motor current)							

For selection of the predefined connection set, please refer to: 2.2.8 Ethernet/IP Host Object

An input assembly instance is only accessible by explicit messaging, when selected as predefined connection set. The accordant instances of discrete input object or the AC/DC drive object can be used, to reach the same functionality.

Network Configuration

Exception Status Bit Map

Bit	Function
0	ALARM / device-common
1	ALARM / device-specific
2	ALARM / manufacturer-specific
3	0 (reserved)
4	WARNING / device-common
5	WARNING / device-specific
6	WARNING / manufacturer-specific
7	1 (expanded method)

Speed Status Attribute Bit Map

Bit	Speed Status	Status Description
0	Running	On and SpeedActual > 0
1	At Idle	Zero current
2	At Standby Speed	SpeedActual = SpeedStandby (actual not selectable via Ethernet/IP)
3	Coasting	Zero Torque (generator mode)
4	Stopped	SpeedActual = 0
5	Accelerating	SpeedActual is increasing
6	At Reference	SpeedActual = SpeedRef
7	Decelerating	SpeedActual is decreasing

Network Configuration

2.2.3 Output Assembly

Class Code: 4 (0x04)

Attribute ID: 3 (0x03)

Instance ID	Type	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
5 (0x05)	Output	0	Reserved, all bits must be set to "0"							Pump On
6 (0x06)	Output	0	Reserved, all bits must be set to "0"							Pump On
		1	Speed Control (see the "Speed Control Attribute and Speed Status Attribute Bit Map" below)							
7 (0x07)	Output	0	Reserved, all bits must be set to "0"							Pump On
		1	Speed Control (see the "Speed Control Attribute and Speed Status Attribute Bit Map" below)							
		2 – 3	Speed Target pump speed or pump rotating frequency in r.p.m. ("revolutions per second" or Hz) Attention: value must be set within the designated speed range of the pump							
101 (0x65) default predefined output connection set	Output	0	Quit failure	Aux. Volts Control**	Standby active / inactive	Reserved, must be set to "0"	Vent Valve*	Purge Valve*	Reserved, must be set to "0"	Pump On
102 (0x66)	Output	0	Quit failure	Aux. Volts Control**	Standby active / inactive	Reserved, must be set to "0"	Vent Valve*	Purge Valve*	Reserved, must be set to "0"	Pump On
		1 – 2	Speed Target pump speed or pump rotating frequency in r.p.m. ("revolutions per second" or Hz) Attention: value must be set within the designated speed range of the pump							

* For future applications

** Parameter 134 must be set to 18 or 21 via RS232 to activate this function.

For selection of the predefined connection set, please refer to: 2.2.8 Ethernet/IP Host Object

An output assembly instance is only accessible by explicit messaging, when selected as predefined connection set. The accordant instances of discrete input object or the AC/DC drive object can be used, to reach the same functionality.

When cyclic process data exchange is established, the process control is assigned to the Ethernet/IP interface connection.

The pump control is also directed to the Ethernet/IP Interface, if the Discrete Output Point Object (#9), any of the Attributes, Instance #9 is activated, or if the AC/DC Object (#42) Instance #1, Attribute #38: Speed Control is used (at least 1 bit is set to "1").

Speed Control Attribute Bit Map

Bit	Speed Control	Description
0	Run Request	A "1" starts the pump, if bit 1 is set to "0"
1	Idle Request	A "1" stops the pump, regardless of setting of the other bits
2	Standby Request	A "1" selects the standby frequency, if bit 0 is set to "1" and bit 1 is set to "0"
3	Reserved	
4	Reserved	
5	Reserved	
6	Reserved	
7	Reserved	

All the time all bits must be set to "0"

Network Configuration

2.2.4 Discrete Input Point Object

Class Code: 8 (0x08)

Instance ID	Attribute ID	Access Rule	Name	Data Type	Description
1 (0x01)	3	Get	Pump ON/OFF	BOOL	0 = Pump Off (or Pump On and Speed = 0) 1 = Pump On (Pump running)
100(0x64)	3	Get	Normal	BOOL	Normal Speed reached
101(0x65)	3	Get	Acceleration	BOOL	The pump increases speed
102(0x66)	3	Get	Deceleration	BOOL	The pump decreases speed
103(0x67)	3	Get	Generator Mode	BOOL	The pump is running in generator mode Mains voltage is missing
104(0x68)	3	Get	Standby	BOOL	The pump is running in standby mode
105(0x69)	3	Get	Standstill and Drive not active	BOOL	Standstill and Drive not active
106(0x6A)	3	Get	Remote Operation	BOOL	The pump is under control of EtherNet
108(0x6C)	3	Get	Standby Speed reached	BOOL	The pump is running at standby speed

Network Configuration

2.2.5 Discrete Output Point Object

Class Code: 9 (0x09)

If at least one of the DOP Activate Pump control functions is set, the control of the pump is directed to the Ethernet/IP interface connection.

The pump control is also directed to the Ethernet/IP Interface if the cyclic process data exchange is established, or if the AC/DC Object (#42) Instance #1, Attribute #38: Speed Control is used (at least 1 bit is set to "1").

Instance ID	Attribute ID	Access Rule	Data Type	Name	Description
1 (0x01)	3	Set	BOOL	Pump On / Off	0 = Pump Off 1 = Pump On
	9	Set	BOOL	Activate Pump control	Enables the control of the pump by the Ethernet/IP interface connections
3 (0x03)	3	Set	BOOL	Purge Gas Valve*	0 = Valve closed 1 = Valve open
	9	Set	BOOL	Activate Pump control	Enables the control of the pump by the Ethernet/IP interface connections
101 (0x65)	3	Set	BOOL	Quit Failure	0 = do not reset error condition 1 = Reset only possible if Pump On/Off is set to Off
	9	Set	BOOL	Activate Pump control	Enables the control of the pump by the Ethernet/IP interface connections
102 (0x66)	3	Set	BOOL	Standby	0 = Pump will run at target speed 1 = Pump will run at standby speed
	9	Set	BOOL	Activate Pump control	Enables the control of the pump by the Ethernet/IP interface connections
103 (0x67)	3	Set	BOOL	Auxiliary Voltage control (fan, valve etc.)**	0 = 24 Volts OFF 1 = 24 Volts ON (default)
	9	Set	BOOL	Activate Pump control	Enables the control of the pump by the Ethernet/IP interface connections
104 (0x68)	3	Set	BOOL	Vent Valve*	0 = Valve closed 1 = Valve open
	9	Set	BOOL	Activate Pump control	Enables the control of the pump by the Ethernet/IP interface connections

* For future applications

** Parameter 134 must be set to 18 or 21 via RS232 to activate this function.

NOTICE



Setting one of the control instances (Attribute ID 9) to TRUE enables the control of the pump and enables the discrete output point object functionality by the Ethernet/IP interface connection.

Setting one of the control instances (Attribute ID 9) to FALSE disables the control of the pump and disables the discrete output point object functionality by the Ethernet/IP interface connection.

Network Configuration

2.2.6 AC/DC Drive Object

Class Code: 42 (0x2A)

Instance ID: 1 (0x01)

Attribute ID	Access Rule	Name	Data Type	Description															
3 (0x03)	Get	AtReference	BOOL	Normal operation status															
4 (0x04)	Get / Set	NetRef	BOOL	Requests process control reference to be local or from the network. 0 = Set reference speed not from Ethernet/IP 1 = Set reference speed from Ethernet/IP Default value is 0 will be activated automatically, if cyclic process data exchange Output Assembly Attribute ID #3, Instance #7 is selected and in progress															
5 (0x05)	Set / Get	NetProc	BOOL	Requests process control reference to be local or from the network. 0 = Set Process not DN Control 1 = Set Process at DN Control Default value is 0 without cyclic process data established; will be set to “1” automatically, if cyclic process data exchange is in progress, or is set with one of the associated explicit messages															
6 (0x06)	Get	DriveMode	INT	Always set to “2” = Closed Loop Operation															
7 (0x07)	Get	SpeedActual	INT	Actual counted speed of the pump [R.P.S.]															
8 (0x08)	Set / Get	SpeedRef	INT	Reference speed of the pump [R.P.S.]; can be overridden by Output Assembly #7 selected or by Standby selected															
9 (0x09)	Get	Current Actual	INT	Actual motor current [0.1 Ampere]															
10 (0x0A)	Get	CurrentLimit	INT	Limit of the motor current [0.1 Ampere]															
15 (0x0F)	Get	PowerActual	INT	Actual value of the direct current link power [0.1 Watt]															
16 (0x10)	Get	InputVoltage	INT	Actual value of the direct current link voltage															
20 (0x14)	Get	LowSpd Limit	UINT	Low limit of the pump speed [RPS]															
21 (0x15)	Get	HighSpd Limit	UINT	High limit of the pump speed [RPS]															
38 (0x26)	Set	Speed Control	USINT	<table><tr><th>Bit</th><th>Speed Control</th><th>Description</th></tr><tr><td>0</td><td>Run Request</td><td>A “1” starts the pump, if bit 1 is set to “0”</td></tr><tr><td>1</td><td>Idle Request</td><td>A “1” stops the pump, regardless of setting of the other bits</td></tr><tr><td>2</td><td>Standby Request</td><td>A “1” selects the standby frequency, if bit 0 is set to “1” and bit 1 is set to “0”</td></tr><tr><td>3</td><td>Coast Request</td><td>not supported (no function), always set to “0”</td></tr></table>	Bit	Speed Control	Description	0	Run Request	A “1” starts the pump, if bit 1 is set to “0”	1	Idle Request	A “1” stops the pump, regardless of setting of the other bits	2	Standby Request	A “1” selects the standby frequency, if bit 0 is set to “1” and bit 1 is set to “0”	3	Coast Request	not supported (no function), always set to “0”
Bit	Speed Control	Description																	
0	Run Request	A “1” starts the pump, if bit 1 is set to “0”																	
1	Idle Request	A “1” stops the pump, regardless of setting of the other bits																	
2	Standby Request	A “1” selects the standby frequency, if bit 0 is set to “1” and bit 1 is set to “0”																	
3	Coast Request	not supported (no function), always set to “0”																	
The pump control is directed to the Ethernet/IP Interface connection, if this AC/DC Object (#42) Instance #1, Attribute #38: Speed Control is used (at least 1 bit is set to “1”), or if the Discrete Output Point Object (#9), any of the Attributes, Instance #9 is activated, or if the cyclic process data exchange is established. Refer to Section 2.2.3 Output Assembly (Class Code #4) Attribute ID #3																			

Network Configuration

Attribute ID	Access Rule	Name	Data Type	Description
39 (0x27)	Get	Speed Status	USINT	Bit Speed Control Description
				0 Running On and Speed Actual > 0
				1 At Idle Zero current
				2 At Standby Speed Speed Actual = Speed Standby
				3 Coasting Zero Torque (generator mode)
				4 Stopped Speed Actual = 0
				5 Accelerating Speed Actual is increasing
				6 At Reference Speed Actual = Speed Reference
				7 Decelerating Speed Actual is decreasing
40 (0x28)	Get / Set	Speed Trip Time	UINT	Maximum run up time; maximum overload time. (Exceeding of this limit leads to the corresponding error message)
41 (0x29)	Get	Max Rated Speed	INT	High limit of the pump speed [RPS]
43 (0x2B)	Set	Speed Standby	INT	Speed setting for the standby function [RPS] Set command will only accepted at standstill of the turbopump.
44 (0x2C)	Get	Speed actual Data Units	UINT	Fixed value: RPS --> 1F0E _{hex} (rotations per second)
45 (0x2D)	Get	Speed Ref Data Units	UINT	Fixed value: RPS --> 1F0E _{hex} (rotations per second)
46 (0x2E)	Get	Drive On Hours	DINT	Actual value of the pump drive on hours
100 (0x64)	Get	Operating Cycles	UINT	Operating Cycles of the pump: number of complete (from zero speed) and standby acceleration cycles
101 (0x65)	Get	Converter hours	UINT	Number of converter operating hours
102 (0x66)	Get / Set	StartTrip Time	UINT	Maximum run up time until error

Network Configuration

2.2.7 S-Device Supervisor Object

Class Code: 48 (0x30)

Instance ID: 1 (0x01)

Attribute ID	Access Rule	Name	Data Type	Description
3 (0x03)	Get	Device Type	SHORT STRING	Type of the Ethernet/IP Device; "Turbo Pump"
4 (0x04)	Get	SEMI Standard Revision Level	SHORT STRING	Revision level of the SEMI S/A Network Standard of the device; "E54-0997"
5 (0x05)	Get	Manufacturer's Name	SHORT STRING	Manufacturer of the device; "Leybold"
6 (0x06)	Get	Manufacturer's Model Number	SHORT STRING	Catalogue number of the turbo controller; format example: 400001431
7 (0x07)	Get	Software Revision Level	SHORT STRING	Software revision of the turbo controllers main firmware; format example: 18001
8 (0x08)	Get	Hardware Revision Level	SHORT STRING	Hardware revision of the turbo controller; format example: 010212
9 (0x09)	Get	Manufacturer's Serial Number	SHORT STRING	Serial number of the turbo controller; format example: 30000187517
11 (0x0B)	Get	Device Status	USINT	Status of the Ethernet/IP Interface Gateway and the internal data exchange 0 = Undefined 1 = Self Testing 2 = Idle 3 = Self-Test Except. 4 = Executing 5 = Abort 6 = Critical Fault 100 = Internal Serial Fault (internal data communication between Ethernet/IP gateway and pump controller fails) 101 = Invalid Mapping Table (an error was detected in the pump controller specific parameter translation file)
12 (0x0C)	Get	Exception Status	BYTE	"Expanded Method" of the Exception Status Bit Map: bit 0: ALARM/device-common bit 1: ALARM/device-specific bit 2: ALARM/manufacturer-specific bit 3: 0 bit 4: WARNING/device-common bit 5: WARNING/ device-specific bit 6: WARNING/ manufacturer-specific bit 7: 1 = Expanded Method
13 (0x0D)	Get	Exception Detail Alarm	STRUCTs of in summary 14 bytes	Structure of three structures containing a bitmap representation of alarm details; cf. table below for a detailed description of contents
14 (0x0E)	Get	Exception Detail Warning	STRUCTs of in summary 14 bytes	Structure of three structures containing a bitmap representation of warning details; cf. table below for a detailed description
15 (0x0F)	Get / Set	Alarm Enable	BOOL	Controls setting of Alarm bits 1 = Alarms enabled (always enabled! Set to "0" is not possible)
16 (0x10)	Get / Set	Warning Enable	BOOL	Controls setting of Warning bits 1 = Alarms enabled (always enabled! Set to "0" is not possible)
19 (0x13)	Get	Last Maintenance Date	DATE	The date on which the turbo pump was last serviced
100 (0x64)	Get	Pump Name	SHORT STRING	Complete name of the pump
101 (0x65)	Get	Pump Catalog No.	SHORT STRING	Catalog number of the pump
102 (0x66)	Get	Pump Serial Number	SHORT STRING	Serial number of the pump
103 (0x67)	Get	Pump Identifier Revision Level	SHORT STRING	Revision level of the pump identifier data set

Network Configuration

2.2.7.1 Alarms

Data Component	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Common Exception Detail Size	0	0	0	0	0	0	1	0
Common Exception Detail Byte 0	0	Real-time Fault	0	Data Memory	Non-Volatile Memory	Code Memory	Micro-processor	Diagnostic
Common Exception Detail Byte 1	0	0	0	Scheduled Maint. Due	0	0	0	0
Turbo Pump Device Exception Detail Size	0	0	0	0	0	0	1	0
Turbo Pump Device Exception Detail Byte 0	0	Startup Timeout	0	0	Over-speed	Mains Failure	0	CNT Failure
Turbo Pump Device Exception Detail Byte 1	0	0	Bearing Fault	Cable Fault	Controller Overheat	Bearing Overheat	0	Motor Coil Overheat
Manufacturer Exception Detail Size	0	0	0	0	1	0	0	1
<i>Turbo Pump Device Exception Detail Byte 0¹⁾</i>	<i>Dropped to minimal frequency</i>	<i>Overload time exceeded</i>	<i>System overloaded</i>	<i>Motor current high</i>	0	0	<i>Frequency Error</i>	0
<i>Turbo Pump Device Exception Detail Byte 1¹⁾</i>	<i>Run Time Error</i>	0	<i>Converter temperature too high</i>	0	0	0	0	<i>Motor temperature high</i>
<i>Turbo Pump Device Exception Detail Byte 2¹⁾</i>	0	<i>Max. frequency exceeded</i>	0	<i>Acceleration time exceeded</i>	<i>No motor current</i>	<i>Commun. Profile failure</i>	<i>Internal commun. failed</i>	<i>Commun. to Turbo-pump failed</i>
<i>Turbo Pump Device Exception Detail Byte 3¹⁾</i>	<i>Motor phase failure</i>	0	0	0	0	0	0	0
<i>Turbo Pump Device Exception Detail Byte 4¹⁾</i>	<i>Aux. bearings worn out</i>	<i>Unidentified pump error</i>	<i>Pump memory failure</i>	<i>Bearing system overloaded</i>	<i>Orbit failure in Z-axis</i>	<i>Orbit Failure XY2</i>	<i>Orbit Failure XY1</i>	0
<i>Turbo Pump Device Exception Detail Byte 5¹⁾</i>	<i>External Device Error</i>	<i>Interface Options Error</i>	<i>Pump Config. failure</i>	<i>Parameter failure</i>	<i>Display parameter failure</i>	0	0	<i>Main power out of tolerances</i>
<i>Turbo Pump Device Exception Detail Byte 6¹⁾</i>	<i>Initial. failed</i>	<i>System communic. timeout</i>	<i>Serial com. Timeout (USS)</i>	<i>Fieldbus communic. timeout 0</i>	0	<i>Bearing Temp. Sensor failure</i>	0	<i>Motor Temp. Sensor failure</i>
<i>Turbo Pump Device Exception Detail Byte 7¹⁾</i>	<i>Low frequency bearing current overload failure</i>	<i>Bearing current overload failure 6</i>	<i>Bearing current overload failure 5</i>	<i>Bearing current overload failure 4</i>	<i>Bearing current overload failure 3</i>	<i>Bearing current overload failure 2</i>	<i>Bearing current overload failure 1</i>	<i>Bearing current overload failure 0</i>
<i>Turbo Pump Device Exception Detail Byte 8¹⁾</i>	<i>Bearing fault Z axis</i>	<i>Bearing fault level 2</i>	<i>Bearing fault level 1</i>	<i>Bearing power stage 4 overloaded</i>	<i>Bearing power stage 3 overloaded</i>	<i>Bearing power stage 2 overloaded</i>	<i>Bearing power stage 1 overloaded</i>	<i>Bearing power stage 0 overloaded</i>

¹⁾ Italicised entries in the table above have not been finalized yet and are subject to alterations.

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2.2.7.2 Warnings

Data Component	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Common Exception Detail Size	0	0	0	0	0	0	1	0
Common Exception Detail Byte 0	0	0	0	0	0	0	0	0
Common Exception Detail Byte 1	0	0	0	Scheduled Maint. Due	0	0	0	0
Turbo Pump Device Exception Detail Size	0	0	0	0	0	0	1	0
Turbo Pump Device Exception Detail Byte 0	0	0	0	0	Over-speed	Mains failure	0	0
Turbo Pump Device Exception Detail Byte 1	Motor start disabled	0	0	0	Controller Overheat	Bearing Overheat	0	Motor Coil Overheat
Manufacturer Exception Detail Size	0	0	0	0	1	0	0	1
<i>Turbo Pump Device Exception Detail Byte 0¹⁾</i>	0	<i>Overload time exceeded const "0"</i>	<i>System over-loaded</i>	0	0	0	0	0
<i>Turbo Pump Device Exception Detail Byte 1¹⁾</i>	0	0	<i>Converter temperature too high</i>	0	0	0	0	<i>Motor temperature high</i>
<i>Turbo Pump Device Exception Detail Byte 2¹⁾</i>	0	<i>Max. frequency exceeded</i>	0	0	0	0	0	0
<i>Turbo Pump Device Exception Detail Byte 3¹⁾</i>	0	0	0	0	0	0	0	0
<i>Turbo Pump Device Exception Detail Byte 4¹⁾</i>	0	0	0	<i>Bearing syst. overloaded</i>	<i>Unbalance in Z-axis</i>	<i>Unbalance in Y-axis</i>	<i>Unbalance in X-axis</i>	<i>Magnet bearing system deactivated</i>
<i>Turbo Pump Device Exception Detail Byte 5¹⁾</i>	0	0	0	0	0	0	0	<i>Main power out of tolerances const "0"</i>
<i>Turbo Pump Device Exception Detail Byte 6¹⁾</i>	<i>reserved</i>	<i>reserved</i>	<i>reserved</i>	<i>reserved</i>	<i>reserved</i>	<i>reserved</i>	<i>reserved</i>	<i>reserved</i>
<i>Turbo Pump Device Exception Detail Byte 7¹⁾</i>	0	<i>Bearing current high 6</i>	<i>Bearing current high 5</i>	<i>Bearing current high 4</i>	<i>Bearing current high 3</i>	<i>Bearing current high 2</i>	<i>Bearing current high 1</i>	<i>Bearing current high 0</i>
<i>Turbo Pump Device Exception Detail Byte 8¹⁾</i>	0	0	0	0	0	0	0	0

¹⁾ Italicised entries in the table above have not been finalized yet and are subject to alterations.

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2.2.8 Ethernet/IP Host Object

Class Code: 248 (0xF8), Instance ID: 1

The input and output assembly implicit messages setup must be provided in two steps:

- Preparing the MAG.DRIVE internal controller setup by setting the specific Attribute ID codes.

Attribute ID	Access Rule	Name	Data Type	Description; actual value
7 (0x07)	Get/Set	Producing Instance No.	UINT16	Active predefined input connection set; selection of one of 1 / 100 Default value = 100 = (0x64)
8 (0x08)	Get/Set	Consuming Instance No.	UINT16	Active predefined output connection set; selection of one of 5 / 6 / 7 / 101 / 102 Default value = 101 = (0x65)

Note

On setting a valid Producing or Consuming Instance number the EtherNet/IP interface circuitry will perform automatically an initialization procedure, which is indicated by the same LED flashing procedure at the interface module when the MAG.DRIVE is powered on. Any invalid number will not be accepted and the initialization will not be performed.

The default value will be activated everytime the system is powered on!

- Setup of the Ethernet/IP specific interface parameters by using the suitable setup procedure of the Ethernet/IP scanner, referring to the Instance ID codes established in step 1. See the example at the end of this manual.

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2.2.9 S-Analog Sensor Object

Class Code: 49 (0x31)

Motor Coil Temperature (Instance 1)

Attribute ID	Access Rule	Name	Data Type	Description
5 (0x05)	Get	Reading Valid	BOOL	Indicates that the Value attribute contains a valid value. 0 = value invalid 1 = value valid
6 (0x06)	Get	Value	INT	Actual motor coil temperature value [1/10 degrees Centigrade (Celsius)]
7 (0x07)	Get	Status	BYTE	Alarm and Warning State of the motor temperature
17 (0x11)	Get	Alarm Trip Point High	INT	Motor temperature Alarm limit (determines the Value above which an Alarm condition will occur) [1/10 degrees Centigrade (Celsius)]
21 (0x15)	Get	Warning Trip Point High	INT	Motor temperature Warning limit (determines the Value above which an Warning condition will occur) [1/10 degrees Centigrade (Celsius)]

Bearing Temperature (Instance 3)

Attribute ID	Access Rule	Name	Data Type	Description
5 (0x05)	Get	Reading Valid	BOOL	Indicates that the Value attribute contains a valid value. 0 = value invalid 1 = value valid
6 (0x06)	Get	Value	INT	Bearing temperature value [1/10 degrees Centigrade (Celsius)]
7 (0x07)	Get	Status	BYTE	Alarm and Warning State of the bearing temperature
17 (0x11)	Get	Alarm Trip Point High	INT	Bearing temperature Alarm limit (determines the Value above which an Alarm condition will occur) [1/10 degrees Centigrade (Celsius)]
21 (0x15)	Get	Warning Trip Point High	INT	Bearing temperature Warning limit (determines the Value above which an Warning condition will occur) [1/10 degrees Centigrade (Celsius)]

Control Unit Temperature (Instance 4)

Attribute ID	Access Rule	Name	Data Type	Description
5 (0x05)	Get	Reading Valid	BOOL	Not supported; value always = 1
6 (0x06)	Get	Value	INT	Actual controller unit temperature value [1/10 degrees Centigrade (Celsius)]
7 (0x07)	Get	Status	BYTE	Alarm and Warning State of the controller unit temperature
17 (0x11)	Get	Alarm Trip Point High	INT	Not supported; value always = 0
21 (0x15)	Get	Warning Trip Point High	INT	Not supported; value always = 0

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2.2.10 Warning Class

Class Code: 100 (0x64)

Instance 1

Attribute ID	Access Rule	Name	Data Type	Description; actual value
1 (0x01)	Get	Warning Bits 1	INT	See Table below
2 (0x02)	Get	Warning Bits 2	INT	See Table below

Warning Bit 1	Designation	Possible Cause	Remedy
Bit 0	Converter Power Stage Temperature too high	The cooling water flow is too low or the cooling water temperature is too high. The converter is overloaded due to too high gas load. Frequent acceleration and deceleration of the pump.	Cooling system needs to be improved. The gas load needs to be reduced. Allow converter to cool down between the cycles.
Bit 1	Converter Housing Temperature too high	The converter is overloaded due to too high gas load.	The gas load needs to be reduced.
Bit 2	Pump Motor Temperature too high	The cooling water flow is too low or the cooling water temperature is too high.	Cooling system needs to be improved
Bit 3-4	Supply Voltage too high or too low	Usage of a wrong power supply unit. Misaligned output voltage. Too high load. Voltage drop across the supply cable.	Use correct power supply. Adjust the output voltage of the power supply. Replace the power supply by a more powerful one. Increase the copper area of the cable
Bit 5	Overspeed	The frequency setpoint has been set during operation with serial interface e.g. RS232.	Provide for correct speed setting.
Bit 6	Overload	Backing pressure too high during operation. Too high amount of gas flow during operation. Parameter «Normal Operation» is not set correctly.	Reduce backing pressure or process gas flow. Check the chamber pressure during operation. Check the «normal operation» level adjustment.
Bit 7	Bearing Temperature too high	Frequent acceleration and deceleration of the pump.	Cooling system needs to be improved
Bit 8	Motor Start Locked	There was a fatal error before, which is not resettable.	When the pump is stillstanding, disconnect the pump from the power supply and reconnect it. If this behaviour is repeated by the pump, then contact the Leybold service department.
Bit 9	High load	Backing pressure too high during operation. Too high amount of gas flow during operation	Reduce backing pressure or process gas flow. Check the chamber pressure during operation.
Bit 10	Max. Number of Pump Operation Hours are reached	The recommended max. number of operating hours of the pump are reached.	Arrange a service date at Leybold for this pump.
Bit 11	Max. Number of Pump Runup Cycles are reached	The recommended max. number of start cycles of the pump are reached.	Arrange a service date at Leybold for this pump.

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Warning Bit 1	Designation	Possible Cause	Remedy
Bit 12	Magnetic Bearing has not lifted	There was a fatal error before, which is not resettable.	When the pump is stillstanding, disconnect the pump from the power supply and reconnect it. If this behaviour is repeated by the pump, then contact the Leybold service department
Bit 13	reserved		
Bit 14	MAG Bearing Overload 5	The magnetic bearing current for the individual axes is too high. The environmental vibration might be too heavy.	Reduce vibration which might affect the pump.
Bit 15	MAG Bearing Overload 6	The magnetic bearing current for the individual axes is too high. The environmental vibration might be too heavy.	Reduce vibration which might affect the pump.

Warning Bit 2	Designation	Possible Cause	Remedy
Bit 0	MAG Bearing Overload 0	The magnetic bearing current for the individual axes is too high. The environmental vibration might be too heavy.	Reduce vibration which might affect the pump.
Bit 1	MAG Bearing Overload 1	The magnetic bearing current for the individual axes is too high. The environmental vibration might be too heavy.	Reduce vibration which might affect the pump.
Bit 2	MAG Bearing Overload 2	The magnetic bearing current for the individual axes is too high. The environmental vibration might be too heavy.	Reduce vibration which might affect the pump.
Bit 3	MAG Bearing Overload 3	The magnetic bearing current for the individual axes is too high. The environmental vibration might be too heavy.	Reduce vibration which might affect the pump.
Bit 4	MAG Bearing Overload 4	The magnetic bearing current for the individual axes is too high. The environmental vibration might be too heavy.	Reduce vibration which might affect the pump.
Bit 5	MAG Unbalance at the Upper Bearing	Deposition of material from the pumped media at the turbo rotor Due to aggressive media, abrasion at the turbo rotor.	Check the pumped media for suitability with this pump design
Bit 6	MAG Unbalance at the Lower Bearing	Deposition of material from the pumped media at the turbo rotor Due to aggressive media, abrasion at the turbo rotor.	Check the pumped media for suitability with this pump design
Bit 7	MAG Oscillation at the Axial Bearing	The environmental vibration might be too heavy.	Reduce vibration which might affect the pump.
Bit 8	MAG Upper Radial Bearing Displacement X1	The magnetic bearing close to the high vacuum flange has been shifted radially. The environmental vibration might be too heavy.	Reduce vibration which might affect the pump.

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Warning Bit 2	Designation	Possible Cause	Remedy
Bit 9	MAG Upper Radial Bearing Displacement Y1	The magnetic bearing close to the high vacuum flange has been shifted radially. The environmental vibration might be too heavy.	Reduce vibration which might affect the pump.
Bit 10	MAG Lower Radial Bearing Displacement X2	The magnetic bearing close to the forevacuum flange has been shifted radially. The environmental vibration might be too heavy.	Reduce vibration which might affect the pump.
Bit 11	MAG Lower Radial Bearing Displacement Y2	The magnetic bearing close to the forevacuum flange has been shifted radially. The environmental vibration might be too heavy.	Reduce vibration which might affect the pump.
Bit 12	MAG Axial Bearing Displacement Z	The magnetic bearing has been shifted axially. The environmental vibration might be too heavy.	Reduce vibration which might affect the pump.
Bit 13	High Number of Auxiliary Bearing Impacts	The environmental vibration might be too heavy or too many shocks or impacts interfered the pump. Too many full or partial auxiliary bearing run downs affected the pump.	Reduce vibration which might affect the pump. Avoid shocks or impacts at the pump. Avoid stopping the pump by switching off the mains power. Avoid disconnecting the pump cable, when the pump is still running.
Bit 14	High Amount of Cumulated Bearing Touch Down Time	The environmental vibration might be too heavy or too many shocks or impacts interfered the pump. Too many full or partial auxiliary bearing run downs affected the pump.	Reduce vibration which might affect the pump. Avoid shocks or impacts at the pump. Avoid stopping the pump by switching off the mains power. Avoid disconnecting the pump cable, when the pump is still running.
Bit 15	High No. of Touch Down Bearing Run Downs	The number of partial or full touchdowns into the touchdown bearings is too high. The environmental vibration might be too heavy or too many shocks or impacts interfered the pump. Too many full or partial auxiliary bearing run downs affected the pump.	Reduce vibration which might affect the pump. Avoid shocks or impacts at the pump. Avoid stopping the pump by switching off the mains power. Avoid disconnecting the pump cable, when the pump is still running.

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2.2.11 Failure Class

Class Code: 101 (0x65)
Instance 1

Attribute ID	Access Rule	Name	Data Type	Description; actual value
1 (0x01)	Get	Actual error code	INT	See Table below
2 (0x02)	Get	Error frequency	INT	Frequency when actual error occurred [xxx Hz]
3 (0x03)	Get	Error hours	INT	Pump operation hours when actual error occurred [xxx hour]

Error code	Designation	Description	Possible cause	Remedy
2	Motor temperature error	The motor temperature has exceeded the error threshold.	Forevacuum pressure too high, gas flow too high, defective fan.	Check ultimate pressure of the forevacuum pump and if required install a larger forevacuum pump. Seal off leak, check process. Replace fan. Switch water cooling on. Water cooling switched off.
3	Supply voltage failure	Intermediate circuit voltage is too low or maximum generator operating mode duration exceeded.	Mains supply voltage is too low. Mains voltage has failed.	Check voltage at the mains feed point. Remedy mains power failure.
4	Converter temperature failure	Overtemperature at the power output stage or inside the frequency converter.	Ambient temperature too high. Inadequate cooling owing to cooling water which is too warm.	Do not exceed the maximum ambient temperature of 45 °C. Improve cooling, comply with specified cooling water temperature and cooling water quantity.
5	Overload failure	Rotational speed has dropped below the minimum speed.	Forevacuum pressure is too high. Gas flow is too high.	Check ultimate of the forevacuum pump and if required install a larger forevacuum pump. Seal off leak, check process.
6	Run-up failure	Pump has not attained its normal operating frequency after the maximum run-up time has elapsed.	Forevacuum pressure is too high. Gas flow is too high.	Check ultimate pressure of the forevacuum pump and if required install a larger forevacuum pump. Seal off leak, check process.
7	Run-up time failure	Maximum permissible bearing temperature was exceeded.	Forevacuum pressure is too high. Gas flow is too high.	Check ultimate pressure of the forevacuum pump and if required install a larger forevacuum pump. Seal off leak. Check process.
9	Bearing temperature failure	Maximum permissible bearing temperature was exceeded.	Forevacuum pressure is too high. Gas flow is too high. Water cooling switched off.	Check ultimate pressure of the forevacuum pump and if required install a larger forevacuum pump. Seal off leak. Replace fan. Water cooling disabled or cooling water throughput or cooling water temperature inadequate.

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Error Designation code	Description	Possible cause	Remedy	
12	Orbit monitoring, level XY1	Deflection of the rotor at the radial magnetic bearing on the high vacuum side is too high.	Mechanical impacts, possibly through maintenance work. Cross influences of vibrations between several pumps. Vibration influences through external exciting. Balancing condition of the rotor insufficient due to deposits or wear.	Remove external influences. Should the error still occur inform Leybold Service; have the pump replaced.
13	Orbit monitoring, level XY2	Deflection of the rotor at the radial magnetic bearing on the forevacuum side is too high.	Mechanical impacts, possibly through maintenance work. Cross influences of vibrations between several pumps. Vibration influences through external exciting. Balancing condition of the rotor insufficient due to deposits or wear.	Remove external influences. Should the error still occur inform Leybold Service; have the pump replaced.
14	Axial orbit monitoring	Deflection of the rotor at the axial bearing is too high.	Venting gas flow is too high, mechanical impacts, possibly through maintenance work. Cross influences of vibrations between several pumps. Vibration influences through external exciting.	Remove external influences. Should the error still occur inform Leybold Service; have the pump replaced.
16	Overload duration failure	After having attained its normal operating frequency the pump was operated for a longer period of time below its normal operating frequency.	Forevacuum pressure too high. Gas flow too high.	Check ultimate pressure of the forevacuum pump and if required install a larger forevacuum pump. Seal off leak. Check process.
17	Motor current failure	Motor current below set-point current.	With start command being present: frequency converter not properly connected to the pump or damaged connector between pump and frequency converter. Internal fault within the frequency converter.	Inform Leybold Service; have connectors and if required the cable checked. Have the converter replaced.
19	Passthrough time failure	The pump did not attain its minimum speed within the maximum passthrough time.	Forevacuum pressure too high when starting the system. Seized rotor.	Reduce forevacuum pressure. Check to ensure that the rotor rotates freely.
26	Bearing temperature sensor failure	Bearing temperature sensor is defective.	Component is defective, sensor short-circuit or interruption.	Inform Leybold Service. If required have converter respectively pump replaced.
28	Motor temperature sensor failure	Motor temperature sensor is defective.	Component is defective, sensor short-circuit or interruption.	Inform Leybold Service. If required have converter respectively pump replaced.
31	High load duration failure	Motor current has exceeded the warning threshold too long (time span defined through parameter "Overload time 2").	Forevacuum pressure is too high. Gas flow is too high.	Check ultimate pressure of the forevacuum pump and if required install a larger forevacuum pump. Seal off leak. Check process conditions.

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Error code	Designation	Description	Possible cause	Remedy
39	Magnetic bearing start-up failure	Magnetic bearing is not able to lift the rotor properly.	Pump was shock vented. Excessively high vibrations or mechanical impacts from the system. Vibration influences between several pumps.	Refer to the pump manual for correct venting of the pump. Avoid vibrations or mechanical impacts.
43	Overspeed failure	The actual frequency exceeds the setpoint frequency.	Setpoint frequency was changed during operation via a serial interface, RS 232, for example.	Provide for correct speed setting.
63	Internal parameter failure		There is a parameter mismatch which occurred during start-up or while saving the parameters. The pump was disconnected from its power supply while storing important system data was in progress.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
65	Internal communication failure	Failure of internal data communication with the frequency converter.	Cyclic pump communication has failed.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON.
66	Magnetic bearing current too high	Overloading of one or several magnetic bearing power output stages.	Excessively high vibrations or mechanical impacts from the system.	Reduce the level of vibrations or mechanical impacts.
67	Internal overload		Internal drive overload.	Stop the pump. Wait for standstill. Switch mains power OFF and ON again and restart the system.
71	First time initialisation failure of the parameter list.	Interface parameter/table mapping error.	First time initialisation of the pump parameters has failed.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON.
73	First time initialisation failure of the parameter list.	The registered number of start and standby cycles exceeds the maximum permissible number for safe operation.	Very high number of starts respectively much use of the standby function.	Have the pump serviced.
74	Number of operating hours exceeded.	The number of operating hours of the pump exceeds the maximum permissible number of hours for safe operation.	The number of operating hours of the system has reached the level necessary for servicing.	Have the pump serviced.
75	Failure during the initialisation of the pump data.	Failure during identification and initialisation of the pump.	Failure in frequency converter or in the pump.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.

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Error code	Designation	Description	Possible cause	Remedy
77	Too many touchdown bearing contacts were detected.	The registered number of touchdown bearing contacts exceeds the permissible alarm limit.	Due to external or internal influences of the pump the turbo rotor makes contact with the emergency bearings (touchdown bearings): mechanical impacts, possibly due to maintenance work. Vibration influences between several pumps. Vibration influences due to external exciting. Balancing condition of the rotor inadequate due to deposits or wear. Magnetic suspension is defective. Full or partial shutdown of the pump without magnetic bearing support due to mains power failure or failure in the frequency converter.	Have the pump serviced. If required check frequency converter and the connections. Check installation orientation of the pump and if required correct it. Avoid external influences (vibrations, impacts etc.). Review electric power supply and control concept.
78	Bearing contact time too long was detected.	The registered total duration of all touchdown bearing contacts exceeds the permissible alarm limit.	Due to external or internal influences of the pump the turbo rotor makes contact with the emergency bearings (touchdown bearings): mechanical impacts, possibly due to maintenance work. Vibration influences between several pumps. Vibration influences due to external exciting. Balancing condition of the rotor inadequate due to deposits or wear. Magnetic suspension is defective. Full or partial shutdown of the pump without magnetic bearing support due to mains power failure or failure in the frequency converter.	Have the pump serviced. If required check frequency converter and the connections. Check installation orientation of the pump and if required correct it. Avoid external influences (vibrations, impacts etc.). Review electric power supply and control concept.
79	Internal communication failure.	Failure of the internal data communication of the frequency converter.	Failure in the frequency converter.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
80	Invalid interface module combination.	Configuration of the interface module slots is inconsistent.	Two active Fieldbus modules were inserted, the X1 24 V PLC module has been inserted into the "Service" slot.	Correct installation of the interface modules: use control interface slot (CONTROL) with Fieldbus module (Profibus), RS 485, RS 232 or X1. Equip the service slot with a RS 232, a RS 485 or an USB module only.
81	Watchdog for monitoring of USS communication has responded.	Cyclic communication has failed for a longer period of time than defined through P 182.	Cable running to the controller was removed. Controller has interrupted communication. Interface module is defective.	Reinsert cable. Check controller. Inform Leybold Service.

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Error code	Designation	Description	Possible cause	Remedy
82	Watchdog for monitoring Fieldbus communication has responded.	Cyclic communication has failed for a longer period of time than defined through P 925.	Cable running to the controller was removed. Controller has interrupted communication. Fieldbus interface is defective.	Reinsert cable. Check controller. Inform Leybold Service; have frequency converter replaced.
90	Setpoint speed setting higher than permissible.	Frequency setpoint is higher than the maximum value defined through parameter 45.	Incorrect setpoint entry or parameterisation of the pump is in error.	Correct setpoint entry or run a software respectively parameter update.
200	Pump identification temperature failure	Temperature in the pump identification is too high.	Forevacuum pressure is too high. Gas flow is too high. Water cooling switched off.	Check ultimate pressure of the forevacuum pump and if required install a larger forevacuum pump. Seal off leak. Check process. Water cooling disabled or cooling water throughput or cooling water temperature inadequate.
201	Unidentifiable failure on control board	Failure affecting the control computer of the frequency converter.	External interference or hardware failure affecting the frequency converter electronics.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
203	Failure during self test	Failure affecting the parameter table mapping.	External interference or hardware failure affecting the frequency converter electronics.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
204	RAM area insufficient for scope functionality	Failure in the control computer of the frequency converter.	External interference or hardware failure affecting the frequency converter electronics.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
206	Pump parameter failure	Failure during identification and initialisation of the pump or the frequency converter.	Failure in the frequency converter, in the pump respectively in the pump's cables.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
209	Pump initialisation failure	Failure during identification and initialisation of the pump or the frequency converter.	Failure in the frequency converter, in the pump respectively in the pump's cables.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
210	Non-cyclic data transfer to pump identification interrupted (parameter transfer)	Communication malfunction with data memory of pump identification.	Temporary EMC interference. Defective hardware.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.

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Error code	Designation	Description	Possible cause	Remedy
213	Intermediate circuit overvoltage	The power supply voltage is too high.	The frequency converter has detected an intermediate circuit voltage which is too high.	Check power supply on the mains power side.
936	The current offset and gain values deviate from the initial data.	Internal Failure	Failure in the frequency converter, in the pump or in the pump's cable.	Contact Leybold Service.
937	The Soffset values are outside of the defined range (initialisation).	Internal Failure	Failure in the frequency converter, in the pump or in the pump's cable.	Contact Leybold Service.
938	Cable parameters soffs, sgain and xgain are at their factory defaults.	Internal Failure	Failure in the frequency converter, in the pump or in the pump's cable.	Contact Leybold Service.
939	Cancellation during calculation of the checksum across the range of the static parameters in the pump identification.	Internal Failure	Failure in the frequency converter, in the pump or in the pump's cable.	Contact Leybold Service.
940	Cancellation during the calculation of the checksum across the range of the static parameters in the frequency converter.	Internal Failure	Failure in the frequency converter, in the pump or in the pump's cable.	Contact Leybold Service.
941	Incompatible compiling of the profile adapter version.	Interface parameter table mapping error.	Failure during software update.	If required repeat the software update, respectively check combination of software and profile adapter file.

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Error code	Designation	Description	Possible cause	Remedy
949	Checksum error during initialisation of the equipment settings.	Failure while operating or identifying and initialising the pump.	Failure in the frequency converter, in the pump respectively in the pump's cable.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
950	Checksum error during initialisation of the autosave parameters	Failure while operating or identifying and initialising the pump.	Failure in the frequency converter, in the pump respectively in the pump's cable.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
951	Error while writing a string parameter to the fixed parameter memory.	Failure while operating or identifying and initialising the pump.	Failure in the frequency converter, in the pump respectively in the pump's cable.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
952	Failure during reading of the permanent parameter memory during the start-up phase.	Failure during operation or while identifying and initialising the pump.	Malfunction in the frequency converter, in the pump respectively in the pump's cable.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
953	Failure while writing to the fixed parameter memory.	Failure during operation or while identifying and initialising the pump.	Malfunction in the frequency converter, in the pump respectively in the pump's cable.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
955	Watchdog for monitoring the communication via Lustbus has responded.	Failure affecting the internal data communication of the frequency converter.	Malfunction in the frequency converter.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
956	Profile adapter: no opcode	Failure affecting the internal data communication of the frequency converter.	Malfunction in the frequency converter.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
957	Profile adapter: invalid opcode	Profile adapter: invalid opcode	Malfunction in the frequency converter.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.

Network Configuration

Error code	Designation	Description	Possible cause	Remedy
958	Profile adapter: failure during reading of parameters.	Failure affecting the internal data communication of the frequency converter.	Malfunction in the frequency converter.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
959	Profile adapter: failure during writing of parameters	Failure affecting the internal data communication of the frequency converter.	Malfunction in the frequency converter.	
979	General failure during floating point calculation	Failure affecting the control computer of the frequency converter.	External interference or hardware fault of the frequency converter electronics.	
980	Not enough memory for module parameters	Failure affecting the control computer of the frequency converter.		
982	Failure during initialisation of the generator mode.	Internal frequency converter failure.		
983	Failure during initialisation of the speed controller.	Internal frequency converter failure.		
984	Failure during initialisation of rotational speed calculation.	Internal frequency converter failure.		
985	Failure during initialisation of the current controller.	Internal frequency converter failure.		
986	Failure during initialisation of the controller.	Internal frequency converter failure.		
987	Internal failure of the state machine controller.	Internal frequency converter failure.		
988	Failure during initialisation of the motor protection module.	Internal frequency converter failure.		
989	Internal failure affecting the number formats.	Internal frequency converter failure.		
990	Failure during internal parameter access via KP 200. A parameter could not be read or written.	Internal frequency converter failure.		

Network Configuration

Error code	Designation	Description	Possible cause	Remedy
991	Failure during initialisation of a parameter with its saved setting.	Internal frequency converter failure.	External interference or hardware fault in the frequency converter electronics.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
992	User stack has exceeded the maximum size.			
994	Runtime error during checking of the assisting parameter			
995	An exception was initiated.			
996	Non-identifiable parameter access level.			
997	Runtime error during enabling of an assisting parameter.			
Theoretically there are further error codes. Should these be displayed, please contact Leybold. In the case of malfunctions also note the troubleshooting information provided in the Operating Instructions for the pump.				

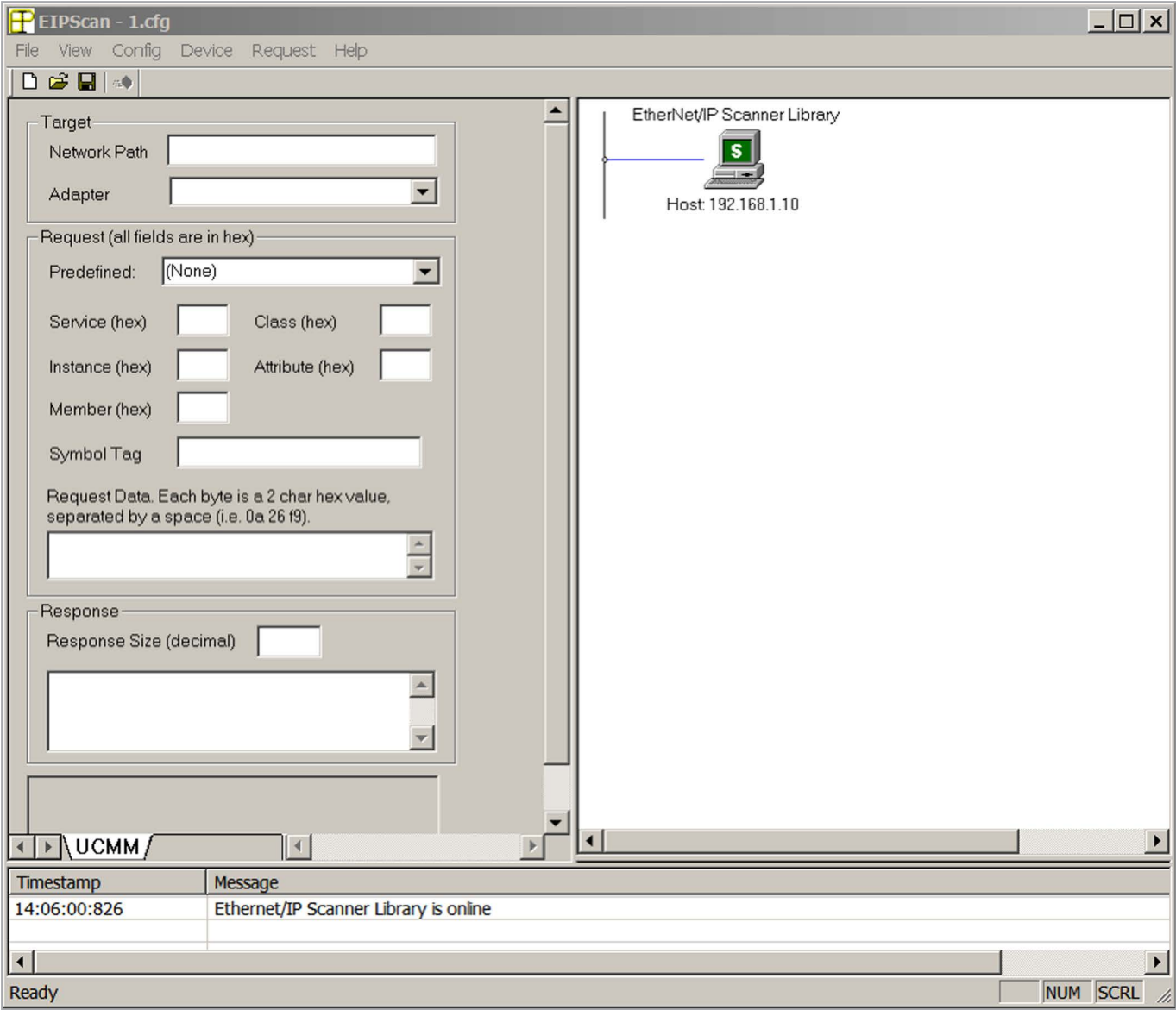
Running cyclic operations

3 Example for running cyclic operations by using the EIPScan tool

The EIPScan software is sold by:

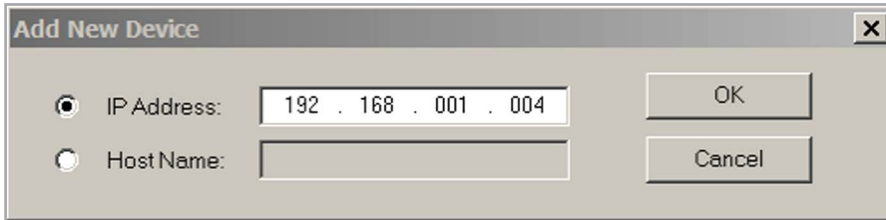
Pyramid Solutions, Inc.
30150 Telegraph Road
Suite 200
Bingham Farms, MI 48025
USA

www.pyramidsolutions.com



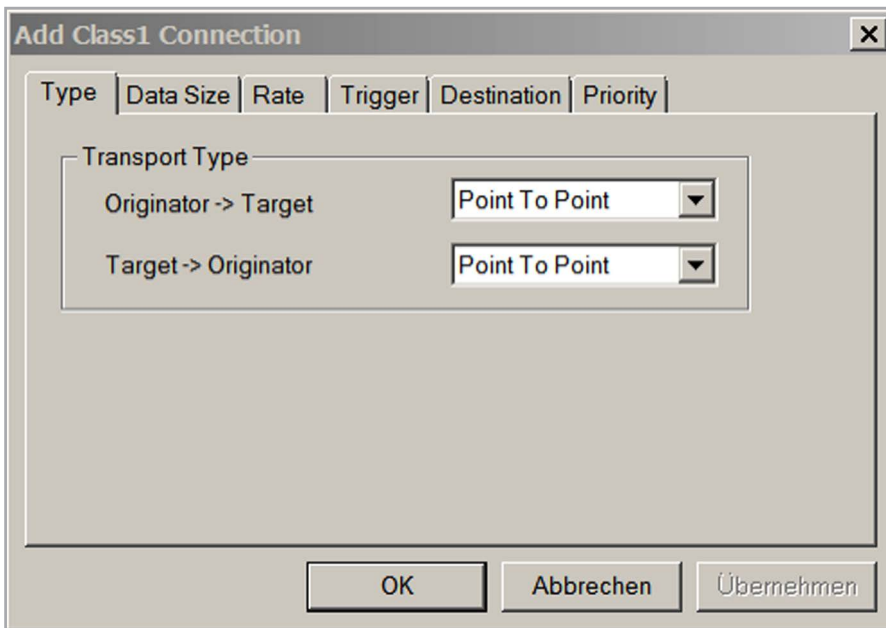
Add Device (frequency converter) by right key mouse click in the Device windows.

Running cyclic operations



The 'Add New Device' dialog box has a title bar with a close button (X). It contains two radio buttons: 'IP Address:' and 'Host Name:'. The 'IP Address:' radio button is selected. Next to it is a text field containing '192 . 168 . 001 . 004'. To the right of the text field are two buttons: 'OK' and 'Cancel'.

Fill in the valid IP address of the converter unit.



The 'Add Class1 Connection' dialog box has a title bar with a close button (X). It features a tabbed interface with tabs for 'Type', 'Data Size', 'Rate', 'Trigger', 'Destination', and 'Priority'. The 'Type' tab is active. Inside the 'Type' tab, there is a section titled 'Transport Type' containing two rows: 'Originator -> Target' and 'Target -> Originator'. Each row has a dropdown menu set to 'Point To Point'. At the bottom of the dialog are three buttons: 'OK', 'Abbrechen', and 'Übernehmen'.

Add I/O Connection by right key mouse click on the device you just added. You might want to change the Target->Originator to Point to Point. Otherwise there will be a lot of broadcast messages on the network.

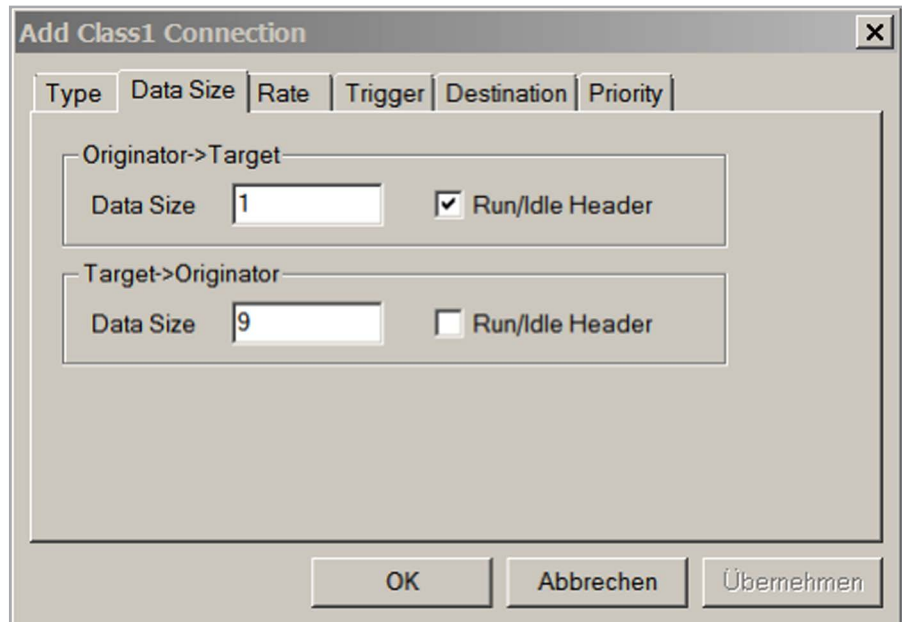
Configure the size of the I/O Assembly Object instances you wish to use.

Depending on the present I/O assemblies. in general the following value will be possible, but only a connection with the instances defined with the Ethernet/IP Host Object can be realized. If you want different instance like shown below, the setting in the Ethernet/IP Host object has to be changed first.

Instance Target -> Originator	Size	Instance Originator->Target	Size
		5	1
3	9	6	2
100 (0x64) default	9	7	4
		101 (0x65) default	1
		102 (0x66)	3
			4

Running cyclic operations

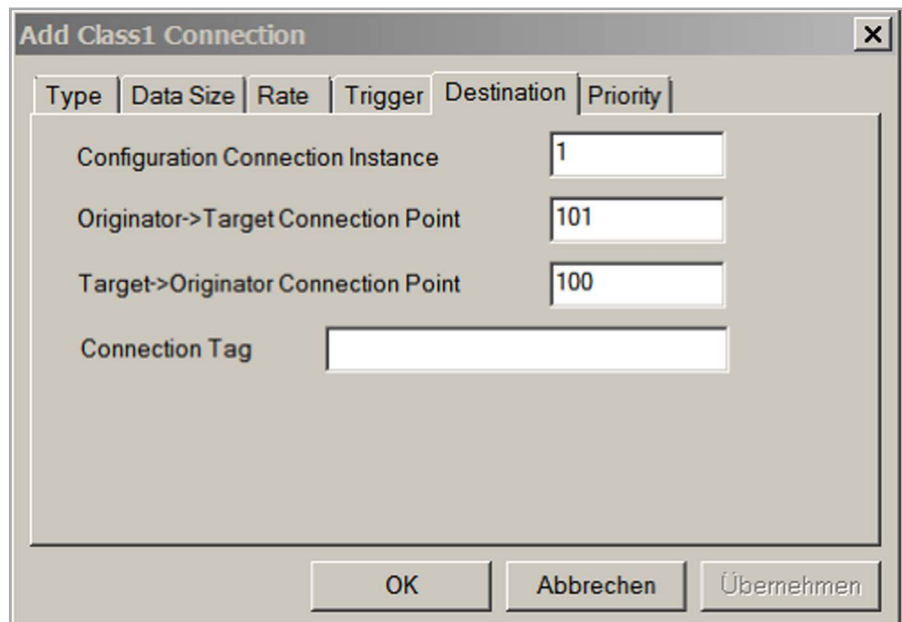
Configure DATA SIZE



The 'Add Class1 Connection' dialog box has a tabbed interface with 'Type', 'Data Size', 'Rate', 'Trigger', 'Destination', and 'Priority' tabs. The 'Data Size' tab is active. It contains two sections: 'Originator->Target' and 'Target->Originator'. In the 'Originator->Target' section, the 'Data Size' is set to 1 and the 'Run/Idle Header' checkbox is checked. In the 'Target->Originator' section, the 'Data Size' is set to 9 and the 'Run/Idle Header' checkbox is unchecked. At the bottom are 'OK', 'Abbrechen', and 'Übernehmen' buttons.

Section	Data Size	Run/Idle Header
Originator->Target	1	<input checked="" type="checkbox"/>
Target->Originator	9	<input type="checkbox"/>

Configure Originator and Target Instances



The 'Add Class1 Connection' dialog box has the same tabbed interface as the previous image, but the 'Data Size' tab is not active. The 'Type' tab is active, showing fields for 'Configuration Connection Instance' (set to 1), 'Originator->Target Connection Point' (set to 101), 'Target->Originator Connection Point' (set to 100), and 'Connection Tag' (empty). At the bottom are 'OK', 'Abbrechen', and 'Übernehmen' buttons.

Field	Value
Configuration Connection Instance	1
Originator->Target Connection Point	101
Target->Originator Connection Point	100
Connection Tag	

Running cyclic operations

I/O connection is configured and running with I/O instance 100 (0x64) and 101 (0x65)

The screenshot shows the EIPScan - 1.cfg application window. The left pane contains configuration fields for a target and request. The right pane shows a network diagram with two hosts connected by a red line. Below the diagram, there are two rows of hex data: 00 10 00 00 00 00 00 00 00 and 00.

Target Configuration:

- Network Path: 192.168.1.4
- Adapter: 192.168.1.10

Request Configuration (all fields are in hex):

- Predefined: (None)
- Service (hex): e, Class (hex): f8
- Instance (hex): 1, Attribute (hex): 8
- Member (hex):
- Symbol Tag:

Response Configuration:

- Response Size (decimal): 2
- Response Data: 65 00

Network Diagram:

- Host 192.168.1.10 (green 'S' icon)
- Host 192.168.1.4 (green 'I' icon)
- Connection: MAG.DRIVE ()M - Connection Instance 1, RPIs 100 / 100, Cyclic
- Bit fields: 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0

Log Window:

Timestamp	Message
10:02:38...	Ethernet/IP Scanner Library is online
10:03:54...	Connection opened with Instance 1, Max Recv Delay 1 msec, Max Send Delay 2 msec, Rcv API 99.97 msec, Sent API 100.99 msec, Rcvd pkts 11...

Status Bar: 1 Class1 connections active, Max Recv Delay 1 msec, Max Send Delay 2 msec, Max Recv API 99.97, Max Send API 100.99

Sales and Service

Germany

Leybold GmbH

Sales, Service, Support Center (3SC)
Bonner Strasse 498
D-50968 Cologne
T: +49-(0)221-347 1234
F: +49-(0)221-347 31234
sales@leybold.com
www.leybold.com

Leybold GmbH

Sales Area North

Branch Office Berlin
Industriestrasse 10b
D-12099 Berlin
T: +49-(0)30-435 609 0
F: +49-(0)30-435 609 10
sales.bn@leybold.com

Leybold GmbH

Sales Office South

Branch Office Munich
Karl-Hammerschmidt-Strasse 34
D-85609 Aschheim-Dornach
T: +49-(0)89-357 33 9-10
F: +49-(0)89-357 33 9-33
sales.mn@leybold.com
service.mn@leybold.com

Leybold Dresden GmbH

Service Competence Center

Zur Wetterwarte 50, Haus 304
D-01109 Dresden
Service:
T: +49-(0)351-88 55 00
F: +49-(0)351-88 55 041
info.dr@leybold.com

Europe

Belgium

Leybold Nederland B.V.

Belgisch bijkantoor

Leuvensesteenweg 542-9A
B-1930 Zaventem
Sales:
T: +32-2-711 00 83
F: +32-2-720 83 38
sales.zv@leybold.com
Service:
T: +32-2-711 00 82
F: +32-2-720 83 38
service.zv@leybold.com

France

Leybold France S.A.S.

Parc du Technopolis, Bâtiment Beta
3, Avenue du Canada
F-91940 Les Ulis cedex
Sales and Service:
T: +33-1-69 82 48 00
F: +33-1-69 07 57 38
info.ctb@leybold.com
sales.ctb@leybold.com

Leybold France S.A.S.

Valence Factory
640, Rue A. Bergès
B.P. 107
F-26501 Bourg-lès-Valence Cedex
T: +33-4-75 82 33 00
F: +33-4-75 82 92 69
marketing.vc@leybold.com

Great Britain

Leybold UK LTD.

Unit 9
Silverglade Business Park
Leatherhead Road
Chessington
Surrey (London)
KT9 2QL
Sales:
T: +44-13-7273 7300
F: +44-13-7273 7301
sales.ln@leybold.com
Service:
T: +44-13-7273 7320
F: +44-13-7273 7303
service.ln@leybold.com

Italy

Leybold Italia S.r.l.

Via Trasimeno 8
I-20128 Mailand
Sales:
T: +39-02-27 22 31
F: +39-02-27 20 96 41
sales.mi@leybold.com
Service:
T: +39-02-27 22 31
F: +39-02-27 22 32 17
service.mi@leybold.com

Netherlands

Leybold Nederland B.V.

Floridadreef 102
NL-3565 AM Utrecht
Sales and Service:
T: +31-(30) 242 63 30
F: +31-(30) 242 63 31
sales.ut@leybold.com
service.ut@leybold.com

Switzerland

Leybold Schweiz AG, Pfäffikon

Churerstrasse 120
CH-8808 Pfäffikon
Warehouse and shipping address:
Riedthofstrasse 214
CH-8105 Regensdorf
Sales:
T: +41-44-308 40 50
F: +41-44-302 43 73
sales.zh@leybold.com
Service:
T: +41-44-308 40 62
F: +41-44-308 40 60
service.zh@leybold.com

Spain

Leybold Spain, S.A.

C/. Huelva, 7
E-08940 Cornellà de Llobregat
(Barcelona)
Sales:
T: +34-93-666 43 11
F: +34-93-666 43 70
sales.ba@leybold.com
Service:
T: +34-93-666 46 11
F: +34-93-685 43 70
service.ba@leybold.com

America

USA

Leybold USA Inc.

5700 Mellon Road
USA-Export, PA 15632
T: +1-724-327-5700
F: +1-724-325-3577
info.ex@leybold.com
Sales:
T: +1-724-327-5700
F: +1-724-333-1217
Service:
T: +1-724-327-5700
F: +1-724-325-3577

Brazil

Leybold do Brasil

Rod. Vice-Prefeito Hermenegildo Tonolli,
nº. 4413 - 6B
Distrito Industrial
Jundiá - SP
CEP 13.213-086
Sales and Service:
T: +55 11 3395 3180
F: +55 11 99467 5934
sales.ju@leybold.com
service.ju@leybold.com

Asia

P. R. China

Leybold (Tianjin)

International Trade Co. Ltd.
Beichen Economic
Development Area (BEDA),
No. 8 Western Shuangchen Road
Tianjin 300400
China
Sales and Service:
T: +86-22-2697 0808
F: +86-22-2697 4061
F: +86-22-2697 2017
sales.tj@leybold.com
service.tj@leybold.com

India

Leybold India Pvt Ltd.

No. 82(P), 4th Phase
K.I.A.D.B. Plot
Bommasandra Industrial Area
Bangalore - 560 099
Indien
Sales and Service:
T: +91-80-2783 9925
F: +91-80-2783 9926
sales.bgl@leybold.com
service.bgl@leybold.com

Japan

Leybold Japan Co., Ltd.

Headquarters
Shin-Yokohama A.K.Bldg., 4th floor
3-23-3, Shin-Yokohama
Kohoku-ku, Yokohama-shi
Kanawaga 222-0033
Japan
Sales:
T: +81-45-471-3330
F: +81-45-471-3323
sales.yh@leybold.com

Leybold Japan Co., Ltd.

Tsukuba Technical Service Center
1959, Kami-yokoba
Tsukuba-shi, Ibaraki-shi 305-0854
Japan
Service:
T: +81-29 839 5480
F: +81-29 839 5485
service.iik@leybold.com

Malaysia

Leybold Malaysia

Leybold Singapore Pte Ltd.

No. 1 Jalan Hi-Tech 2/6
Kulim Hi-Tech Park
Kulim, Kedah Darul
Aman 09000
Malaysia
Sales and Service:
T: +604 4020 222
F: +604 4020 221
sales.ku@leybold.com
service.ku@leybold.com

South Korea

Leybold Korea Ltd.

3F. Jellzone 2 Tower
Jeongja-dong 159-4
Bundang-gu Sungnam-si
Gyeonggi-do
Bundang 463-384, Korea
Sales:
T: +82-31 785 1367
F: +82-31 785 1359
sales.bd@leybold.com
Service:
623-7, Upsung-Dong
Cheonan-Si
Chungcheongnam-Do
Korea 330-290
T: +82-41 589 3035
F: +82-41 588 0166
service.cn@leybold.com

Singapore

Leybold Singapore Pte Ltd.

8 Commonwealth Lane #01-01
Singapore 149555
Singapore
Sales and Service:
T: +65-6303 7030
F: +65-6773 0039
sales.sg@leybold.com
service.sg@leybold.com

Taiwan

Leybold Taiwan Ltd.

No 416-1, Sec. 3
Chunghsin Rd., Chutung
Hsinchu County 310
Taiwan, R.O.C.
Sales and Service:
T: +886-3-500 1688
F: +886-3-583 3999
sales.hc@leybold.com
service.hc@leybold.com

Headquarter

Leybold GmbH

Bonner Strasse 498
D-50968 Cologne
T: +49-(0)221-347-0
F: +49-(0)221-347-1250
info@leybold.com



www.leybold.com