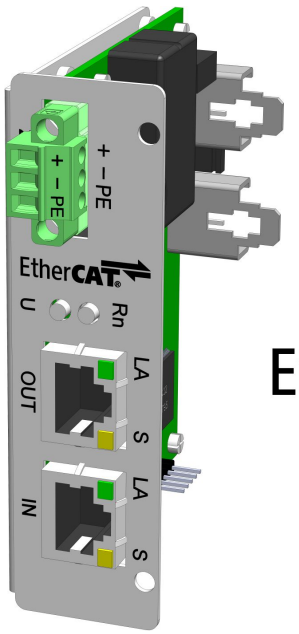


REOVIB

Control Equipment for the Vibratory Feeder Industry

MFS 368
Frequency Converter for Vibratory Feeders

Annnex: EtherCAT V02 - programming

MFS_368_EtherCAT_V02_Anhang_rev00.en.doc
03.12.2020

Safety notice for the user

This description contains the required information for the intended usage of the products described herein. They are intended for use by technically qualified personnel.

Qualified personnel are those persons who, due to their training, experience and instruction, as well as their knowledge of the relevant standards, requirements, accident prevention regulations and operational conditions, are authorized by those responsible for the safety of the system to carry out their respective duties, and to recognize possible dangers and prevent them (Definition for experts according to IEC 364).

Danger warnings

The following notices serve to protect the personnel safety of the operators and the safety of the described products as well as the devices connected to them.

Warning!
Dangerous Voltage.
Inattention can lead to death, serious injuries or damage to equipment.

- Turn off the supply power before assembly or disassembly work and when fuses are changed, or equipment modifications are undertaken.
- Observe the applicable accident prevention and safety regulations for the respective application.
- Before placing the equipment in operation, check whether the rated voltage of the device is in agreement with the supply voltage.
- **Emergency OFF equipment must remain effective in all operating modes. Unlocking the emergency OFF equipment must not cause an uncontrolled startup of equipment.**
- **The electrical connections must be covered!**
- **The ground lead connections must be inspected after mounting to insure that they function perfectly!**

Usage according to the regulations

The devices described herein are electrical operational equipment for application in industrial systems. They are constructed for the regulation of vibratory feeder equipment.

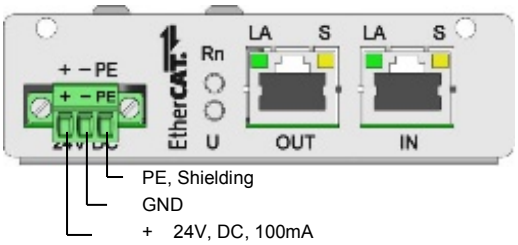
Contents

1.0 General

The frequency converter for vibratory feeders REOVIB MFS 368 series can be operated with a EtherCAT interface. In "normal mode" the setpoint value for the conveying capacity is transmitted from the PLC to the controller and the device status (ready for operation / fault) is reported back. In a further parameter mode, the device can be fully configured via EtherCAT.
For the interface an external voltage supply of 24 V DC is required.

Delivery of the equipment belongs a corresponding XML-File.

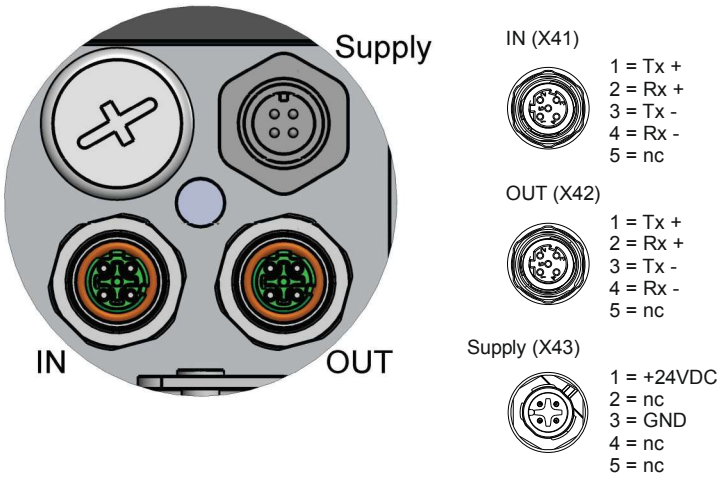
Interface module (IP20)



Rn = continous light: Communication externally active
Blinking or Off: Communication disturbed externally

U = blinking: Operating voltage available

Interface connection (IP54)



The interface enables communication with the frequency converter, using 4 data words (i.e. 16 Bits). The four 16 Bit words are transmitted and acknowledged every bus cycle.

! Important – Data consistence is required to operate with EtherCAT-Master !

Note: Data consistency is defined e.g. in a Siemens S7 PLC with SFC 14 and SFC 15

Units are factory set prior to delivery and so are configured for bus operation. If the unit is required for manual control then the parameter “Bus operation“ in menu “Interface” should be deactivated. You get back to bus operation, if you activate this parameter again.

2.0 Interface operation (EtherCAT - Slave)

Bus Power Supply	24 V, DC, 100 mA
Bus connector	2 x RJ-45
Internal interface	CAN-Bus
Communication	Data consistency required
Protocol	EtherCAT

3.0 Activate interface

To activate interface operation, the "Bus operation" parameter must be activated in the "Interface" menu. If the unit is to be operated manually, this parameter must be deactivated.
Important: The "Bus address" parameter must remain set to "1" and the "Bit rate" parameter to 1Mbit/s.

No.	Menu / Parameter	Meaning	Adjustment
5	**Interface**		
5.1	Bus operation	Interface activate / deactivate	☑/☐
5.2	Bus address	Internal bus address (do not change)	1…16
5.3	Bit rate	Internal bus bitrate (do not change)	1Mbit/s / 500kbit/s
5.4	CAN Proto	Interface protocol (do not change)	V1.i / V2.f

4.0 XML-File

Following XML File is required for the operation with the EtherCAT interface:

XML File name:	**REOec200417.xml**

The XML file can be accessed at www.reo.de in the download area.

5.0 Bus operating modes

Two fundamental operating modes can be chosen for bus communication.

Normal Operation:

Control of the frequency controller in production, in which case the Set point and ON/OFF control signals are transmitted.

Parameter Operation:

Adjustment of the frequency controller for the desired operation mode and limits. In a special mode, the parameter and parameter addresses are transmitted and acknowledged. In parameter operation, the unit's specific values, such as frequency, soft start
In parameter operation, unit-specific values such as frequency, soft start, time delay, switch, etc. are set.

Parameter operation mode is not suitable for continuously setting of values as it releases write operations in the internal retentive memory while the latter enables only a limited number of memory processes.

Control-words and **Status-words** functionally are composed of 16 individual Bits (Control-word) or resp. 1 Byte and 8 Bits (Status-word). Depending on the possibilities of the PLC used, there are several procedures to create the Control-word as desired. If this is composed of smaller blocks (Byte/Bit), it must be observed in which order the PLC used maps high- and low byte in the storage area.
With limited number of possible combinations these can be predefined as a constant for example and then transmitted into the word to perform the function (0000H, 0004H, 8000H and 8004H. Please consider that the unit will keep running only with a set enable bit.)

The Status-word includes the Status-Code as a Byte value as well as additional Status-Indications in Bit form. As in the Bit-area there are various un-defined Status-Bits (these are provided only for internal production tests and may be modified in their function any time), the Status-word cannot be meaningfully evaluated with a simple comparative operation.

Prior to its comparison the value of the Status-code must be extracted. Same applies to an individual Status-Bit. Depending on PLC used, for ex-ample there are options such as Variable Overlay, Mask Out by means of linking functions (and/or in case of need also push operations and type conversion) or Slice access. With trouble-free running unit it is possible to recognize from the returned value A5H, in which order the PLC is storing High- and Low-Byte in memory.

The internal processing cycle for bus communication is at about 32 msec. The data transmitted to the unit are not internally buffered, and therefore it is necessary that the parameter command remains unchanged until the associated feedback has not acknowledged its receipt.

5.1 Programming for the Bus operation

In normal operation the set point for Amplitude (throughout/feed rate) and the digital control signals, such as enable are set across the interface. The actual voltage/current values and unit status (ready or fault) are fed back. All data words are within the range 0…FFFF H.
The following communication words are given in bit form.

5.1.1 Send to controller

H-Byte								L-Byte								
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	**Word 1** 0000 H (reserved)
H-Byte								L-Byte								
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	**Word 2** Set point 1, 16-Bit 100 % = FFFF H
H-Byte								L-Byte								
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	**Word 3** reserved
H-Byte								L-Byte								
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	**Word 4**
Mode bit	0	0	0	0	0	0	0	0	0	0	0	0	Enable	0	0	Control - word Bit = „1“ = Function ON **All unused bits MUST be set to `0`**
	Control information (unit specific)															

0 = Normal operation
1 = Parameter operation

Enable-bit

5.1.2 Reply from controller

H-Byte								L-Byte								
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	**Word 1** xxxx H (undefined)
H-Byte								L-Byte								
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	**Word 2 (only in regulation mode)** Feedback actual acceleration 16 Bit 100% = 8000H
H-Byte								L-Byte								
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	**Word 3** Feedback actual output current, 16 Bit 100% = 8000H (in % of I-nom)
H-Byte								L-Byte								
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	**Word 4**
Status - Code ERROR - Code								X	X	X	OFF	X	X	X	X	Status - Word X = not defined Bit = „1“ = Function ON
								Status information Unit specific								

00	Unit not responding
A5 (H)	Unit ready
47 (H)	ERROR Peak
58 (H)	ERROR OC
02 (H)	ERROR OL
0C (H)	ERROR ACC
37 (H)	ERROR OU
C0 (H)	Acknowledge Parameter mode

OFF - Bit
Acknowledge

Status, actual acceleration and actual output current are received.

5.2 Parameter operation

In parameter operation, the specific unit parameters can be monitored and adjusted.
A `write` enable must be transmitted before parameters can be altered. On closing, the `write` enable must be cancelled.

A `read` request must be sent before data can be read.

Word 4 in the acknowledge is always `C0DE H`. This indicates that the controller is in parameter mode.

After a command, has been sent, it is inadmissible to await the associated positive response before the next command is sent!

5.2.1 Creating parameter addresses and values

In parameter operation the most significant bit (msb) in Word 1 is defined as a read or write bit (R/W), where 1 = write and 0 = read, this should be accompanied by the corresponding parameter address.

The mode bit (msb in Word 4) is used to select normal or parameter operation, 0 = Normal or 1 = parameter operation.

Word 1:	**reserved**	**0000 H**
Word 2:	**R / W – Bit + Address**	**e.g. 8000 H + 1009 H => 9009 H**
Word 3:	**Parameter value**	**e.g. 7FFF H**
Word 4:	**Mode bit = 1 + control bit's**	**e.g. 8000 H + 0004 H => 9004 H**

For bit, orientated parameters, ONLY those bits relating to the required function may be changed, all other bits MUST remain unaltered, otherwise factory specific settings may be inadvertently altered!

Procedure for changing bit parameters:
1. Select parameter value.
2. Change only the required bit (s) in the selected parameter.
3. Send `write` enable.
4. Send the changed parameters back to the same address.
5. Close the `write` enable.

Alternative proposal:
1. Switch on write enable first.
2. Then read out the current value immediately before writing.
3. Modify immediately and write back immediately.
4. Do not reset the write enable until all parameterization options have been terminated.

5.2.2 Send Write Enable

H-Byte								L-Byte								**Word 1**
00								**00**								0000 H (reserved)
H-Byte								L-Byte								**Word 2**
C0								**DE**								Write Enable Address =C0DE H
H-Byte								L-Byte								**Word 3**
B5								**E7**								Write Enable =B5E7 H
H-Byte								L-Byte								**Word 4**
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Control - Word + 8000 H
1 Mode bit	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Mode Bit must be set to `1` !! All unused bits must be set to `0` Bit = `1` = Function ON
	Control Information (unit specific)															

5.2.3 Receive, Acknowledge Write Enable

H-Byte	L-Byte	**Word 1**
00	**00**	xxxx H (undefined)
H-Byte	L-Byte	**Word 2**
C0	**DE**	C0DE H
H-Byte	L-Byte	**Word 3**
B5	**E7**	B5E7 H
H-Byte	L-Byte	**Word 4**
C0	**DE**	C0DE H

The parameters can be sent after receipt of the acknowledge.

5.2.4 Send Parameter

H-Byte								L-Byte								**Word 1**
00								**00**								0000 H (reserve)
H-Byte								L-Byte								**Word 2**
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
R / W	*Parameter address*															Parameter address + R / W – Bit (16-Bit) **=** 0...FFFF H
H-Byte								L-Byte								**Word 3**
XX								**XX**								Parameter value (16-Bit) = 0...FFFF H
H-Byte								L-Byte								**Word 4**
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
1 Mode bit	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Control - Word + 8000H Mode must be set to `1`!! All unused bits must be set to `0` Bit = `1` = Function ON
	Control Information (unit specific)															

Received acknowledge

H-Byte								L-Byte								**Word 1**
00								**00**								xxxx H (undefiniert)
H-Byte								L-Byte								**Word 2**
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
R / W	*Parameter address*															Acknowledge the sent address + R / W - Bit
H-Byte								L-Byte								**Word 3**
XX								***XX***								**Acknowledge the Parameter value**
H-Byte								L-Byte								**Word 4**
C0								**DE**								Acknowledge the Parameter mode (always „C0DE“ H)

5.2.5 Close write enable

H-Byte	L-Byte	
00	**00**	**Word 1** 0000 H
H-Byte	L-Byte	**Word 2**
C0	**DE**	Write Enable Address =C0DE H
H-Byte	L-Byte	**Word 3**
00	**00**	Enable Value 0000
H-Byte	L-Byte	**Word 4**
15 14 13 12 11 10 9 8	7 6 5 4 3 2 1 0	
Mode bit 1	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Control - Word + 8000 H Mode bit must be set to `1`! All unused bits must be set to `0` Bit = `1` = Function ON
	Control Information (unit specific)	

5.2.6 Parameter read (send)

H-Byte	L-Byte	
00	**00**	**Word 1** xxxx H (undefined)
H-Byte	L-Byte	**Word 2**
15 14 13 12 11 10 9 8	7 6 5 4 3 2 1 0	
R / W	*Parameter address*	Parameter address + R / W - Bit
H-Byte	L-Byte	**Word 3**
00	**00**	Read Enable Value = 0000
H-Byte	L-Byte	**Word 4**
80	**00**	Mode bit = 1 + Control bits

Received parameter

H-Byte	L-Byte	
00	**00**	**Word 1** xxxx H (undefined)
H-Byte	L-Byte	**Word 2**
15 14 13 12 11 10 9 8	7 6 5 4 3 2 1 0	
R / W	*Parameter address*	Acknowledge Parameter address + R / W - Bit
H-Byte	L-Byte	**Word 3**
XX	**XX**	Parameter value
H-Byte	L-Byte	**Word 4**
C0	**DE**	Acknowlegde Parameter mode

6.0 Parameter Table

Non listed addresses cannot be altered!

Parameter:	Adjustment	Display-Code	Factory Setting:	Parameter address HEX (.bit)	Value HEX
Vibratory feeder					
• Amplitude (throughput)	0...100 %	Feeder	0 %	0x100C	0x0000...0xFFFF
• Second set point / coarse - fine	0…100 %	2.	0 %	0x1006	0x0000...0xFFFF
• Maximum control limit (U_{max})	5...100 %	Max.	90 %	0x1009	0x0CCC...0xFFFF
• Vibrating frequency (according to limit value)	3,33...333 Hz	Frequency	100 Hz	0x1005	01F4...7530 H 500...30000 dec. (FL.)...(FH.)
• Soft start ramp up	0...60 sec.	Soft start	0,1 sec.	0x1013	0x0000...0xFFFF
• Soft stop ramp down	0...60 sec.	Soft stop	0,1 sec.	0x1012	0x0000...0xFFFF
• Switch to external set point	☑/☐	External setpoint	☐	0x5800	0x0000 / 0x FFFF
• Setpoint 0(4)...20 mA	☑/☐	Setpoint	☐	0x5801	0x0000 / 0x FFFF
• Coarse / Fine control	☑/☐	Coarse / Fine	☐	0x580C	0x0000 / 0x FFFF
• Invert enable	☑/☐	Invert. Enable	☐	0x5811	0x0000 / 0x FFFF
Regulation (with sensor)					
• Switch to regulation	☑/☐	Acc. Regulator	☐	0x5808	0x0000 / 0x FFFF
• P characteristic	0...100	Proportional	40	0x100F	0x0000...0xFFFF
• I characteristic	0...100	Integral	100	0x1014	0x0000...0xFFFF
• Automatic frequency control	☑/☐	Auto. Freq.	☐	0x5809	0x0000 / 0x FFFF
Track control					
• Switch on time delay	0...60 sec.	T-ON	1 sec.	0x1003	0x0000...0xFFFF
• Switch off time delay	0...60 sec.	T-OFF	1 sec.	0x1002	0x0000...0xFFFF
• Invert sensor	☑/☐	Invert. Input	☐	0x580A	0x0000 / 0x FFFF
Sensor control					
• Sensor Time-out	☑/☐	Timeout on	☐	0x580B	0x0000 / 0x FFFF
• Sense time delay (Sensor Time-out)	1...240 sec.	Timeout	180 sec.	0x1004	0x0000...0xFFFF
Interface (option)					
• Interface OFF / ON	☑/☐	Bus operation	☑	0x5854	0x0000 / 0x FFFF
Service					
• ERROR Reset	Reset	ERROR Reset		0x1400	0xC009
• Hide programming menus	☑/☐	Hd.C.		0x5804	0x0000 / 0x FFFF
• Choose user parameter menu No. 0...3	0...3	Parameter set	0		[2]
• Save user settings		Parameter set loading			[2]
• Recall factory settings		Load factory settings			[2]
• Choose user parameter menu No. 0...3	0...3	U.S.I.	0		[2]
• Recall user parameter		Saving Parameter			[2]

Parameter:	Adjustment	Display-Code	Factory Setting:	Parameter address HEX (.bit)	Value HEX
Service limits					
• Enable service menu	☑/☐	Service	☐	0x5834	0x0000 / 0x FFFF
• Show output current (0... 100 %)		Ist-Strom		0x200A	0x0000...0x8000 H
• Current limit	0...100 %	Current limit	100	0x1016	0x0000...0xFFFF
• Current regulator P-part	1…100	Prop	20	0x100D	0x0000...0xFFFF
• Current regulator I-part	1…100	Integral	40	0x1032	0x0000...0xFFFF
• Min frequency limit	5…150 Hz	Min. Freq.	35	0x1020	0x01F4…0x7530 500…30000 dec.
• Max frequency limit	5…150 Hz	Max. Freq.	140	0x1021	0x01F4…0x7530 500…30000 dec.

1) Not available IP20 Version
2) Not for fieldbus operation

7.0 Example of bus communication with frequency controller

Variable values are shown in *italics*.

7.1 Normal mode

(Setpoint to 70 %)

	Word	Code	**send**	Code	**Received**
Send set-point	1	0000 H		0000 H	
	2	B332 H	**Setpoint = 70 %**	---	---
	3				
	4	*0004 H*	Enable On	*A5xx H*	Ready

(Controller STOP)

	Word	Code	**send**	Code	**Received**
Send set-point	1	0000 H		0000 H	
	2	B332 H	**Setpoint = 70 %**	---	---
	3				
	4	*0000 H*	Enable OFF	*A5xx H*	Ready

7.2 Parameter mode

(e.g. set frequency to 50 Hz and soft start to 2 second)

	Word	Code	**send**	Code	**Received**
Open write enable	1	0000 H		0000 H	
	2	C0DE H	Write enable Address	C0DE H	Acknowledge
	3	B5E7 H	Write enable value	B5E7 H	Acknowledge
	4	8000 H + Control bits	Set mode bit = 1	C0DE H	Acknowledge

Write parameter	1	0000 H		0000 H	
	2	9005 H	Parameter address Vibrating frequency +R / W - Bit	9005 H	Acknowledge
	3	*1388H*	**Frequency 50 Hz**	*1388 H*	Acknowledge 50 Hz
	4	8000 H + Control bits	Set mode bit = 1	C0DE H	Acknowledge

Write parameter	1	0000 H		0000 H	
	2	*9013 H*	Parameter address Soft start + R / W - Bit	*9013 H*	Acknowledge
	3	*3333 H*	**Soft start 2 sec.**	*3333 H*	Acknowledge 2 sec.
	4	8000 H + Control bits	Set mode bit = 1	C0DE H	Acknowledge

	Word	Code	**send**	Code	**Received**
Close write enable	1	0000 H		0000 H	
	2	C0DE H	Write enable address	C0DE H	Acknowledge
	3	0000 H	Write enable Value	0000 H	Acknowledge
	4	8000 H + Control bits	Set mode bit = 1	C0DE H	Acknowledge

Example of switch parameter change

Enable invert

	Word	Code	**send**	Code	**Received**
Open write enable	1	0000 H		0000 H	
	2	C0DE H	Write Enable Address	C0DE H	Acknowledge
	3	B5E7 H	Write Enable Value	B5E7 H	Acknowledge
	4	8000 H + Control bits	Set mode bit = 1	C0DE H	Acknowledge

Write parame-ter	1	0000 H		0000 H	
	2	*D811 H*	Parameter address	*D811 H*	Acknowledge
	3	*FFFF H*	New Parameter	*FFFF H*	Acknowledge
	4	8000 H + Control bits	Set mode bit = 1	C0DE H	Acknowledge

	Word	Code	**send**	Code	**Received**
Close write enable	1	0000 H		0000 H	
	2	C0DE H	Write Enable Address	C0DE H	Acknowledge
	3	0000 H	Write Enable Value	0000 H	Acknowledge
	4	8000 H + Control bits	Set mode bit = 1	C0DE H	Acknowledge

(Read only the parameter)

	Word	Code	**send**	Code	**Received**
Read	1	0000 H		0000 H	
	2	*1013 H*	Parameter address Soft start	1013 H	Acknowledge
	3	0000 H	Read parameter	*8000 H*	Parameter value (=> 5 seconds)
	4	8000 H + Control bits	Set mode bit = 1	C0DE H	Acknowledge parameter mode

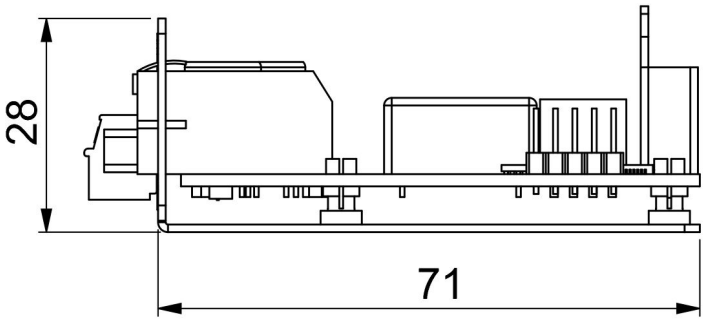
7.3 RESET Controller

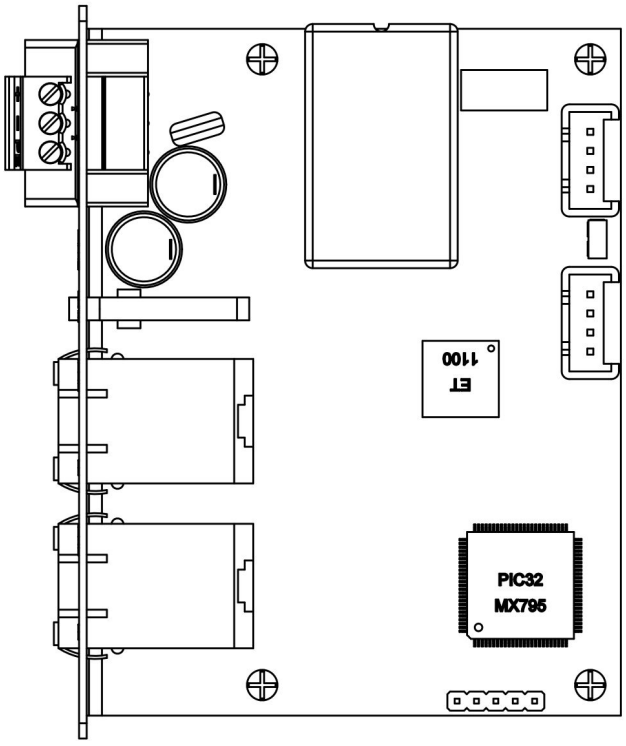
	Word	Code	**send**	Code	**Received**
Open write enable	1	0000 H		0000 H	
	1	C0DE H	Write Enable Address	C0DE H	Acknowledge
	2	B5C9 H	Write Enable Value	B5C9 H	Acknowledge
	3	8000 H + Control bits	Set mode bit = 1	C0DE H	Acknowledge

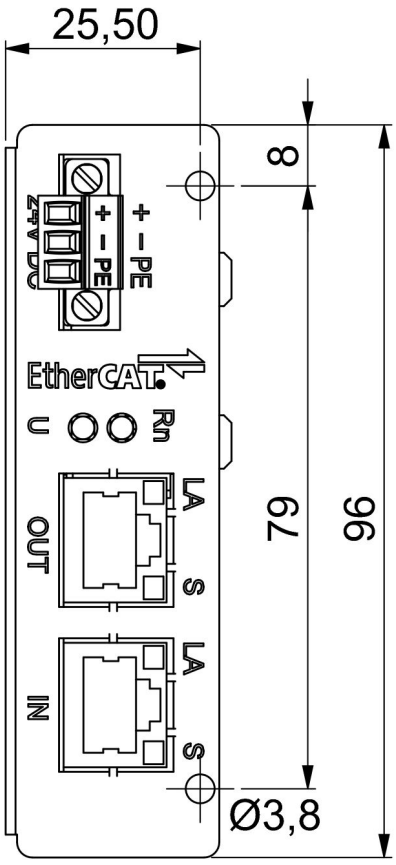
Write parameter	1	0000 H		0000 H	
	2	*9400 H*	Parameter address Reset + R / W - Bit	*0000 H*	Acknowledge
	3	*C009 H*	**RESET.**	*0000 H*	
	4	8000 H + Control bits	Set mode bit = 1	C0DE H	

Allow approximately 0.5 sec. for RESET

9.0 Dimensions [mm]







REO AG
Brühler Straße 100 · D-42657 Solingen
Tel.: +49 (0)212 8804 0 · Fax: +49 (0)212 8804 188

E-Mail: info@reo.de
Internet: www.reo.de

Divisions:

REO Vibratory Feeding and Power Electronics Division

REO Vibratory Feeding and Power Electronics Division
Brühler Straße 100 · D-42657 Solingen
Tel.: +49 (0)212 8804 0 · Fax: +49 (0)212 8804 188
E-Mail: info@reo.de

REO Train Technologies Division

REO Train Technologies Division
Erasmusstraße 14 · D-10553 Berlin
Tel.: +49 (0)30 3670236 0 · Fax: +49 (0)30 3670236 10
E-Mail: zentrale.berlin@reo.de

REO Drives Division

REO Drives Division
Holzhausener Straße 52
D-16866 Kyritz
Tel.: +49 (0)33971 485 0 · Fax: +49 (0)33971 485 90
E-Mail: zentrale.kyritz@reo.de

REO Medical and Current Transformer Division

REO Medical and Current Transformer Division
Schuldholzinger Weg 7 · D-84347 Pfarrkirchen
Tel.: +49 (0)8561 9886 0 · Fax: +49 (0)8561 9886 40
E-Mail: zentrale.pfarrkirchen@reo.de

REO Test and PowerQuality Division

REO Test and PowerQuality Division
Brühler Straße 100 · D-42657 Solingen
Tel.: +49 (0)212 8804 0 · Fax: +49 (0)212 8804 188
E-Mail: info@reo.de

PRODUCTION+SALES:

- India
  REO GPD INDUCTIVE COMPONENTS PVT. LTD
  E-Mail: info@reogpd.com · Internet: www.reo-ag.in
- USA
  REO-USA, Inc.
  E-Mail: info@reo-usa.com · Internet: www.reo-usa.com

SALES:

- France
  REO VARIAC S.A.R.L.
  E-Mail: reovariac@reo.fr · Internet: www.reo.fr
- Great Britain
  REO (UK) Ltd.
  E-Mail: main@reo.co.uk · Internet: www.reo.co.uk
- Italy
  REO ITALIA S.r.l.
  E-Mail: info@reoitalia.it · Internet: www.reoitalia.it
- Poland
  REO CROMA Sp.zo.o
  E-Mail: croma@croma.com.pl · Internet: www.croma.com.pl
- Spain
  REO ESPAÑA 2002 S.A.
  E-Mail: info@reospain.com · Internet: www.reospain.com
- Switzerland
  REO ELEKTRONIK AG
  E-Mail: info@reo.ch · Internet: www.reo.ch
- Turkey
  REOTURKEY ELEKTRONİK San. ve Tic. Ltd. Şti.
  E-Mail: info@reo-turkey.com · Internet: www.reo-turkey.com
- China
  REO Shanghai Inductive Components Co., Ltd
  E-Mail: info@reo.cn · Internet: www.reo.cn