COMPREHENSIVE SERVICES

We offer competitive repair and calibration services, as well as easily accessible documentation and free downloadable resources.

SELL YOUR SURPLUS

We buy new, used, decommissioned, and surplus parts from every NI series. We work out the best solution to suit your individual needs.

Sell For Cash Get Credit Receive a Trade-In Deal

OBSOLETE NI HARDWARE IN STOCK & READY TO SHIP

We stock **New, New Surplus, Refurbished,** and **Reconditioned** NI Hardware.

APEX WAVES

Bridging the gap *between the manufacturer and your legacy test system.*

1-800-915-6216

www.apexwaves.com

sales@apexwaves.com

Request a Quote CLICK HERE *REM-11178*

VENDOR CONFIGURATION GUIDE

NI Remote I/O

This document contains information about accessing all of the functionality of the Remote I/O modules using vendor extensions to the object dictionary on the EtherCAT expansion chassis.

Contents

NI REM-11100 2
- Process Data 2
- Significant Values in Various Formats 3
- Parameter, Diagnostics and Information (PDI) 4
- Standard Objects 5
- Application Objects 11

NI REM-11102 16
- Process Data 16
- Significant Values in Various Formats 17
- Parameter, Diagnostics and Information (PDI) 19
- Standard Objects 20
- Application Objects 26

NI REM-11115 31
- Process Data 31
- Significant Values in Various Formats 33
- Parameter, Diagnostics and Information (PDI) 35
- Standard Objects 36
- Application Objects 48
- Writing the Analog Values over the PDI Channel 49

NI REM-11120 50
- Process Data 50
- Open Circuit 51
- Significant Values in Various Formats 51
- Parameter, Diagnostics and Information (PDI) 52
- Standard Objects 53
- Application Objects 60
- Writing the Analog Values over the PDI Channel 69

NI REM-11152 69
- Process Data 69
- Parameter, Diagnostics and Information (PDI) 70
- Standard Objects 71
- Application Objects 75

NI REM-11154 76
- Process Data 76
- Parameter, Diagnostics and Information (PDI) 77

NATIONAL INSTRUMENTS

Standard Objects 78
Application Objects 82
NI REM-11175 82
Process Data 82
Parameter, Diagnostics and Information (PDI) 83
Standard Objects 84
Application Objects 88
NI REM-11178 89
Process Data 89
Parameter, Diagnostics and Information (PDI) 90
Standard Objects 91
Application Objects 96
NI REM-11180 97
Object Dictionary 97
Process Data 111
Diagnostics Strategy 112

NI REM-11100

Process Data

The module uses four words of IN process data. Each channel is mapped to a word.

Input Words IN0 to IN3

The measured values are transmitted to the controller board or the computer using process data input words IN0 to IN3.

The measured values are depicted in IB IL or S7-compatible format. In both cases, the measured value is displayed in 16 bit format. The data type is Integer 16 from a technical programming point of view.

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Analog value															

In the IB IL format a diagnostic code is mapped to the input data in the event of an error.

Code (hex)	Cause
8001	Measuring range exceeded (overrange)
8004	Measured value invalid/no valid measured value available
8020	Supply voltage faulty (supply for analog modules U_A)
8040	Device faulty
8080	Below measuring range (underrange)

Significant Values in Various Formats

Table 1. Significant Values in IB IL Format

Input data		0 V to 10 V	±10 V	0 V to 5 V	± 5 V
hex	**dec**	**V**	**V**	**V**	**V**
8001	Overrange	>+10.837	>+10.837	>+5.419	>+5.419
7F00	32512	+10.837	+10.837	+5.419	+5.419
7530	30000	+10.0	+10.0	+5.0	+5.0
0001	1	+333.33 µV	+333.33 µV	+166.67 µV	+166.67 µV
0000	0	≤0	0	≤0	0
FFFF	-1	—	-333.33 µV	—	-166.67 µV
8AD0	-30000	—	-10.0	—	-5.0
8100	-32512	—	-10.837	—	-5.419
8080	Underrange	—	<-10.837	—	<-5.419

The maximum measured value is $7F00_{hex}$.

Depending on the measuring range, the minimum measured value is either 0000_{hex} or 8100_{hex}.

Table 2. Significant Values in S7-compatible Format

Input data		0 V to 10 V	±10 V	0 V to 5 V	± 5 V
hex	**dec**	**V**	**V**	**V**	**V**
7FFF	Overrange	>+11.759	>+11.759	>+5.879	>+5.879
7EFF	32511	+11.759	+11.759	+5.879	+5.879
6C00	27648	+10.0	+10.0	+5.0	+5.0
0001	1	+361.69 µV	+361.69 µV	+180.85 µV	+180.85 µV
0000	0	≤ 0	0	≤ 0	0
FFFF	-1	—	-361.69 µV	—	-180.85 µV
F940	-1728	—	-0.625	—	-0.3125
9400	-27648	—	-10.0	—	-5.0
8100	-32512	—	-11.759	—	-5.879
8000	Underrange	—	<-11.759	—	<-5.879

The maximum measured value is $7EFF_{hex}$.

Depending on the measuring range, the minimum measured value is either 0000_{hex} or 8100_{hex}.

Parameter, Diagnostics and Information (PDI)

Parameter and diagnostic data as well as other information is transmitted via the PDI channel of the NI Remote I/O system.

The standard and application objects stored in the module are described in the following section.

The following applies to all tables below:

Please refer to the *NI REM-11180 User Manual* for an explanation of the object codes and data types.

Abbreviation	Meaning
A	Number of elements
L	Length of the elements in bytes
R	Read
W	Write

Note Every visible string is terminated with a zero terminator (00_{hex}). The length of a visible string element is therefore one byte larger than the amount of user data.

Standard Objects

Table 3. Objects for identifIcation (Device Rating Plate)

Index (hex)	Object Name	Object Type	Data Type	A	L	Rights	Meaning	Contents
Manufacturer								
0001	VendorName	Var	Visible String	1	21	R	Vendor name	National Instruments
0002	VendorID	Var	Visible String	1	7	R	Vendor ID	00802F
0003	VendorText	Var	Visible String	1	7	R	Vendor text	—
0012	VendorURL	Var	Visible String	1	18	R	Vendor URL	ni.com
Module—General								
0004	DeviceFamily	Var	Visible String	1	14	R	Device family	I/O analog IN
0006	ProductFamily	Var	Visible String	1	11	R	Product family	Remote I/O
000E	CommProfile	Var	Visible String	1	4	R	Communication profile	633
000F	DeviceProfile	Var	Visible String	1	5	R	Device profile	0010
0011	ProfileVersion	Record	Visible String	2	11; 20	R	Profile version	2011-12-07; Basis - Profil V2.0
003A	VersionCount	Array	Unsigned 16	4	4 * 2	R	Version counter	E.g., 0007 0001 0001 0001_{hex}

Table 3. Objects for identifIcation (Device Rating Plate) (Continued)

Index (hex)	Object Name	Object Type	Data Type	A	L	Rights	Meaning	Contents
Module—special								
0005	Capabilities	Array	Visible String	1	8	R	Features	Energ_0
0007	ProductName	Var	Visible String	1	10	R	Product name	REM-11100
0008	SerialNo	Var	Visible String	1	11	R	Serial number	xxxxxxxxxx (e. g., 1234512345)
0009	ProductText	Var	Visible String	1	34	R	Product text	4 analog input channels (voltage)
000A	OrderNumber	Var	Visible String	1	10	R	Order No.	784748-01
000B	HardwareVersion	Record	Visible String	2	11; 3	R	Hardware version	e. g., 2010-06-21; 01
000C	FirmwareVersion	Record	Visible String	2	11; 6	R	Firmware version	e. g., 2010-06-21; V1.10
000D	PChVersion	Record	Visible String	2	11; 6	R	Parameter channel version	2010-01-08; V1.00
0037	DeviceType	Var	Octet string	1	8	R	Module identification	00 20 00 08 00 00 00 $A5_{hex}$
Use of the device								
0014	Location	Var	Visible String	1	59	R/W	Location	Can be filled out by the user.
0015	EquipmentIdent	Var	Visible String	1	59	R/W	Equipment identifier	Can be filled out by the user.
0016	ApplDeviceAddr	Var	Unsigned 16	1	2	R/W	Application device address	Can be filled out by the user.

Table 4. Object for Multilingual Capacity

Index (hex)	Object Name	Object Type	Data Type	A	L	Rights	Meaning	Contents
0017	Language	Record	Visible String	2	6; 8	R	Language	en-us; English

Table 5. Object Descriptions

Index (hex)	Object Name	Object Type	Data Type	A	L	Rights	Meaning
0038	ObjDescrReq	Record	—	2	3	Read, write	Object description request
0039	ObjDescr	Record	—	16	See subindexes	Read	Object description

Note These objects are only important for tools and are therefore not described in more detail here. Please refer to the basic profile for comprehensive information.

Table 6. Diagnostics Objects

Index (hex)	Object Name	Object Type	Data Type	A	L	Rights	Assignment
0018	DiagState	Record	—	6	2; 1; 1; 2; 1; 14	R	Diagnostic state
0019	ResetDiag	Var	Unsigned 8	1	1	W	Reset diagnostics

Diagnostics State (0018_{hex}: DiagState)

This object is used for a structured message of an error.

Table 7. 0018_{hex}: DiagState (Read)

Subindex	Data Type	Length in Bytes	Meaning	Contents	
0	Record	21	Diagnostic state	Complete diagnostics information	
1	Unsigned 16	2	Error number	0 to 65535_{dez}	
2	Unsigned 8	1	Priority	00_{hex}	No error
				01_{hex}	Error
				02_{hex}	Warning
				81_{hex}	Error removed
				82_{hex}	Warning eliminated
3	Unsigned 8	1	Channel/group/ module	00_{hex}	No error
				01_{hex}	Channel 1
				:	:
				04_{hex}	Channel 4
				FF_{hex}	entire device
4	Unsigned 16	2	Error code	See table below	
5	Unsigned 8	1	More follows	00_{hex}	
6	Visible String	14	Text (14 characters)	See table below	

Note The message with the priority 81_{hex} or 82_{hex} is a one-time internal message to the bus coupler that is implemented onto the error mechanisms of the higher-level system by the bus coupler.

Table 8. Error and Status of the Local Status and Diagnostics Indicators

Subindex	2	3	4	6	Process Data	LED			
Error	Priority hex	Channel/ group/ module hex	Error Code hex	Text		D	UA	E1	E2
No error	00	00	0000	Status OK	xxxx	Green ON	ON	OFF	OFF
Supply voltage faulty (supply for analog modules U_A)	01	FF	5160	Supply fail	8020	Flashing green/yellow	OFF	ON	ON
Device error	01	FF	6301	CS FLASH	8040	Green ON	ON	OFF	ON
Flash format error	01	FF	6302	FO FLASH	8040	Green ON	ON	OFF	ON
Parameter table invalid	01	FF	6320	Invalid para	8010	Green ON	ON	OFF	ON
Overrange	02	01 to 04	8910	Overrange	8001	Green ON	ON	OFF	ON
Underrange	02	01 to 04	8920	Underrange	8080	Green ON	ON	OFF	ON

Reset Diagnostic Messages (0019_{hex}: ResetDiag)

You can delete the diagnostics memory and acknowledge the diagnostic messages with this object.

Table 9. 0019_{hex}: ResetDiag (Write)

Subindex	Data Type	Length in Bytes	Meaning	Contents	
0	Unsigned 8	1	Reset diagnostics	00_{hex}	All diagnostic messages approved
				02_{hex}	Deletes and acknowledges all pending diagnostic messages that have not been read out
				06_{hex}	Deletes and acknowledges all the diagnostic messages and allows no further diagnostic messages
				Other	Reserved

Table 10. Objects for Process Data Management

Index (hex)	Object Name	Object Type	Data Type	A	L	Rights	Assignment
0025	PDIN	Var	Octet string	1	8	R	Input process data
0026	PDOUT	Var	Octet string	1	8	R	OUT process data; not applicable
003B	PDIN_ Descr	Record		3	12	R	Description of the IN process data
003C	PDOUT_ Descr	Record		3	12	R	Description of the output process data

Note Objects $003B_{hex}$ and $003C_{hex}$ are only applicable to tools and are therefore not described in more detail here. Please refer to the basic profile for comprehensive information.

IN Process Data (0025_{hex}: PDIN)

You can read the IN process data of the module with this object.

The structure corresponds to the representation in the “Process data” section.

Table 11. 0025_{hex}: PDIN (Read)

Subindex	Data Type	Length in Bytes	Meaning
0	Octet string	8	Input process data

Table 12. Objects for Device Management*

Index (hex)	Object Name	Object Type	Data Type	A	L	Rights	Meaning
002D	ResetParam	Simple variable	Unsigned 8	1	1	R/W	Reset parameterization
002E	CheckSum	Simple variable	Unsigned 32	1	4	R	Checksum
* These objects are available as of firmware 1.10.							

Reset Parameterization ($002D_{hex}$: ResetParam)

This object is used to reset the module to the default settings.

To reset the module value 01_{hex} must be transferred during write access. Any other values are not permissible and will be acknowledged with an error.

Then the default settings of the channels are loaded and all the user-set parameters are reset.

Checksum ($002E_{hex}$: Checksum)

The data of the startup objects is verified with this CRC32 checksum.

Checksum for the default setting: 6A 04 35 76

Application Objects

Index (hex)	Object Name	Object Type	Data Type	A	L	Rights	Assignment
0080	ParaTable	Array	Unsigned 16	6	6 * 2	R/W	Parameter table
0082	Measured Value Float	Array	Octet string	4	4 * 6	R	Measured values in the extended float format
0083	PD Min	Array	Integer 16	4	4 * 2	R	Minimum process data value
0084	PD Max	Array	Integer 16	4	4 * 2	R	Maximum process data value

Parameter Table (0080_{hex}: ParaTable)

Parameterize the module using this object.

In the case of valid parameters, the parameterization is stored in the module permanently.

After resetting, the module works with the last permanently stored data. Upon delivery, the module works with the default data (default settings).

Table 13. 0080_{hex}: ParaTable (Read, Write)

Subindex	Data Type	Length in Bytes	Meaning	Default Value
0	Array of Unsigned 16	6 * 2	Read/write all elements	See subindexes
1	Unsigned 16	2	Parameterization of channel 1	0000_{hex}
:	Unsigned 16	2	:	0000_{hex}
4	Unsigned 16	2	Parameterization of channel 4	0000_{hex}
5	Unsigned 16	2	Data format	0000_{hex}
6	Unsigned 16	2	Reserved	0000_{hex}

Parameterization Channel 1 to Channel 4

Table 14. Parameterization Word

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	Filter	0	0	Mean-value		0	0	0	0	Measuring range			

Filter	Code (bin)	Code (hex)
30 Hz (default)	0	0
12 kHz	1	1

Measuring Range	Code (bin)	Code (hex)
0 V to 10 V (default)	0000	0
±10 V	0001	1

Measuring Range	Code (bin)	Code (hex)
0 V to 5 V	0010	2
±5 V	0011	3
Channel inactive	1111	F
Reserved	Other	

Mean-value	Code (bin)	Code (hex)
16-sample (default)	00	0
No mean-value	01	1
4-sample	10	2
32-sample	11	3

Table 15. Data Format

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	0	0	Data format		0	0	0	0	0	0	0	0

Data Format	Code (bin)	Code (hex)
IB IL (default setting)	00	0
Reserved	01	1
S7-compatible	10	2
Reserved	11	3

Measured Value in Extended Float Format (0082_{hex}: Measured Value Float)

You can read the IN process data in IB IL or S7-compatible format with the 0025_{hex} object.

The 0082_{hex} object is also available.

This object provides the measured value in the highest internal accuracy of the terminal in the float format.

Table 16. 0082_{hex}: Measured Value Float (Read)

Subindex	Data Type	Length in Bytes	Meaning
0	Array of Records	4 * 6	Read all elements
1	Record	6	Measured value for channel 1
:	:	:	:
4	Record	6	Measured value channel 4

Table 17. Measured value channel 1 to channel 4

Element	Data Type	Length in Bytes	Meaning
1	Float 32	4	Measured value in float format according to IEEE 754
2	Unsigned 8	1	Status
3	Unsigned 8	1	Unit

Table 18. Structure of the Float Format According to IEEE 754 in the Bit Representation

VEEE EEEE	EMMM MMMM	MMMM MMMM	MMMM MMMM
V = 1 sign bit, 0: positive, 1: negative E = 8 bits exponent with offset $7F_{hex}$ M = 23 bits mantissa			

Some example values for conversion from floating point to hexadecimal representation:

Floating Point	Hexadecimal Representation
1.0	3F 80 00 00
10.0	41 20 00 00
1.03965528	3F 85 13 6D
-1.0	BF 80 00 00

Extended Float Format

Extended Float Format is a specially defined format. It consists of the measured value in float format, a status, and a unit.

Status is necessary because the float format defines no patterns providing information on the status of the numerical value.

The status corresponds to the LSB of the diagnostic code in IB IL format (e.g., overrange: status = 01, diagnostic code = 8001_{hex}). If status = 0, the measured value is valid.

Unit	Code
Volt (V)	58 ($3A_{hex}$)

Status	Code
Measured value is valid	00_{hex}
Measured value is invalid	Other

Minimum Process Data Value (0083_{hex}: PD Min)

Object 0083_{hex} can be used to read the minimum IN process data values.

The values are initialized after each parameterization. The highest value is assigned for the minimum process data value.

PD Min = $7FFF\ 7FFF\ 7FFF\ 7FFF_{hex}$

On every analog conversion, the PD Min value is compared with the current measured values and overwritten if necessary.

Table 19. 0083_{hex}: PD Min (Read)

Subindex	Data Type	Length in Bytes	Meaning
0	Array of Integer 16	4 * 2	Read all elements
1	Integer 16	2	Minimum process data value channel 1
:	:	:	:
4	Integer 16	2	Minimum process data value channel 4

Maximum Process Data Value (0084_{hex}: PD Max)

Object 0084_{hex} can be used to read the maximum IN process data values.

The values are initialized after each parameterization. The lowest value is assigned for the maximum process data value.

PD Max = $8000\ 8000\ 8000\ 8000_{hex}$

On every analog conversion, the PD Max value is compared with the current measured values and overwritten if necessary.

0084_{hex}: PD Max (Read)			
Subindex	**Data Type**	**Length in Bytes**	**Meaning**
0	Array of Integer 16	4 * 2	Read all elements
1	Integer 16	2	Maximum process data value channel 1
:	:	:	:
4	Integer 16	2	Maximum process data value channel 4

NI REM-11102

Process Data

The module uses four words of IN process data. Each channel is mapped to a word.

Input Words IN1 to IN4

The measured values are transmitted to the controller board or the computer using process data input words IN1 to IN4.

The measured values are depicted in IB IL or S7-compatible format. In both cases, the measured value is displayed in 16 bit format. The data type is Integer 16 from a technical programming point of view.

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Analog value															

In the IB IL format a diagnostic code is mapped to the input data in the event of an error.

Code (hex)	Cause
8001	Measuring range exceeded (overrange)
8002	Open circuit
8004	Measured value invalid/no valid measured value available
8020	Faulty supply voltage
8040	Device faulty
8080	Below measuring range (underrange)

Significant Values in Various Formats

Table 20. Significant Values in IB IL Format

Input data		0 mA to 20 mA	± 20 mA	4 mA to 20 mA
hex	dec	mA	mA	mA
8001	Overrange	> +21.6747	> +21.6747	> +21.3397
7F00	32512	+21.6747	+21.6747	+21.3397
7530	30000	+20.0	+20.0	+20.0
0001	1	+0.6667 µA	+0.6667 µA	+4.0005333
0000	0	≤ 0	0	+4.0 to +3.2
FFFF	-1	—	-0.6667 µA	—
8AD0	-30000	—	-20.0	—
8100	-32512	—	-21.6747	—
8080	Underrange	—	< -21.6747	—
8002	Open circuit	—	—	< +3.2

The maximum measured value is $7F00_{hex}$.

Depending on the measuring range, the minimum measured value is either 0000_{hex} or 8100_{hex}.

Table 21. Significant Values in S7-compatible Format

Input data		0 mA to 20 mA	± 20 mA	4 mA to 20 mA
hex	dec	mA	mA	mA
7FFF	Overrange	> +23.5157	> +23.5157	> +22.8142
7EFF	32511	+23.5157	+23.5157	+22.8142
6C00	27648	+20.0	+20.0	+20.0
0001	1	+0.7234 µA	+0.7234 µA	+4.0005787
0000	0	≤ 0	0	+4.0
FFFF	-1	—	-0.7234 µA	+3.9994
F940	-1728	—	-1.25	+3.0
9400	-27648	—	-20.0	—
8100	-32512	—	-23.5157	—
8000	Underrange/ open circuit	—	< -23.5157	< +1.1852

The maximum measured value is $7EFF_{hex}$.

Depending on the measuring range, the minimum measured value is either 0000_{hex} or 8100_{hex}.

Calculation of the Measured Value from the Process Data Input Value

The following examples explain the calculation of the measured value from the process data input value for the measuring range 4 mA to 20 mA.

PD IW = Process data input word = input data

IB IL Format

Resolution = (20 mA - 4 mA) / 30000 = 0.0005333

Measured value = PD-EW × 0.0005333 mA +4 mA

Table 22. Example 1

PD IW	$493F_{hex} = 18751_{dec}$
Value × resolution	18751 × 0.000533 mA = 10 mA
+ 4 mA	10 mA + 4 mA = 14 mA
Measured value	14 mA

S7-compatible Format

Resolution = (20 mA - 4 mA) / 27648 = 0.0005787

Measured value = PD IW × 0.0005787 mA + 4 mA

Table 23. Example 1

PD IW	$6C00_{hex} = 27648_{dec}$
Value × resolution	27648 × 0.0005787 mA = 16 mA
+ 4 mA	16 mA + 4 mA = 20 mA
Measured value	20 mA

Table 24. Example 2

PD IW	$F940_{hex}$ -> $FFFF_{hex}$ - $F940_{hex}$ + 1 = -1728_{dec}
Value × resolution	-1728 × 0.0005787 mA = -1 mA
+ 4 mA	-1 mA + 4 mA = 3 mA
Measured value	3 mA

Parameter, Diagnostics and Information (PDI)

Parameter and diagnostic data as well as other information is transmitted via the PDI channel of the NI Remote I/O system.

The standard and application objects stored in the module are described in the following section.

The following applies to all tables below:

Please refer to the *NI REM-11180 User Manual* for an explanation of the object codes and data types.

Abbreviation	Meaning
A	Number of elements
L	Length of the elements in bytes
R	Read
W	Write

Note Every visible string is terminated with a zero terminator (00_{hex}). The length of a visible string element is therefore one byte larger than the amount of user data.

Standard Objects

Table 25. Objects for identification (device rating plate)

Index (hex)	Object Name	Object Type	Data Type	A	L	Rights	Meaning	Contents
Manufacturer								
0001	VendorName	Var	Visible String	1	21	R	Vendor name	National Instruments
0002	VendorID	Var	Visible String	1	7	R	Vendor ID	00802F
0003	VendorText	Var	Visible String	1	7	R	Vendor text	—
0012	VendorURL	Var	Visible String	1	18	R	Vendor URL	ni.com
Module—general								
0004	DeviceFamily	Var	Visible String	1	14	R	Device family	I/O analog IN
0006	ProductFamily	Var	Visible String	1	11	R	Product family	Remote I/O
000E	CommProfile	Var	Visible String	1	4	R	Communication profile	633
000F	DeviceProfile	Var	Visible String	1	5	R	Device profile	0010
0011	ProfileVersion	Record	Visible String	2	11; 20	R	Profile version	2011-12-07; Basic Profile V2.0
003A	VersionCount	Array	Unsigned 16	4	4 * 2	R	Version counter	e. g., 0007 0001 0001 0001_{hex}

Table 25. Objects for identification (device rating plate) (Continued)

Index (hex)	Object Name	Object Type	Data Type	A	L	Rights	Meaning	Contents
Module—special								
0005	Capabilities	Array	Visible String	1	10	R	Features	Energ_0
0007	ProductName	Var	Visible String	1	10	R	Product name	REM-11102
0008	SerialNo	Var	Visible String	1	11	R	Serial number	xxxxxxxxxx (e. g., 1234512345)
0009	ProductText	Var	Visible String	1	34	R	Product text	4 analog input channels (current)
000A	OrderNumber	Var	Visible String	1	10	R	Order No.	784747-01
000B	HardwareVersion	Record	Visible String	2	11; 3	R	Hardware version	e. g., 2010-06-21; 01
000C	FirmwareVersion	Record	Visible String	2	11; 6	R	Firmware version	e. g., 2010-06-21; V1.10
000D	PChVersion	Record	Visible String	2	11; 6	R	Parameter channel version	2010-01-08; V1.00
0037	DeviceType	Var	Octet string	1	8	R	Module identification	00 20 00 08 00 00 00 $A6_{hex}$
Use of the device								
0014	Location	Var	Visible String	1	59	R/W	Location	Can be filled out by the user.
0015	EquipmentIdent	Var	Visible String	1	59	R/W	Equipment identifier	Can be filled out by the user.
0016	ApplDeviceAddr	Var	Unsigned 16	1	2	R/W	Application device address	Can be filled out by the user.

Table 26. Object for Multilingual Capacity

Index (hex)	Object Name	Object Type	Data Type	A	L	Rights	Meaning	Contents
0017	Language	Record	Visible String	2	6; 8	R	Language	en-us; English

Table 27. Object Descriptions

Index (hex)	Object Name	Object Type	Data Type	A	L	Rights	Meaning
0038	ObjDescrReq	Record	—	2	3	Read, write	Object description request
0039	ObjDescr	Record	—	16	See subindexes	Read	Object description
003B	PDIN_Descr	Record	—	3	12	R	Description of the IN process data
003C	PDOUT_ Descr	Record	—	3	12	R	Description of the output process data

Note These objects are only important for tools and are therefore not described in more detail here. Please refer to the basic profile for comprehensive information.

Table 28. Diagnostics Objects

Index (hex)	Object Name	Object Type	Data Type	A	L	Rights	Assignment
0018	DiagState	Record		6	2; 1; 1; 2; 1; 14	R	Diagnostic state
0019	ResetDiag	Var	Unsigned 8	1	1	W	Reset diagnostics

Diagnostics State (0018_{hex}: DiagState)

This object is used for a structured message of an error.

Table 29. 0018_{hex}: DiagState (Read)

Subindex	Data Type	Length in Bytes	Meaning	Contents
0	Record	21	Diagnostic state	Complete diagnostics information
1	Unsigned 16	2	Error number	0 to 65535_{dez}

Table 29. 0018_{hex}: DiagState (Read) (Continued)

Subindex	Data Type	Length in Bytes	Meaning	Contents	
2	Unsigned 8	1	Priority	00_{hex}	No error
				01_{hex}	Error
				02_{hex}	Warning
				81_{hex}	Error removed
				82_{hex}	Warning eliminated
3	Unsigned 8	1	Channel/group/ module	00_{hex}	No error
				01_{hex}	Channel 1
				:	:
				04_{hex}	Channel 4
				FF_{hex}	entire device
4	Unsigned 16	2	Error code	See Table 30, *Error and Status of the Local Status and Diagnostics Indicators*	
5	Unsigned 8	1	More follows	00_{hex}	
6	Visible String	14	Text (14 characters)	See Table 30, *Error and Status of the Local Status and Diagnostics Indicators*	

Note The message with the priority 81_{hex} or 82_{hex} is a one-time internal message to the bus coupler that is implemented onto the error mechanisms of the higher-level system by the bus coupler.

Table 30. Error and Status of the Local Status and Diagnostics Indicators

Subindex	2	3	4		6	Process Data	LED			
Error	Priority	Channel/ group/ module	Error Code		Text		D	UA	E1	E2
	hex	hex	hex	dec						
No error	00	00	0000	0	Status OK	xxxx	Green ON	ON	OFF	OFF
Faulty supply voltage	01	FF	5160	20832	Supply fail	8020	Flashing green/yellow	OFF	ON	ON
Device error	01	FF	6301	25345	CS FLASH	8040	Green ON	ON	OFF	ON
Flash format error	01	FF	6302	25346	FO FLASH	8040	Green ON	ON	OFF	ON
Parameter table invalid	01	FF	6320	25376	Invalid para	8010	Green ON	ON	OFF	ON
Open circuit	01	01 to 04	7710	30480	Open circuit	8002	Green ON	ON	OFF	ON
Overrange	02	01 to 04	8910	35088	Overrange	8001	Green ON	ON	OFF	ON
Underrange	02	01 to 04	8920	35104	Underrange	8080	Green ON	ON	OFF	ON

Reset Diagnostic Messages (0019_{hex}: ResetDiag)

You can delete the diagnostics memory and acknowledge the diagnostic messages with this object.

Table 31. 0019_{hex}: ResetDiag (Write)

Subindex	Data Type	Length in Bytes	Meaning	Contents	
0	Unsigned 8	1	Reset diagnostics	00_{hex}	All diagnostic messages approved
				02_{hex}	Deletes and acknowledges all pending diagnostic messages that have not been read out
				06_{hex}	Deletes and acknowledges all the diagnostic messages and allows no further diagnostic messages
				Other	Reserved

Table 32. Objects for Process Data Management

Index (hex)	Object Name	Object Type	Data Type	A	L	Rights	Assignment
0025	PDIN	Var	Octet string	1	8	R	Input process data
0026	PDOUT	Var	Octet string	1	8	R	OUT process data; not applicable

IN Process Data (0025_{hex}: PDIN)

You can read the IN process data of the module with this object.

The structure corresponds to the representation in the “Process data” section.

Table 33. 0025_{hex}: PDIN (Read)

Subindex	Data Type	Length in Bytes	Meaning
0	Octet string	8	Input process data

Objects for Device Management

Table 34. These Objects Are Available as of Firmware 1.10

Index (hex)	Object Name	Object Type	Data Type	A	L	Rights	Meaning
002D	ResetParam	Simple variable	Unsigned 8	1	1	R/W	Reset parameterization
002E	CheckSum	Simple variable	Unsigned 32	1	4	R	Checksum

Reset Parameterization ($002D_{hex}$: ResetParam)

This object is used to reset the module to the default settings.

To reset the module value 01_{hex} must be transferred during write access. Any other values are not permissible and will be acknowledged with an error.

Then the default settings of the channels are loaded and all the user-set parameters are reset.

Checksum ($002E_{hex}$: Checksum)

The data of the startup objects is verified with this CRC32 checksum.

Checksum for the default setting: B2 33 65 FE

Application Objects

Index (hex)	Object Name	Object Type	Data Type	A	L	Rights	Assignment
0080	ParaTable	Array	Unsigned 16	6	6 * 2	R/W	Parameter table
0082	Measured Value Float	Array	Octet string	4	4 * 6	R	Measured values in the extended float format
0083	PD Min	Array	Integer 16	4	4 * 2	R	Minimum process data value
0084	PD Max	Array	Integer 16	4	4 * 2	R	Maximum process data value

Parameter Table (0080_{hex}: ParaTable)

Parameterize the module using this object.

In the case of valid parameters, the parameterization is stored in the module permanently.

After resetting, the module works with the last permanently stored data. Upon delivery, the module works with the default data (default settings).

Table 35. 0080_{hex}: ParaTable (Read, Write)

Subindex	Data Type	Length in Bytes	Meaning	Default value
0	Array of Unsigned 16	6 * 2	Read/write all elements	See subindexes
1	Unsigned 16	2	Parameterization of channel 1	0004_{hex}
:	Unsigned 16	2	:	0004_{hex}
4	Unsigned 16	2	Parameterization of channel 4	0004_{hex}
5	Unsigned 16	2	Data format	0000_{hex}
6	Unsigned 16	2	Reserved	0000_{hex}

Parameterization Channel 1 to channel 4

Table 36. Parameterization Word

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	Filter	0	0	Mean-value		0	0	0	0	Measuring range			

Filter	Code (bin)	Code (hex)
30 Hz (default)	0	0
12 kHz	1	1

Measuring Range	Code (bin)	Code (hex)
0 mA to 20 mA (default)	0100	4
±20 mA	0101	5
4 mA to 20 mA	0110	6
Channel inactive	1111	F
Reserved	Other	

Mean-value	Code (bin)	Code (hex)
16-sample (default)	00	0
No mean-value	01	1
4-sample	10	2
32-sample	11	3

Table 37. Data Format

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	0	0	Data format		0	0	0	0	0	0	0	0

Data Format	Code (bin)	Code (hex)
IB IL (default setting)	00	0
Reserved	01	1
S7-compatible	10	2
Reserved	11	3

Measured Value in Extended Float Format (0082_{hex}: Measured Value Float)

You can read the IN process data in IB IL or S7-compatible format with the 0025_{hex} object.

The 0082_{hex} object is also available.

This object provides the measured value in the highest internal accuracy of the terminal in the float format.

Table 38. 0082_{hex}: Measured Value Float (Read)

Subindex	Data Type	Length in Bytes	Meaning
0	Array of Records	4 * 6	Read all elements
1	Record	6	Measured value for channel 1
:	:	:	:
4	Record	6	Measured value channel 4

Table 39. Measured Value Channel 1 to Channel 4

Element	Data Type	Length in Bytes	Meaning
1	Float 32	4	Measured value in float format according to IEEE 754
2	Unsigned 8	1	Status
3	Unsigned 8	1	Unit

Structure of the float format according to IEEE 754 in the bit representation:

VEEE EEEE	EMMM MMMM	MMMM MMMM	MMMM MMMM
V = 1 sign bit, 0: positive, 1: negative E = 8 bits exponent with offset $7F_{hex}$ M = 23 bits mantissa			

Table 40. Some Example Values for Conversion from Floating Point to Hexadecimal Representation

Floating Point	Hexadecimal Representation
1.0	3F 80 00 00
10.0	41 20 00 00
1.03965528	3F 85 13 6D
-1.0	BF 80 00 00

Extended Float Format

Extended Float Format is a specially defined format. It consists of the measured value in float format, a status, and a unit.

Status is necessary because the float format defines no patterns providing information on the status of the numerical value.

The status corresponds to the LSB of the diagnostic code in IB IL format (e.g., overrange: status = 01, diagnostic code = 8001_{hex}). If status = 0, the measured value is valid.

Unit	Code
Milliampere (mA)	39 (27_{hex})

Status	Code
Measured value is valid	00_{hex}
Measured value is invalid	Other

Minimum Process Data Value (0083_{hex}: PD Min)

Object 0083_{hex} can be used to read the minimum process data values.

The values are initialized after each parameterization. The highest value is assigned for the minimum process data value.

PD Min = $7FFF\ 7FFF\ 7FFF\ 7FFF_{hex}$

On every analog conversion, the PD Min value is compared with the current measured values and overwritten if necessary.

Table 41. 0083_{hex}: PD Min (Read)

Subindex	Data Type	Length in Bytes	Meaning
0	Array of Integer 16	4 * 2	Read all elements
1	Integer 16	2	Minimum process data value channel 1
:	:	:	:
4	Integer 16	2	Minimum process data value channel 4

Maximum Process Value (0084_{hex}: PD Max)

Object 0084_{hex} can be used to read the maximum process data values.

The values are initialized after each parameterization. The lowest value is assigned for the maximum process data value.

PD Max = $8000\ 8000\ 8000\ 8000_{hex}$

On every analog conversion, the PD Max value is compared with the current measured values and overwritten if necessary.

Table 42. 0084_{hex}: PD Max (Read)

Subindex	Data Type	Length in Bytes	Meaning
0	Array of Integer 16	4 * 2	Read all elements
1	Integer 16	2	Maximum process data value channel 1
:	:	:	:
4	Integer 16	2	Maximum process data value channel 4

NI REM-11115

Process Data

The module uses four words of IN process data and four words of OUT process data. Each channel is mapped to a word.

OUT Process Data

The output values are transmitted from the controller board or the computer to the module using process data output words OUT1 to OUT4.

Table 43. Order of the Process Data Words

OUT1	...	OUT4
Channel 1	...	Channel 4
AV	...	AV

AV Output value

Output Value

The output values are mapped in IB IL format or S7-compatible format. In both formats the output value is represented in bits 14 to 0. An additional bit (bit 15) is available as a sign bit.

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
V	Analog value														

V Sign bit

IN Process Data

Note In the case of Sercos, the IN process data is hidden and therefore unavailable.

The following data is transmitted in the input process data:

- During normal error-free operation, the output value is mirrored in the input process data for each channel.
- If an error occurs, the diagnostic message is mirrored (in IB IL format) in the input process data for each channel. The diagnostics message is deleted as soon as the error is eliminated.

Table 44. Order of the Process Data Words

IN1	...	IN4
Channel 1	...	Channel 4
AW*/Diag	...	AW*/Diag

AW*/Diag Mirrored output value or diagnostics messages (in IB IL format)

Table 45. Diagnostic Message (in IB IL Format)

Code (hex)	Cause
8002	Open circuit
8003	Short-circuit
8010	Parameter table invalid
8020	Faulty supply voltage
8040	Device faulty

Note In the event of error, a currently existing error is mirrored in the process data on the corresponding channel.

Significant Values in Various Formats

Table 46. Significant Values in IB IL Format

Output data		0 V to 10 V	±10 V	0 V to 5 V	± 5 V	0 mA to 20 mA	4 mA to 20 mA
hex	dec	V	V	V	V	mA	mA
7FFF to 7F01		+10.837	+10.837	+5.419	+5.419	+21.6747	+21.3397
7F00	32512	+10.837	+10.837	+5.419	+5.419	+21.6747	+21.3397
7530	30000	+10.0	+10.0	+5.0	+5.0	+20.0	+20.0
3A98	15000	+5.0	+5.0	+2.5	+2.5	+10.0	+12.0
0001	1	+333.33 µV	+333.33 µV	+166.67 µV	+166.67 µV	+0.6667 µA	+4.0005333
0000	0	0	0	0	0	0	+4.0
FFFF	-1	0	-333.33 µV	0	-166.67 µV	0	+4.0
C568	-15000	0	-5.0	0	-2.5	0	+4.0
8AD0	-30000	0	-10.0	0	-5.0	0	+4.0
8100	-32512	0	-10.837	0	-5.419	0	+4.0
80FF to 8000*	—	Hold last value	Hold last value	Hold last value	Hold last value	Hold last value	Hold last value
8001	Overrange	+10.837	+10.837	+5.419	+5.419	+21.6747	+21.3397
8080	Underrange	0	-10.837	0	-5.419	0	Hold last value
* without 8001, 8080							

Table 47. Significant Values in S7-compatible Format

Output data		0 V to 10 V	±10 V	0 V to 5 V	± 5 V	0 mA to 20 mA	4 mA to 20 mA
hex	dec	V	V	V	V	mA	mA
7FFF to 7F00	Overrange	0	0	0	0	0	0
7EFF	32511	+11.759	+11.759	+5.879	+5.879	+23.5157	+22.8142
6C00	27648	+10.0	+10.0	+5.0	+5.0	+20.0	+20.0
5100	20736	+7.5	+7.5	+3.75	+3.75	+15.0	+16.0
0001	1	+361.69 µV	+361.69 µV	+180.85 µV	+180.85 µV	+0.7234 µA	+4.0005787
0000	0	0	0	0	0	0	+4.0
FFFF	-1	0	-361.69 µV	0	-180.85 µV	0	+3.9994
E501	-6911	0	-2.4996	0	-1.2498	0	0.578 µA
E500	-6912	0	-2.5	0	-1.25	0	0
AF00	-20736	0	-7.5	0	-3.75	0	0
9400	-27648	0	-10.0	0	-5.0	0	0
8100	-32512	0	-11.759	0	-5.879	0	0
80FF to 8000	Underrange	0	0	0	0	0	0

Parameter, Diagnostics and Information (PDI)

Parameter and diagnostic data as well as other information is transmitted via the PDI channel of the NI Remote I/O system.

The standard and application objects stored in the module are described in the following section.

The following applies to all tables below:

Please refer to the *NI REM-11180 User Manual* for an explanation of the object codes and data types.

Abbreviation	Meaning
A	Number of elements
L	Length of the elements in bytes
R	Read
W	Write

Note Every visible string is terminated with a zero terminator (00_{hex}). The length of a visible string element is therefore one byte larger than the amount of user data.

Standard Objects

Table 48. Objects for identifIcation (Device Rating Plate)

Index (hex)	Object Name	Object Type	Data Type	A	L	Rights	Meaning	Contents
Manufacturer								
0001	VendorName	Var	Visible String	1	21	R	Vendor name	National Instruments
0002	VendorID	Var	Visible String	1	7	R	Vendor ID	00802F
0003	VendorText	Var	Visible String	1	7	R	Vendor text	—
0012	VendorURL	Var	Visible String	1	30	R	Vendor URL	ni.com
Module—general								
0004	DeviceFamily	Var	Visible String	1	15	R	Device family	I/O analog OUT
0006	ProductFamily	Var	Visible String	1	11	R	Product family	Remote I/O
000E	CommProfile	Var	Visible String	1	4	R	Communication profile	633
000F	DeviceProfile	Var	Visible String	1	5	R	Device profile	0010
0011	ProfileVersion	Record	Visible String	2	11; 20	R	Profile version	2011-12-07; Basic Profile V2.0
003A	VersionCount	Array	Unsigned 16	4	4 * 2	R	Version counter	e. g., 0007 0001 0001 0001_{hex}

Table 48. Objects for identifIcation (Device Rating Plate) (Continued)

Index (hex)	Object Name	Object Type	Data Type	A	L	Rights	Meaning	Contents
Module—special								
0005	Capabilities	Array	Visible String	1	8	R	Features	Energ_0
0007	ProductName	Var	Visible String	1	10	R	Product name	REM-11115
0008	SerialNo	Var	Visible String	1	11	R	Serial number	xxxxxxxxxx (e. g., 1234512345)
0009	ProductText	Var	Visible String	1	25	R	Product text	4 analog output channels
000A	OrderNumber	Var	Visible String	1	10	R	Order No.	784749-01
000B	HardwareVersion	Record	Visible String	2	11; 3	R	Hardware version	e. g., 2010-06-21; 01
000C	FirmwareVersion	Record	Visible String	2	11; 6	R	Firmware version	e. g., 2010-06-21; V1.10
000D	PChVersion	Record	Visible String	2	11; 6	R	Parameter channel version	2010-01-08; V1.00
0037	DeviceType	Var	Octet string	1	8	R	Module identification	00 10 00 08 00 00 00 $A7_{hex}$
Use of the device								
0014	Location	Var	Visible String	1	59	R/W	Location	Can be filled out by the user.
0015	EquipmentIdent	Var	Visible String	1	59	R/W	Equipment identifier	Can be filled out by the user.
0016	ApplDeviceAddr	Var	Unsigned 16	1	2	R/W	Application device address	Can be filled out by the user.

Table 49. Object for Multilingual Capacity

Index (hex)	Object Name	Object Type	Data Type	A	L	Rights	Meaning	Contents
0017	Language	Record	Visible String	2	6; 8	R	Language	en-us; English

Table 50. Object Descriptions

Index (hex)	Object Name	Object Type	Data Type	A	L	Rights	Meaning
0038	ObjDescrReq	Record	—	2	3	Read, write	Object description request
0039	ObjDescr	Record	—	16	See subindexes	Read	Object description
003B	PDIN_ Descr	Record	—	3	12	R	Description of the IN process data
003C	PDOUT_ Descr	Record	—	3	12	R	Description of the output process data

Note These objects are only important for tools and are therefore not described in more detail here. Please refer to the basic profile for comprehensive information.

Table 51. Diagnostics Objects

Index (hex)	Object Name	Object Type	Data Type	A	L	Rights	Assignment
0018	DiagState	Record	—	6	2; 1; 1; 2; 1; 14	R	Diagnostic state
0019	ResetDiag	Var	Unsigned 8	1	1	W	Reset diagnostics

Diagnostics State (0018_{hex}: DiagState)

This object is used for a structured message of an error.

Table 52. 0018_{hex}: DiagState (Read)

Subindex	Data Type	Length in Bytes	Meaning	Contents	
0	Record	21	Diagnostic state	Complete diagnostics information	
1	Unsigned 16	2	Error number	0 to 65535_{dez}	
2	Unsigned 8	1	Priority	00_{hex}	No error
				01_{hex}	Error
				02_{hex}	Warning
				81_{hex}	Error removed
				82_{hex}	Warning eliminated
3	Unsigned 8	1	Channel/ group/ module	00_{hex}	No error
				01_{hex}	Channel 1
				:	:
				04_{hex}	Channel 4
				FF_{hex}	entire device
4	Unsigned 16	2	Error code	See Table 53, *Error and Status of the Local Status and Diagnostics Indicators*	
5	Unsigned 8	1	More follows	00_{hex}	
6	Visible String	14	Text (14 characters)	See Table 53, *Error and Status of the Local Status and Diagnostics Indicators*	

Note The message with the priority 81_{hex} or 82_{hex} is a one-time internal message to the bus coupler that is implemented onto the error mechanisms of the higher-level system by the bus coupler.

Table 53. Error and Status of the Local Status and Diagnostics Indicators

Subindex	2	3	4		6	Process Data	LED			
	Priority	Channel/ group/ module	Error Code							
Error	hex	hex	hex	dec	Text		D	UA	E1	E2
No error	00	00	0000	0	Status OK	xxxx	Green ON	ON	OFF	OFF
Short-circuit	01	01 to 04	2130	8496	Short-circuit	8003	Green ON	ON	OFF	ON
Faulty supply voltage	01	FF	5160	20832	Supply fail	8020	Flashing green/yellow	OFF	ON	ON
Device error	01	FF	6301	25345	CS FLASH	8040	Green ON	ON	OFF	ON
Flash format error	01	FF	6302	25346	FO FLASH	8040	Green ON	ON	OFF	ON
Parameter table invalid	01	FF	6320	25376	Invalid para	8010	Green ON	ON	OFF	ON
Open circuit	01	01 to 04	7710	30480	Open circuit	8002	Green ON	ON	OFF	ON

Reset Diagnostic Messages (0019_{hex}: ResetDiag)

You can delete the diagnostics memory and acknowledge the diagnostic messages with this object.

Table 54. 0019_{hex}: ResetDiag (Write)

Subindex	Data Type	Length in Bytes	Meaning	Contents	
0	Unsigned 8	1	Reset diagnostics	00_{hex}	All diagnostic messages approved
				02_{hex}	Deletes and acknowledges all pending diagnostic messages that have not been read out
				06_{hex}	Deletes and acknowledges all the diagnostic messages and allows no further diagnostic messages
				Other	Reserved

Table 55. Objects for Process Data Management

Index (hex)	Object Name	Object Type	Data Type	A	L	Rights	Assignment
0024	ResetCode	Simple variable	Unsigned 16	4	2	R/W	Behavior during a bus reset
0025	PDIN	Var	Octet string	1	8	R	Input process data
0026	PDOUT	Var	Octet string	1	8	R/W	Output process data
0027	GetExRight	—	Integer 8	1	1	R/W	Get exclusive process data write rights
002F	PDOUT_ Subst	—	Integer 16	4	2	R/W	Substitute value for the OUT process data

Behavior during a Bus Reset (0024_{hex}: ResetCode)

This object is used to parameterize the behavior of the outputs when a bus reset is detected.

Table 56. 0024_{hex}: BusResetCode (Read, Write)

Subindex	Data Type	Length in Bytes	Meaning	Contents	Default value
0	Array	4 * 2	Behavior during a bus reset	—	—

Element	Data Type	Length in Bytes	Meaning	Contents	Default Value
1	Unsigned 16	2	Channel 1 reset code	0000 to 0003_{hex}	0002_{hex}
:	:	:	:	:	:
4	Unsigned 16	2	Channel 4 reset code	0000 to 0003_{hex}	0002_{hex}

Table 57. Value Range

Code (hex)	Behavior
0000	Output of zero values (0 V/0 mA/4 mA) at output
0001	Output of final values (10 V/5 V/20 mA) at output
0002	Hold the last values
0003	Transfer the substitute values from the “Replace output process data” ($002F_{hex}$) object

Table 58. Behavior of the Outputs When the Supply Voltage Fails

U_A	U_{Bus}	Behavior of the Outputs
Available	Available	Nominal operation or see object 0024_{hex}
Missing	Available	Outputs to 0 V/0 mA
Available	Missing	Outputs to 0 V/0 mA

Special features

- You can only access this object via subindex 0, i. e., you access the entire object.
- In the case of valid parameters, the object is stored permanently.

IN Process Data (0025_{hex}: PDIN)

Note In the case of Sercos, the IN process data is hidden and therefore unavailable.

You can read the IN process data of the module with this object.

The structure corresponds to the representation in the “Process data” section.

Table 59. 0025_{hex}: PDIN (Read)

Subindex	Data Type	Length in Bytes	Meaning
0	Octet string	8	Input process data

OUT Process Data (0026_{hex}: PDOUT)

You can read or write the OUT process data of the module with this object.

The structure corresponds to the representation in the “Process data” section.

Table 60. 0026_{hex}: PDOUT (Read)

Subindex	Data Type	Length in Bytes	Meaning
0	Octet string	8	Output process data

There are 2 bytes available for each channel, starting with channel 1.

Observe the notes in the section “Writing the Analog Values over the PDI Channel.”

Request Exclusive Write Access (0027_{hex}: GetExRight)

This object allows you to determine which channel (process data channel or PDI channel) gets the rights for writing the outputs.

Table 61. 0027_{hex}: GetExRight (Read, Write)

Subindex	Data Type	Length in Bytes	Meaning	Contents	
0	Simple variable	1	Get exclusive process data write rights	00_{hex}	Rights for writing output data over the PD channel (process data channel)
				01_{hex}	Rights for writing output data via the PDI channel

All other values are invalid and will be acknowledged with an error.

Note The parameterization in object 0027_{hex} “Rights for writing the output data via the PDI channel” overwrites the OUT process data transmitted via the process data channel with the values from object 0026_{hex} PDOUT. From now, the OUT process data can only be changed using the PDI object. Changes on the process data channel will have no effect. If the value from the process data channel is to be used again, write access must be changed to “Rights for writing the output data via the PD channel (process data channel)” via the GetExRight object. After a power reset, the values transmitted via the process data channel are always valid.

Substitute Value for the OUT Process Data ($002F_{hex}$: PDOUT_Subst)

This object is used to parameterize the substitute values that are to be output at the analog outputs during a bus reset. However, option 0003 must have been selected in the “Behavior during bus reset” object (0024_{hex}).

In the case of valid parameters, the parameterization is stored in the module permanently.

After resetting, the module works with the last permanently stored data. Upon delivery, the module works with the default data (default settings).

Table 62. $002F_{hex}$: PDOUT_Subst (Read, Write)

Subindex	Data Type	Length in Bytes	Meaning
0	Array of Unsigned 16	4 * 2	Replace output process data

There are 2 bytes available for each channel, starting with channel 1.

The values are used in the parameterized format.

Example:

Channel 1: 1 V, channel 2: 2 V to channel 4: 4 V, IB IL format
0B B8 17 70 23 28 2E E0

Special features

- You can only access this object via subindex 0, i. e., you access the entire object.
- In the case of valid parameters, the object is stored permanently.
- The parameterized values are compared with the selected output range. If the substitute value does not correspond to the output range, an error message is issued.

Table 63. Objects for Device Management*

Index (hex)	Object Name	Object Type	Data Type	A	L	Rights	Meaning
001D	Password	Simple variable	Octet string	1	9	W	Password
0029	ParamSetWriteControl	Byte	Unsigned 8	1	1	R/W	Parameter set write control
002A	ConflictDictionary	Record	—	N	12	R	Conflict dictionary
002D	ResetParam	Simple variable	Unsigned 8	1	1	R/W	Reset parameterization
002E	CheckSum	Simple variable	Unsigned 32	1	4	R	Checksum
* Objects 0029_{hex}, $002A_{hex}$, $002D_{hex}$, and $002E_{hex}$ are available as of firmware 1.10.							

Password ($001D_{hex}$: Password)

By entering the “Superuser” password you permit writing to the “Exclusive right received” object. These rights are required to transmit process data over the PDI channel.

Table 64. $001D_{hex}$: Password (Write)

Subindex	Data Type	Length in Bytes	Meaning
0	Simple variable	9	Password

Parameter Record Write Control (0029_{hex}: ParamSetWriteControl)

This object is used to control block parameterization.

Table 65. 0029_{hex}: ParameterSetWriteControl (Read/Write)

Subindex	Data Type	Length in Bytes	Meaning	
0	Unsigned 8	1	Parameter record write control	
			00_{hex}	Termination of block parameterization
			01_{hex}	Initiation of block parameterization

Block parameterization serves to enable the joint transfer of interdependent parameters.

If you attempt to parameterize dependent parameters individually, this may result in the error message “Dependency of other parameter not taken into consideration”. Block parameterization should be used in this case.

The plausibility check for the parameterization data is disabled during block parameterization, the data is only stored temporarily. However, the data length and subindex are checked.

The plausibility check is only performed when block parameterization is terminated with data item 00_{hex}.

If the check was completed with no errors, the temporarily stored parameterization data is applied and stored in the Flash memory.

If errors were detected in the temporarily stored parameterization data, the service is acknowledged negatively with 08, 00, 0040_{hex}. The exact cause of the error can be read in object $002A_{hex}$. The error codes are indicated by object 0080_{hex}.

Not all startup objects have to be written.

The following actions are carried out when the parameter contents are modified:

Write control changes from 00_{hex} to 01_{hex}: initiation of block parameterization

- Block parameterization is initiated
- Conflict dictionary is reset

Write control changes from 01_{hex} to 00_{hex}: termination of block parameterization

- Block parameterization is terminated
- Individual parameterization is active
- Parameterization is checked for compatibility

  Parameters are compatible:

  – The parameter contents are accepted.

  – Write access to the write control parameter is acknowledged positively.

  Parameters are not compatible:

  – The old contents of all the parameters required for block parameterization remain in effect.

  – The conflict dictionary is updated.

  – Write access to the write control parameter is acknowledged negatively.

Table 66. Error Code in the Event of Negative Acknowledgment

Code (hex)	Additional Code (hex)	Meaning	Remedy
0801	0040	Dependent values were not taken into consideration.	Check the parameterization.

To use block parameterization without tools, proceed in the following sequence:

1. Initiate block parameterization by writing the value 01_{hex} to object 0029_{hex}.
2. Write the parameter table (ParaTable) to object 0080_{hex}.

3. Write the substitute value behavior during a bus reset (ResetCode) to object 0024_{hex}.
4. Write the substitute value for the OUT process data in the event of an error (PDOUT_Subst) to object $002F_{hex}$.
5. Terminate block parameterization by writing the value 00_{hex} to object 0029_{hex}.

Conflict Dictionary ($002A_{hex}$: ConflictDictionary)

This object contains the indexes and error messages (additional code) for the parameters involved in the conflict.

Table 67. $002A_{hex}$: ConflictDictionary (Read)

Subindex	Data Type	Length in Bytes	Meaning
0	—	12	Conflict dictionary

Meaning	Length in Bytes	Example	
Subslot	1	00	No subslot
Index	2	00 2F	PDOUT_Subst
Subindex	1	02	Substitute value for OUT2
Parameter number	1	01	—
Error code and class	1	80	—
Additional error code	2	02 40	Substitute value for OUT2 outside the limit values

Reset Parameterization ($002D_{hex}$: ResetParam)

This object is used to reset the module to the default settings.

To reset the module value 01_{hex} must be transferred during write access. Any other values are not permissible and will be acknowledged with an error.

Then the default settings of the channels are loaded and all the user-set parameters are reset.

Checksum ($002E_{hex}$: Checksum)

The data of the startup objects is verified with this CRC32 checksum.

Checksum for the default setting: 6D CC 50 18

Application Objects

Index (hex)	Object Name	Object Type	Data Type	A	L	Rights	Assignment
0080	ParaTable	Array	Unsigned 16	6	6 * 2	R/W	Parameter table

Parameter Table (0080_{hex}: ParaTable)

Parameterize the module using this object.

In the case of valid parameters, the parameterization is stored in the module permanently.

After resetting, the module works with the last permanently stored data. Upon delivery, the module works with the default data (default settings).

Table 68. 0080_{hex}: ParaTable (Read, Write)

Subindex	Data Type	Length in Bytes	Meaning	Default value
0	Array of Unsigned 16	6 * 2	Read/write all elements	See subindexes
1	Unsigned 16	2	Parameterization of channel 1	0000_{hex}
:	Unsigned 16	2	:	0000_{hex}
4	Unsigned 16	2	Parameterization of channel 4	0000_{hex}
5	Unsigned 16	2	Data format	0000_{hex}
6	Unsigned 16	2	Reserved	0000_{hex}

Parameterization Channel 1 to channel 4

Table 69. Parameterization Word

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	0	0	0	0	0	0	0	0	Output range			

Table 70. Output Range

Output range	Code (bin)	Code (hex)
0 V to 10 V (default)	0000	0
±10 V	0001	1
0 V to 5 V	0010	2
±5 V	0011	3
0 mA to 20 mA	0100	4
Reserved	0101	5
4 mA to 20 mA	0110	6
Channel inactive	1111	F
Other	Reserved	

Table 71. Data Format

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	0	0	Data format		0	0	0	0	0	0	0	0

Data Format	Code (bin)	Code (hex)
IB IL (default setting)	00	0
Reserved	01	1
S7-compatible	10	2
Reserved	11	3

Note Set all unused bits to 0.

Writing the Analog Values over the PDI Channel

PDI = Parameters, Diagnostics and Information

The exclusive right must be changed first, if the analog values are not to be output via the process data, but via the PDI channel. To do this, proceed as follows.

1. Write the ASCII string “Superuser” to the “Password” ($001D_{hex}$) object.
2. Write the value 01_{hex} to the “Request exclusive write access” object (0027_{hex}).

You may now write to the “Output process data” (0026_{hex}) object.

Process Data

The module uses five words of IN process data and five words of OUT process data.

Input Words IN1 to IN5

The measured values of the TC channels are transmitted to the controller board or the computer via process data input words IN1 to IN5.

IN5 is used to transmit the measured value for the voltage input.

The measured values are depicted in IB IL or S7-compatible format. In both cases, the measured value is displayed in 16 bit format. The data type is Integer 16 from a technical programming point of view.

IN1: measured value channel 0
:
IN4: measured value channel 3
IN5: measured value voltage input

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Analog value															

In the IB IL format a diagnostic code is mapped to the input data in the event of an error.

Code (hex)	Cause
8001	Measuring range exceeded (overrange)
8002	Open circuit
8004	Measured value invalid/no valid measured value available
8008	Cold junction defective
8010	Parameter table invalid
8020	Faulty supply voltage
8040	Device faulty
8080	Below measuring range (underrange)

Note In the event of a cold junction error, code 8008_{hex} is indicated for the channel to which the affected cold junction is assigned. In order to determine the exact cause of the error, select the “Cold junction” sensor type via the parameterization. The detailed error message is then output for this channel (8080_{hex}, 8001_{hex} or 8002_{hex}).

Table 72. Output Words OUT1 to OUT5

OUT1: cold junction temperature specification
OUT2: -
:
OUT5: -

Open Circuit

Channels 0 to 3 (TC/linear Voltage)

Channels 0 to 3 have open circuit detection.

As soon as an open circuit occurs, this is indicated in the process data and in PDI object 0018_{hex}.

In addition, the corresponding diagnostic LED for the channel lights up red.

Voltage Input ±5 V

In the event of an error, the voltage input value goes to 0.

A diagnostic message is not generated, this error is not indicated at the diagnostic LEDs either.

Significant Values in Various Formats

Table 73. Significant Values in IB IL Format

Input Data		Temperature Sensors		Linear Voltage ±100 mV	
Resolution		1°C or 1°F	0.1°C or 0.1°F		
hex	dec	°C or °F	°C or °F	1 µV	10 µV
8001	Overrange	> Limit value	> Limit value	> 32.512 mV	>100 mV
03E8	1000	+1000.0	+100.0	+1 mV	+10 mV
0001	1	+1.0	+0.1	+1 µV	+10 µV
0000	0	0	0	0 µV	0 µV
FFFF	-1	-1	-0.1	-1 µV	-10 µV
FC18	-1000	-1000.0	-100.0	-1 mV	-10 mV
8080	Underrange	< Limit value	< Limit value	< -32.512 mV	< -100 mV

Table 74. Significant Values in S7-compatible Format

Input Data		Temperature Sensors		Linear Voltage ±100 mV	
Resolution		1°C or 1°F	0.1°C or 0.1°F		
hex	dec	°C or °F	°C or °F	1 µV	10 µV
8000	Overrange	> Limit value	> Limit value	> 32.512 mV	>100 mV
03E8	1000	+1000.0	+100.0	+1 mV	+10 mV
0001	1	+1.0	+0.1	+1 µV	+10 µV
0000	0	0	0	0	0
FFFF	-1	-1	-0.1	-1 µV	-10 µV
FC18	-1000	-1000.0	-100.0	-1 mV	-10 mV
7FFF	Underrange	< Limit value	< Limit value	< -32.512 mV	< -100 mV

Parameter, Diagnostics and Information (PDI)

Parameter and diagnostic data as well as other information is transmitted via the PDI channel of the NI Remote I/O system.

The standard and application objects stored in the module are described in the following section.

The following applies to all tables below:

Please refer to the *NI REM-11180 User Manual* for an explanation of the object codes and data types.

Abbreviation	Meaning
A	Number of elements
L	Length of the elements in bytes
R	Read
W	Write

Note Every visible string is terminated with a zero terminator (00_{hex}). The length of a visible string element is therefore one byte larger than the amount of user data.

Table 75. Objects for identifIcation (Device Rating Plate)

Index (hex)	Object Name	Object Type	Data Type	A	L	Rights	Meaning	Contents
Manufacturer								
0001	VendorName	Var	Visible String	1	21	R	Vendor name	National Instruments
0002	VendorID	Var	Visible String	1	7	R	Vendor ID	00802F
0003	VendorText	Var	Visible String	1	7	R	Vendor text	—
0012	VendorURL	Var	Visible String	1	18	R	Vendor URL	ni.com
Module—general								
0004	DeviceFamily	Var	Visible String	1	14	R	Device family	I/O analog IN
0006	ProductFamily	Var	Visible String	1	11	R	Product family	Remote I/O
000E	CommProfile	Var	Visible String	1	4	R	Communication profile	633
000F	DeviceProfile	Var	Visible String	1	5	R	Device profile	0010
0011	ProfileVersion	Record	Visible String	2	11; 20	R	Profile version	2011-12-07; Basic Profile V2.0
003A	VersionCount	Array	Unsigned 16	4	4 * 2	R	Version counter	e. g., 0007 0001 0001 0001_{hex}
Module—special								
0005	Capabilities	Array	Visible String	1	8	R	Capabilities	Nothing
0007	ProductName	Var	Visible String	1	10	R	Product name	REM-11120
0008	SerialNo	Var	Visible String	1	11	R	Serial number	xxxxxxxxxx (e. g., 1234512345)

Table 75. Objects for identifIcation (Device Rating Plate) (Continued)

Index (hex)	Object Name	Object Type	Data Type	A	L	Rights	Meaning	Contents
0009	ProductText	Var	Visible String	1	28	R	Product text	4 analog UTH input channels
000A	OrderNumber	Var	Visible String	1	10	R	Order No.	784750-01
000B	HardwareVersion	Record	Visible String	2	11; 3	R	Hardware version	e. g., 2010-06-21; 01
000C	FirmwareVersion	Record	Visible String	2	11; 6	R	Firmware version	e. g., 2010-06-21; V1.10
000D	PChVersion	Record	Visible String	2	11; 6	R	Parameter channel version	2010-01-08; V1.00
0037	DeviceType	Var	Octet string	1	8	R	Module identification	00 20 00 08 00 00 00 $A8_{hex}$
Use of the device								
0014	Location	Var	Visible String	1	59	R/W	Location	Can be filled out by the user.
0015	EquipmentIdent	Var	Visible String	1	59	R/W	Equipment identifier	Can be filled out by the user.
0016	ApplDeviceAddr	Var	Unsigned 16	1	2	R/W	Application device address	Can be filled out by the user.

Table 76. Object for Multilingual Capacity

Index (hex)	Object Name	Object Type	Data Type	A	L	Rights	Meaning	Contents
0017	Language	Record	Visible String	2	6; 8	R	Language	en-us; English

Table 77. Object Descriptions

Index (hex)	Object Name	Object Type	Data Type	A	L	Rights	Meaning
0038	ObjDescrReq	Record	—	2	3	Read, write	Object description request
0039	ObjDescr	Record	—	16	36	Read	Object description
003B	PDIN_Descr	Record	—	3	12	R	Description of the IN process data
003C	PDOUT_ Descr	Record	—	6	24	R	Description of the output process data

Note These objects are only important for tools and are therefore not described in more detail here. Please refer to the basic profile for comprehensive information.

Table 78. Diagnostics Objects

Index (hex)	Object Name	Object Type	Data Type	A	L	Rights	Assignment
0018	DiagState	Record	—	6	2; 1; 1; 2; 1; 14	R	Diagnostic state
0019	ResetDiag	Var	Unsigned 8	1	1	W	Reset diagnostics

Diagnostics State (0018_{hex}: DiagState)

This object is used for a structured message of an error.

Table 79. 0018_{hex}: DiagState (Read)

Subindex	Data Type	Length in Bytes	Meaning	Contents	
0	Record	21	Diagnostic state	Complete diagnostics information	
1	Unsigned 16	2	Error number	0 to 65535_{dez}	
2	Unsigned 8	1	Priority	00_{hex}	No error
				01_{hex}	Error
				02_{hex}	Warning
				81_{hex}	Error removed
				82_{hex}	Warning eliminated
3	Unsigned 8	1	Channel/group/ module	00_{hex}	No error
				01_{hex}	Channel 1
				:	:
				04_{hex}	Channel 4
				05_{hex}	±5 V voltage input
				FF_{hex}	entire device
4	Unsigned 16	2	Error code	See table below	
5	Unsigned 8	1	More follows	00_{hex}	
6	Visible String	14	Text (14 characters)	See table below	

Note The message with the priority 81_{hex} or 82_{hex} is a one-time internal message to the bus coupler that is implemented onto the error mechanisms of the higher-level system by the bus coupler.

Table 80. Error and Status of the Local Status and Diagnostics Indicators

Subindex	2	3	4		6						
	Priority	Channel/ group/ module	Error Code			Process Data	LED				
Error	hex	hex	hex	dec	Text		D	UA	E1	E2	10 to 13
No error	00	00	0000	0	Status OK	xxxx	Green ON	ON	OFF	OFF	X
Cold junction invalid	01	01 to 04	5120	20768	Cold junction (CJ)	8008	Green ON	ON	OFF	ON	Red ON
Faulty supply voltage	01	FF	5160	20832	Supply fail	8020	Flashing green/yellow	OFF	ON	ON	Red ON
Device error	01	FF	6301	25345	CS FLASH	8040	Green ON	ON	OFF	ON	Red ON
Flash format error	01	FF	6302	25346	FO FLASH	8040	Green ON	ON	OFF	ON	Red ON
Parameter table invalid	01	FF	6320	25376	Invalid para	8010	Green ON	ON	OFF	ON	Red ON
Open circuit	01	01 to 04	7710	30480	Open circuit	8002	Green ON	ON	OFF	ON	Red ON
Overrange	02	01 to 05	8910	35088	Overrange	8001	Green ON	ON	OFF	ON	Red ON
Underrange	02	01 to 05	8920	35104	Underrange	8080	Green ON	ON	OFF	ON	Red ON
X 05_{hex}	The LED is not affected by this error. Overrange or underrange at ±5 V voltage input This state is not indicated by an LED.										

Note An error at a channel (channel = 01 to 04) is indicated via the corresponding LED (LED 10 to 13). An error which affects the entire device (channel = FF), is only indicated on active channels via LEDs 10 to 13. The corresponding LED is off for inactive channels.

Note Once the malfunction has been eliminated, it is automatically reset.

Reset Diagnostic Messages (0019_{hex}: ResetDiag)

You can delete the diagnostics memory and acknowledge the diagnostic messages with this object.

Table 81. 0019_{hex}: ResetDiag (Write)

Subindex	Data Type	Length in Bytes	Meaning	Contents	
0	Unsigned 8	1	Reset diagnostics	00_{hex}	All diagnostic messages approved
				02_{hex}	Deletes and acknowledges all pending diagnostic messages that have not been read out
				06_{hex}	Deletes and acknowledges all the diagnostic messages and allows no further diagnostic messages
				Other	Reserved

Table 82. Objects for Process Data Management

Index (hex)	Object Name	Object Type	Data Type	A	L	Rights	Assignment
0025	PDIN	Var	Octet string	1	10	R	Input process data
0026	PDOUT	Var	Octet string	1	10	R/W	Output process data
0027	GetExRight	Var	Simple variable	1	1	R/W	Get exclusive process data write rights

IN Process Data (0025_{hex}: PDIN)

You can read the IN process data of the module with this object.

The structure corresponds to the representation in the “Process data” section.

Table 83.

Subindex	Data Type	Length in Bytes	Meaning
0	Octet string	10	Input process data

There are 2 bytes available for each channel, starting with channel 1.

There are also 2 bytes available to transmit the heater voltage measured value.

OUT Process Data (0026_{hex}: PDOUT)

You can read and write the OUT process data of the module with this object.

The structure corresponds to the representation in the “Process data” section.

Output data can be written in order to specify the temperature as an external cold junction, in you do not want to use the process data for this. If you use the first word (specification of the cold junction temperature), reset the remaining words to 0.

Table 84. 0026_{hex}: PDOUT (Read, Write)

Subindex	Data Type	Length in Bytes	Meaning	Contents
0	Octet string	10	Output process data	The structure corresponds to the representation in the “Process data” section.

Observe the notes in the section “Writing the Analog Values over the PDI Channel.”

Request Exclusive Write Access (0027_{hex}: GetExRight)

This object allows you to determine which channel (process data channel or PDI channel) gets the rights for writing the outputs.

Table 85. 0027_{hex}: GetExRight (Read, Write)

Subindex	Data Type	Length in Bytes	Meaning	Contents	
0	Simple variable	1	Get exclusive process data write rights	00_{hex}	Rights for writing output data over the PD channel (process data channel)
				01_{hex}	Rights for writing output data via the PDI channel

Table 86. Objects for Device Management

Index (hex)	Object Name	Object Type	Data Type	A	L	Rights	Meaning
001D	Password	Simple variable	Octet string	1	9	W	Password

“Password” Object

By entering the “Superuser” password you permit writing to the “Exclusive right received” object. These rights are required to transmit process data over the PDI channel.

Table 87. $001D_{hex}$: password (Write)

Subindex	Data Type	Length in Bytes	Meaning
0	Simple variable	9	Password

Application Objects

Index (hex)	Object Name	Object Type	Data Type	A	L	Rights	Assignment
0080	ParaTable	Array	Unsigned 16	6	6 * 2	R/W	Parameter table
0082	Measured Value Float	Array	Octet string	4	4 * 6	R	Measured values in the extended float format
0083	PD Min	Array	Integer 16	5	5 * 2	R	Minimum process data value
0084	PD Max	Array	Integer 16	5	5 * 2	R	Maximum process data value
008F	Local adjust value	Var	Octet string	1	8	R/W	Local adjust values
0090	Channel Scout	Var	Unsigned 8	1	1	R/W	Channel Scout

Parameter Table (0080_{hex}: ParaTable)

Parameterize the module using this object.

In the case of valid parameters, the parameterization is stored in the module permanently.

After resetting, the module works with the last permanently stored data. Upon delivery, the module works with the default data (default settings).

Table 88. 0080_{hex}: ParaTable (Read, Write)

Subindex	Data Type	Length in Bytes	Meaning	Default Value
0	Array of Unsigned 16	6 * 2	Read/write all elements	See subindexes
1	Unsigned 16	2	Parameterization of channel 1	$001F_{hex}$
:	Unsigned 16	2	:	
4	Unsigned 16	2	Parameterization of channel 4	$001F_{hex}$
5	Unsigned 16	2	Data format, mounting position	0000_{hex}
6	Unsigned 16	2	Reserved	0000_{hex}

Subindex 1 to 4: Parameterization of Channel 1 to Channel 4

Table 89. Parameterization Word

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	Filter		Cold junction type				Resolution		0	Sensor type				

The values displayed in bold are pre-settings.

Code (bin)	Filter	
00	**120 ms**	**8.3 Hz**
01	100 ms	10 Hz
10	60 ms	16.6 Hz
11	40 ms	25 Hz

Code (bin)	Code (hex)	Cold Junction Type		
0000	**0**	**Internal**		
0001	1	Switched off		
0010	2	External	Pt 100	Connector 1
0011	3	External	Pt 100	Connector 2
0100	4	Reserved		
0101	5	Reserved		
0110	6	Process data		
Other		Reserved		

Internal = There are several internal cold junction sensors in the module.
When you select the “Internal” cold junction type for a channel, the corresponding cold junction for this channel is automatically assigned to it.

External = You can connect a Pt 100 sensor to every connector as an external cold junction sensor.
Up to four external cold junctions are therefore available. One of these four external cold junctions can be assigned to each of the eight channels.

Process data = This parameterization offers the following option:
Determine the temperature of the cold junction via an additional device.
Transfer this temperature to the temperature module via the first process data output word. Use IB IL format with a resolution of 0.1°C.

Code (bin)	Resolution
00	**0.1 °C (or 1 µV for sensor type linear voltage ±100 mV)**
01	1 °C (or 10 µV for sensor type linear voltage ±100 mV)
10	0.1 °F
11	1 °F

Code (bin)	Code (hex)	Sensor Type
00000	0	K
00001	1	J
00010	2	E
00011	3	R
00100	4	S
00101	5	T
00110	6	B
00111	7	N
01000	8	U
01001	9	L
01010	A	C
01011	B	W
01100	C	HK
01101	D	Reserved
01110	E	Reserved
01111	F	Cold junction (CJ)
10000	10	Linear voltage ±100 mV
11111	1F	Channel inactive
Other		Reserved

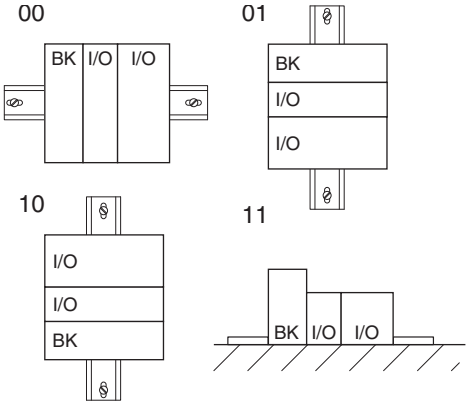
Table 90. Subindex 5: Data Format, Mounting Position

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	Mounting position		0	0	Data format		0	0	0	0	0	0	0	0

Code (bin)	Data Format
00	IB IL
01	Reserved
10	S7-compatible
11	Reserved

Code (bin)	Mounting Position
00	Horizontal (preferred mounting position)
01	Vertical, bus coupler above
10	Vertical, bus coupler below
11	Lying

Figure 1. Mounting position



BK = Bus coupler I/O = I/O module

Measured Value in Extended Float Format (0082_{hex}: Measured Value Float)

You can read the IN process data in IB IL or S7-compatible format with the 0025_{hex} object.

The 0082_{hex} object is also available.

This object provides the measured value in the highest internal accuracy of the terminal in the float format.

Table 91. 0082_{hex}: Measured Value Float (Read)

Subindex	Data Type	Length in Bytes	Meaning
0	Array of Records	4 * 6	Read all elements
1	Record	6	Measured value for channel 1
:	:	:	:
4	Record	6	Measured value channel 4

Table 92. Measured Value Channel 1 to Channel 4

Element	Data Type	Length in Bytes	Meaning
1	Float 32	4	Measured value in float format according to IEEE 754
2	Unsigned 8	1	Status
3	Unsigned 8	1	Unit

Table 93. Structure of the Float Format According to IEEE 754 in the Bit Representation

VEEE EEEE	EMMM MMMM	MMMM MMMM	MMMM MMMM
V = 1 sign bit, 0: positive, 1: negative E = 8 bits exponent with offset $7F_{hex}$ M = 23 bits mantissa			

Table 94. Some Example Values for Conversion from Floating Point to Hexadecimal Representation

Floating Point	Hexadecimal Representation
1.0	3F 80 00 00
10.0	41 20 00 00
1.03965528	3F 85 13 6D
-1.0	BF 80 00 00

Extended Float Format

Extended Float Format is a specially defined format. It consists of the measured value in float format, a status, and a unit.

Status is necessary because the float format defines no patterns providing information on the status of the numerical value.

The status corresponds to the LSB of the diagnostic code in IB IL format (e.g., overrange: status = 01, diagnostic code = 8001_{hex}). If status = 0, the measured value is valid.

Unit	Code
°C	32 (20_{hex})
°F	33 (21_{hex})
Millivolts (mV)	36 (24_{hex})

Status	Code
Measured value is valid	00_{hex}
Measured value is invalid	Other

Minimum Process Data Value (0083_{hex}: PD Min)

Object 0083_{hex} can be used to read the minimum process data values.

The values are initialized after each parameterization. The highest value is assigned for the minimum process data value.

PD Min = 7FFF 7FFF 7FFF 7FFF $7FFF_{hex}$

On every analog conversion, the PD Min value is compared with the current measured values and overwritten if necessary.

Table 95. 0083_{hex}: PD Min (Read)

Subindex	Data Type	Length in Bytes	Meaning
0	Array of Integer 16	5 * 2	Read all elements
1	Integer 16	2	Minimum process data value channel 1
:	:	:	:
4	Integer 16	2	Minimum process data value channel 4
5	Integer 16	2	Minimum process data value voltage input

Maximum Process Data Value (0084_{hex}: PD Max)

Object 0084_{hex} can be used to read the maximum process data values.

The values are initialized after each parameterization. The lowest value is assigned for the maximum process data value.

PD Max = $8000\ 8000\ 8000\ 8000\ 8000_{hex}$

On every analog conversion, the PD Max value is compared with the current measured values and overwritten if necessary.

Table 96. 0084_{hex}: PD Max (Read)

Subindex	Data Type	Length in Bytes	Meaning
0	Array of Integer 16	5 * 2	Read all elements
1	Integer 16	2	Maximum process data value channel 1
:	:	:	:
4	Integer 16	2	Maximum process data value channel 4
5	Integer 16	2	Maximum process data value voltage input

Local Adjust Values ($008F_{hex}$)

This object supports a channel-specific path calibration function for maximum accuracy. This means, for example, that you can finely tune the tolerances by means of the TC connecting cables and the sensors.

The calibration data is permanently stored on the module.

The object contains the temperature offset of the cold junction with reference to each channel in IB IL format with a resolution of 0.1°C.

Table 97. $008F_{hex}$: Local Adjust Values (Read, Write)

Subindex	Data Type	Length in Bytes	Meaning	Contents	Default Value
0	Var	4 * 2	Local adjust values	—	—

Element	Data Type	Length in Bytes	Meaning	Contents	Default Value
1	Var	2	Temperature offset channel 1	-20.0 °C to +20.0 °C (-200_{dec} to $+200_{dec}$)	0000_{hex}
:	:	:	:	:	:
4	Var	2	Temperature offset channel 4	-20.0 °C to +20.0 °C (-200_{dec} to $+200_{dec}$)	0000_{hex}

Example:

Channel 1 is measuring +2.0°C too high.

A negative offset of -2.0°C is required to correct this error.

In IB IL format, -2 °C corresponds to a value of $-20_{dec} = FFEC_{hex}$.

Channel Scout (0090_{hex})

This object is used to quickly find a channel.

Table 98. 0090_{hex}: Channel Scout (Read, Write)

Subindex	Data Type	Length in Bytes	Meaning	Contents	
0	Var	1	Channel Scout	0	Disable all channel scout processes
				1 to 4	Green LED of the channel is flashing at 0.5 Hz (1 second ON, 1 second OFF)

The function is terminated automatically after five minutes if you do not deactivate the Channel Scout processes. The flashing overrides all diagnostic messages of the selected channel. When a channel is parameterized, the Channel Scout function is aborted.

Writing the Analog Values over the PDI Channel

PDI = Parameters, Diagnostics and Information

To set the temperature of the external cold junction via the PDI channel rather than in the process data, you must change the exclusive right first.

To do this, proceed as follows:

1. Write the ASCII string “Superuser” to the “Password” ($001D_{hex}$) object.
2. Write the value 01_{hex} to the “Request exclusive write access” object (0027_{hex}).

You may now write to the “Output process data” (0026_{hex}) object.

NI REM-11152

Process Data

I/O data is mapped in the Motorola format.

Table 99. IN Process Data

Byte	0							
Bit	7	6	5	4	3	2	1	0
Channel	7	6	5	4	3	2	1	0
Terminal point	07	06	05	04	03	02	01	00

Byte	1							
Bit	7	6	5	4	3	2	1	0
Channel	15	14	13	12	11	10	9	8
Terminal point	47	46	45	44	43	42	41	40

Parameter, Diagnostics and Information (PDI)

Parameter and diagnostic data as well as other information is transmitted via the PDI channel of the NI Remote I/O system.

The standard and application objects stored in the module are described in the following section.

The following applies to all tables below:

Please refer to the *NI REM-11180 User Manual* for an explanation of the object codes and data types.

Abbreviation	Meaning
A	Number of elements
L	Length of the elements
R	Read
W	Write

Note Every visible string is terminated with a zero terminator (00_{hex}). The length of a visible string element is therefore one byte larger than the amount of user data.

Table 100. Objects for identification (device rating plate)

Index (hex)	Object Name	Object Type	Data Type	A	L	Rights	Meaning	Contents
Manufacturer								
0001	VendorName	Var	Visible String	1	21	R	Vendor name	National Instruments
0002	VendorID	Var	Visible String	1	7	R	Vendor ID	00802F
0003	VendorText	Var	Visible String	1	7	R	Vendor text	—
0012	VendorURL	Var	Visible String	1	18	R	Vendor URL	ni.com
Module—general								
0004	DeviceFamily	Var	Visible String	1	15	R	Device family	I/O digital IN
0006	ProductFamily	Var	Visible String	1	33	R	Product family	Remote I/O
000E	CommProfile	Var	Visible String	1	4	R	Communication profile	633
000F	DeviceProfile	Var	Visible String	1	5	R	Device profile	0010
0011	ProfileVersion	Record	Visible String	2	11; 20	R	Profile version	2011-12-07; Basis - Profil V2.0
003A	VersionCount	Array	Unsigned 16	4	4 * 2	R	Version counter	$0006\ 0001\ 0000\ 0000_{hex}$

Table 100. Objects for identification (device rating plate) (Continued)

Index (hex)	Object Name	Object Type	Data Type	A	L	Rights	Meaning	Contents
Module—special								
0005	Capabilities	Array	Visible String	1	8	R	Features	Nothing
0007	ProductName	Var	Visible String	1	10	R	Product name	REM-11152
0008	SerialNo	Var	Visible String	1	11	R	Serial number	xxxxxxxxxx (e. g., 1234512345)
0009	ProductText	Var	Visible String	1	26	R	Product text	16 digital input channels
000A	OrderNumber	Var	Visible String	1	10	R	Order No.	783743-01
000B	HardwareVersion	Record	Visible String	2	11; 3	R	Hardware version	e. g., 2011-02-04; 00
000C	FirmwareVersion	Record	Visible String	2	11; 3	R	Firmware version	0000-00-00; --
000D	PChVersion	Record	Visible String	2	11; 6	R	Parameter channel version	2010-01-08; V1.00
0037	DeviceType	Var	Octet string	1	8	R	Module identification	00 80 00 02 00 00 00 $D0_{hex}$
Use of the device								
0014	Location	Var	Visible String	1	59	R/W	Location	Can be filled out by the user.
0015	EquipmentIdent	Var	Visible String	1	59	R/W	Equipment identifier	Can be filled out by the user.
0016	ApplDeviceAddr	Var	Unsigned 16	1	2	R/W	Application device address	Can be filled out by the user.

Table 101. Object for multilingual capacity

Index (hex)	Object Name	Object Type	Data Type	A	L	Rights	Meaning	Contents
0017	Language	Record	Visible String	2	6; 8	R	Language	en-us; English

Table 102. Diagnostics objects

Index (hex)	Object Name	Object Type	Data Type	A	L	Rights	Assignment/content
0018	DiagState	Record		6	2; 1; 1; 2; 1; 1	R	Diagnostic state

Diagnostics State (0018_{hex}: DiagState)

This object is used for a structured message of an error.

Table 103. 0018_{hex}: DiagState (Read)

Subindex	Data Type	Length in Bytes	Meaning	Contents	
0	Record	8	Diagnostic state	Complete diagnostics information	
1	Unsigned 16	2	Error number	0 to 65535_{dez}	
2	Unsigned 8	1	Priority	00_{hex}	No error
				01_{hex}	Error
				02_{hex}	Warning
				81_{hex}	Error removed
				82_{hex}	Warning eliminated
3	Unsigned 8	1	Channel/group/ module	00_{hex}	No error
				01_{hex}	Group 1 (inputs 1 to 8)
				02_{hex}	Group 2 (inputs 9 to 16)
				FF_{hex}	entire device
4	Unsigned 16	2	Error code	See table below	

Table 103. 0018_{hex}: DiagState (Read) (Continued)

Subindex	Data Type	Length in Bytes	Meaning	Contents
5	Unsigned 8	1	More follows	00_{hex}
6	Visible String	1	Text	00_{hex}

Note The message with the priority 81_{hex} or 82_{hex} is a one-time internal message to the bus coupler that is implemented onto the error mechanisms of the higher-level system by the bus coupler.

Table 104. Error and Status of the Local Status and Diagnostics Indicators

Subindex	2	3	4				
	Priority	Channel/ group/ module	Error Code	LED			
Error	hex	hex	hex	D	UI	E1	E2
No error	00	00	0000	Green ON	ON	OFF	OFF
I/O supply failure	01	FF	3412	Flashing green/ yellow	OFF	OFF	OFF
Sensor supply overload for inputs 1 to 8 (group 1)	01	01	2211	Green ON	ON	ON	OFF
Sensor supply overload for inputs 9 to 16 (group 2)	01	02	2211	Green ON	ON	OFF	ON

Note After all errors have been eliminated, it is automatically reset.

Table 105. Objects for Process Data Management

Index (hex)	Object Name	Object Type	Data Type	A	L	Rights	Assignment
0025	PDIN	Var	Octet string	1	2	R	Input process data
003B	PDIN_ Descr	Array of Records		3	8; 2; 2	R	Description of the IN process data
003C	PDOUT_ Descr	Array of Records		3	8; 2; 2	R	Description of the output process data

The objects $003B_{hex}$ and $003C_{hex}$ are only applicable to tools.

IN Process Data (0025_{hex}: PDIN)

You can read the IN process data of the module with this object.

The structure corresponds to the representation in the “Process data” section.

Table 106. 0025_{hex}: PDIN (Read)

Subindex	Data Type	Length in Bytes	Meaning
0	Octet string	2	Input process data

Application Objects

Index (hex)	Object Name	Object Type	Data Type	A	L	Rights	Assignment
FF8F	Input_Filter	Var	Unsigned 8	1	1	R/W	Filter time

Filter Time ($FF8F_{hex}$: Input_Filter)

You parameterize the filter time of the module with this object.

Table 107. $FF8F_{hex}$: Input_Filter (Read, Write)

Subindex	Data Type	Length in Bytes	Contents	
0	Var	1	00_{hex} (Default)	500 µs
			01_{hex}	<100 µs

Process Data

I/O data is mapped in the Motorola format.

Table 108. IN process data

Byte	0							
Bit	7	6	5	4	3	2	1	0
Channel	7	6	5	4	3	2	1	0
Terminal point	13	12	11	10	03	02	01	00

Byte	1							
Bit	7	6	5	4	3	2	1	0
Channel	15	14	13	12	11	10	9	8
Terminal point	33	32	31	30	23	22	21	20

Byte	2							
Bit	7	6	5	4	3	2	1	0
Channel	23	22	21	20	19	18	17	16
Terminal point	53	52	51	50	43	42	41	40

Byte	3							
Bit	7	6	5	4	3	2	1	0
Channel	31	30	29	28	27	26	25	24
Terminal point	73	72	71	70	63	62	61	60

Parameter, Diagnostics and Information (PDI)

Parameter and diagnostic data as well as other information is transmitted via the PDI channel of the NI Remote I/O system.

The standard and application objects stored in the module are described in the following section.

The following applies to all tables below:

Please refer to the *NI REM-11180 User Manual* for an explanation of the object codes and data types.

Abbreviation	Meaning
A	Number of elements
L	Length of the elements
R	Read
W	Write

Note Every visible string is terminated with a zero terminator (00_{hex}). The length of a visible string element is therefore one byte larger than the amount of user data.

Standard Objects

Table 109. Objects for Identification (Device Rating Plate)

Index (hex)	Object Name	Object Type	Data Type	A	L	Rights	Meaning	Contents
Manufacturer								
0001	VendorName	Var	Visible String	1	21	R	Vendor name	National Instruments
0002	VendorID	Var	Visible String	1	7	R	Vendor ID	00802F
0003	VendorText	Var	Visible String	1	7	R	Vendor text	—
0012	VendorURL	Var	Visible String	1	18	R	Vendor URL	ni.com
Module—general								
0004	DeviceFamily	Var	Visible String	1	15	R	Device family	I/O digital IN
0006	ProductFamily	Var	Visible String	1	11	R	Product family	Remote I/O
000E	CommProfile	Var	Visible String	1	4	R	Communication profile	633
000F	DeviceProfile	Var	Visible String	1	5	R	Device profile	0010
0011	ProfileVersion	Record	Visible String	2	11; 20	R	Profile version	2011-12-07; Basis - Profil V2.0
003A	VersionCount	Array	Unsigned 16	4	4 * 2	R	Version counter	e.g., 0007 0001 0000 0000_{hex}
Module—special								
0005	Capabilities	Array	Visible String	1	8	R	Features	Nothing
0007	ProductName	Var	Visible String	1	10	R	Product name	REM-11154

Table 109. Objects for Identification (Device Rating Plate) (Continued)

Index (hex)	Object Name	Object Type	Data Type	A	L	Rights	Meaning	Contents
0008	SerialNo	Var	Visible String	1	11	R	Serial number	xxxxxxxxxx (e. g., 1234512345)
0009	ProductText	Var	Visible String	1	26	R	Product text	32 digital input channels
000A	OrderNumber	Var	Visible String	1	10	R	Order No.	748744-01
000B	HardwareVersion	Record	Visible String	2	11; 3	R	Hardware version	e. g., 2011-02-04; 00
000C	FirmwareVersion	Record	Visible String	2	11; 3	R	Firmware version	0000-00-00; --
000D	PChVersion	Record	Visible String	2	11; 6	R	Parameter channel version	2010-01-08; V1.00
0037	DeviceType	Var	Octet string	1	8	R	Module identification	00 80 00 04 00 00 0D 03_{hex}
Use of the device								
0014	Location	Var	Visible String	1	59	R/W	Location	Can be filled out by the user.
0015	EquipmentIdent	Var	Visible String	1	59	R/W	Equipment identifier	Can be filled out by the user.
0016	ApplDeviceAddr	Var	Unsigned 16	1	2	R/W	Application device address	Can be filled out by the user.

Table 110. Object for Multilingual Capacity

Index (hex)	Object Name	Object Type	Data Type	A	L	Rights	Meaning	Contents
0017	Language	Record	Visible String	2	6; 8	R	Language	en-us; English

Table 111. Diagnostics Objects

Index (hex)	Object Name	Object Type	Data Type	A	L	Rights	Assignment/content
0018	DiagState	Record	—	6	2; 1; 1; 2; 1; 1	R	Diagnostic state

Diagnostics State (0018_{hex}: DiagState)

This object is used for a structured message of an error.

Table 112. 0018_{hex}: DiagState (Read)

Subindex	Data Type	Length in Bytes	Meaning	Contents	
0	Record	8	Diagnostic state	Complete diagnostics information	
1	Unsigned 16	2	Error number	0 to 65535_{dez}	
2	Unsigned 8	1	Priority	00_{hex}	No error
				01_{hex}	Error
				02_{hex}	Warning
				81_{hex}	Error removed
				82_{hex}	Warning eliminated
3	Unsigned 8	1	Channel/group/ module	00_{hex}	No error
				FF_{hex}	entire device
4	Unsigned 16	2	Error code	See table below	
5	Unsigned 8	1	More follows	00_{hex}	
6	Visible String	1	Text	00_{hex}	

Note The message with the priority 81_{hex} or 82_{hex} is a one-time internal message to the bus coupler that is implemented onto the error mechanisms of the higher-level system by the bus coupler.

Note After all errors have been eliminated, it is automatically reset.

Table 113. Error and Status of the Local Status and Diagnostics Indicators

Subindex	2	3	4		
	Priority	Channel/ group/ module	Error Code	LED	
Error	hex	hex	hex	D	UI
No error	00	00	0000	Green ON	ON
I/O supply failure	01	FF	3412	Flashing green/yellow	OFF

Table 114. Objects for Process Data Management

Index (hex)	Object Name	Object Type	Data Type	A	L	Rights	Assignment
0025	PDIN	Var	Octet string	1	4	R	Input process data
003B	PDIN_ Descr	Array of Records		3	8; 2; 2	R	Description of the IN process data
003C	PDOUT_ Descr	Array of Records		3	8; 2; 2	R	Description of the output process data

The objects $003B_{hex}$ and $003C_{hex}$ are only applicable to tools.

IN Process Data (0025_{hex}: PDIN)

You can read the IN process data of the module with this object.

The structure corresponds to the representation in the “Process data” section.

Table 115. 0025_{hex}: PDIN (Read)

Subindex	Data Type	Length in Bytes	Meaning
0	Octet string	4	Input process data

Application Objects

Index (hex)	Object Name	Object Type	Data Type	A	L	Rights	Assignment
FF8F	Input_Filter	Var	Unsigned 8	1	1	R/W	Filter time

In the case of valid parameters, the parameterization is stored in the module permanently.

Filter Time ($FF8F_{hex}$: Input_Filter)

You parameterize the filter time of the module with this object.

Table 116. $FF8F_{hex}$: Input_Filter (Read, Write)

Subindex	Data Type	Length in Bytes	Contents	
0	Var	1	00_{hex} (Default)	3000 µs
			01_{hex}	1000 µs
			02_{hex}	<100 µs

NI REM-11175

Process Data

The I/O data is displayed in S7-compatible format.

Byte	0							
Bit	7	6	5	4	3	2	1	0
Channel	7	6	5	4	3	2	1	0
Terminal point	07	06	05	04	03	02	01	00

Byte	1							
Bit	7	6	5	4	3	2	1	0
Channel	15	14	13	12	11	10	9	8
Terminal point	47	46	45	44	43	42	41	40

Parameter, Diagnostics and Information (PDI)

Parameter and diagnostic data as well as other information is transmitted via the PDI channel of the NI Remote I/O system.

The standard and application objects stored in the module are described in the following section.

The following applies to all tables below:

Please refer to the *NI REM-11180 User Manual* for an explanation of the object codes and data types.

Abbreviation	Meaning
A	Number of elements
L	Length of the elements
R	Read
W	Write

Note Every visible string is terminated with a zero terminator (00_{hex}). The length of a visible string element is therefore one byte larger than the amount of user data.

Standard Objects

Table 117. Objects for identifIcation (Device Rating Plate)

Index (hex)	Object Name	Object Type	Data Type	A	L	Rights	Meaning	Contents
Manufacturer								
0001	VendorName	Var	Visible String	1	21	R	Manufacturer name	National Instruments
0002	VendorID	Var	Visible String	1	7	R	Manufacturer identification	00802F
0003	VendorText	Var	Visible String	1	7	R	Comment on the manufacturer	—
0012	VendorURL	Var	Visible String	1	18	R	URL of the manufacturer	ni.com
Module—general								
0004	DeviceFamily	Var	Visible String	1	16	R	Device family	I/O digital OUT
0006	ProductFamily	Var	Visible String	1	11	R	Product family	Remote I/O
000E	CommProfile	Var	Visible String	1	4	R	Communication profile	633
000F	DeviceProfile	Var	Visible String	1	5	R	Device profile	0010
0011	ProfileVersion	Record	Visible String	2	11; 20	R	Device profile version	2011-12-07; Basic Profile V2.0
003A	VersionCount	Array	Unsigned 16	4	4 * 2	R	Version counter	$0006\ 0001\ 0000\ 0000_{hex}$

Table 117. Objects for identifIcation (Device Rating Plate) (Continued)

Index (hex)	Object Name	Object Type	Data Type	A	L	Rights	Meaning	Contents
Module—special								
0005	Capabilities	Array	Visible String	1	8	R	Properties	Nothing
0007	ProductName	Var	Visible String	1	10	R	Product designation	REM-11175
0008	SerialNo	Var	Visible String	1	11	R	Serial number	xxxxxxxxxx (e. g., 1234512345)
0009	ProductText	Var	Visible String	1	27	R	Product text	16 digital output channels
000A	OrderNumber	Var	Visible String	1	10	R	Order No.	748745-01
000B	HardwareVersion	Record	Visible String	2	11; 3	R	Hardware version	e. g., 2011-02-04; 00
000C	FirmwareVersion	Record	Visible String	2	11; 3	R	Firmware version	0000-00-00; --
000D	PChVersion	Record	Visible String	2	11; 6	R	Parameter channel version	2010-01-08; V1.00
0037	DeviceType	Var	Octet string	1	8	R	Module identification	00 40 00 02 00 00 00 $D1_{hex}$
Use of the device								
0014	Location	Var	Visible String	1	59	R/W	Installation location	Can be filled out by the user.
0015	EquipmentIdent	Var	Visible String	1	59	R/W	Equipment identifier	Can be filled out by the user.
0016	ApplDeviceAddr	Var	Unsigned 16	1	2	R/W	User-defined device number	Can be filled out by the user.

Table 118. Object for Multilingual Capacity

Index (hex)	Object Name	Object Type	Data Type	A	L	Rights	Meaning	Contents
0017	Language	Record	Visible String	2	6; 8	R	Language	en-us; English

Table 119. Diagnostics Objects

Index (hex)	Object Name	Object Type	Data Type	A	L	Rights	Assignment/content
0018	DiagState	Record	—	6	2; 1; 1; 2; 1; 1	R	Diagnostics state; see below

Diagnostics State (0018_{hex}: DiagState)

This object is used for a structured message of an error.

Table 120. 0018_{hex}: DiagState (Read)

Subindex	Data Type	Length in Bytes	Meaning	Contents	
0	Record	8	Diagnostic state	Complete diagnostics information	
1	Unsigned 16	2	Error number	0 to 65535_{dec}	
2	Unsigned 8	1	Priority	00_{hex}	No error
				01_{hex}	Error
				02_{hex}	Warning
				81_{hex}	Error removed
				82_{hex}	Warning eliminated
3	Unsigned 8	1	Group	00_{hex}	No error
				FF_{hex}	entire device
4	Unsigned 16	2	Error code	See table below	
5	Unsigned 8	1	More information follows	00_{hex} (not supported)	
6	Visible String	1	Text	00_{hex} (not supported)	

Note The message with the priority 81_{hex} or 82_{hex} is a one-time internal message to the bus coupler that is implemented onto the error mechanisms of the higher-level system by the bus coupler.

Table 121. Error Code and Status of the Local Status and Diagnostics Indicators

Error Code	Error	Priority	Group	LED			
				D	U_O	E1	xx
0000_{hex}	No error	00_{hex}	00_{hex}	Green ON	ON	OFF	OFF
2344_{hex}	Short-circuit/overload of an output.	02_{hex}	FF_{hex}	Green ON	ON	Red on	Red on
3422_{hex}	Actuator supply not present	01_{hex}	FF_{hex}	Flashing green or green/ yellow	OFF	OFF	

xx LED Diagnostics of the output
xx 10 to 17, 50 to 57

The behavior of LED D during an “Actuator supply not present” error depends on whether you have switched error reporting via the $FF8F_{hex}$ object on or off.

Parameterization in $FF8F_{hex}$	D LED
Error is not reported to the controller	Green
Error is reported to the controller	Flashing green/yellow

Note After all errors have been eliminated, it is automatically reset.

Table 122. Objects for Process Data Management

Index (hex)	Object Name	Object Type	Data Type	A	L	Rights	Assignment
0026	PDOUT	Var	Octet string	1	2	R	Output process data
003B	PDIN_Descr	Array of Records		3	8; 2; 2	R	Description of the IN process data
003C	PDOUT_ Descr	Array of Records		3	8; 2; 2	R	Description of the output process data

The objects $003B_{hex}$ and $003C_{hex}$ are only applicable to tools.

OUT Process Data (0026_{hex}: PDOUT)

You can write the output process data of the module with this object.

The structure corresponds to the representation in the “Process data” section.

Table 123. 0026_{hex}: PDOUT (Read)

Subindex	Data Type	Length in Bytes	Meaning
0	Octet string	2	Output process data

Application Objects

Index (hex)	Object Name	Object Type	Data Type	A	L	Rights	Assignment
FF8D	PD Output Substitute Configuration	Var	Unsigned 8	1	1	R/W	Substitute value
FF8F	DiagOut	Var	Unsigned 8	1	1	R/W	Turn on/off reporting of “actuator supply not present” message

Substitute Value ($FF8D_{hex}$: PD Output Substitute Configuration)

Configure the substitute value with which the module is to be operated with an application reset using this object.

Table 124. $FF8D_{hex}$: PD Output Substitute Configuration (Read, Write)

Subindex	Data Type	Length in Bytes	Contents	
0	Var	1	00_{hex} (Default)	“0” output to all output bits
			01_{hex}	Hold last value

Turn On/Off Reporting of “Actuator Supply Not Present” Message ($FF8F_{hex}$: DiagOut)

With this object, you configure whether the “actuator supply not present” error is reported to the controller or not.

If you parameterize the module so that the error is not reported to the controller, the corresponding indicator in LED D (flashing green/yellow) is suppressed and the LED lights up green.

Table 125. $FF8F_{hex}$: DiagOut (Read, Write)

Subindex	Data Type	Length in Bytes	Contents	
0	Var	1	00_{hex} (Default)	Error is not reported to the controller
			01_{hex}	Error is reported to the controller

NI REM-11178

Process Data

Table 126. OUT Process Data

Byte	0							
Bit	7	6	5	4	3	2	1	0
Channel	7	6	5	4	3	2	1	0
Terminal point	07	06	05	04	03	02	01	00

Byte	1							
Bit	7	6	5	4	3	2	1	0
Channel	15	14	13	12	11	10	9	8
Terminal point	17	16	15	14	13	12	11	10

Byte	2							
Bit	7	6	5	4	3	2	1	0
Channel	23	22	21	20	19	18	17	16
Terminal point	27	26	25	24	23	22	21	20

Byte	3							
Bit	7	6	5	4	3	2	1	0
Channel	31	30	29	28	27	26	25	24
Terminal point	37	36	35	34	33	32	31	30

Parameter, Diagnostics and Information (PDI)

Parameter and diagnostic data as well as other information is transmitted via the PDI channel of the NI Remote I/O system.

The standard and application objects stored in the module are described in the following section.

The following applies to all tables below:

Please refer to the *NI REM-11180 User Manual* for an explanation of the object codes and data types.

Abbreviation	Meaning
A	Number of elements
L	Length of the elements in bytes
R	Read
W	Write

Note Every visible string is terminated with a zero terminator (00_{hex}). The length of a visible string element is therefore one byte larger than the amount of user data.

Table 127. Objects for Identification (Device Rating Plate)

Index (hex)	Object Name	Object Type	Data Type	A	L	Rights	Meaning	Contents
Manufacturer								
0001	VendorName	Var	Visible String	1	21	R	Vendor name	National Instruments
0002	VendorID	Var	Visible String	1	7	R	Vendor ID	00802F
0003	VendorText	Var	Visible String	1	7	R	Vendor text	—
0012	VendorURL	Var	Visible String	1	18	R	Vendor URL	ni.com
Module—General								
0004	DeviceFamily	Var	Visible String	1	16	R	Device family	I/O digital OUT
0006	ProductFamily	Var	Visible String	1	11	R	Product family	Remote I/O
000E	CommProfile	Var	Visible String	1	4	R	Communication profile	633
000F	DeviceProfile	Var	Visible String	1	5	R	Device profile	0010
0011	ProfileVersion	Record	Visible String	2	11; 20	R	Profile version	2011-12-07; Basic Profile V2.0
003A	VersionCount	Array	Unsigned 16	4	4 * 2	R	Version counter	e.g., 0007 0001 0000 0000_{hex}

Table 127. Objects for Identification (Device Rating Plate) (Continued)

Index (hex)	Object Name	Object Type	Data Type	A	L	Rights	Meaning	Contents
Module—Special								
0005	Capabilities	Array	Visible String	1	8	R	Features	Nothing
0007	ProductName	Var	Visible String	1	10	R	Product name	REM-11178
0008	SerialNo	Var	Visible String	1	11	R	Serial number	xxxxxxxxxx (e. g., 1234512345)
0009	ProductText	Var	Visible String	1	27	R	Product text	32 digital output channels
000A	OrderNumber	Var	Visible String	1	10	R	Order No.	748746-01
000B	HardwareVersion	Record	Visible String	2	11; 3	R	Hardware version	e. g., 2011-02-04; 00
000C	FirmwareVersion	Record	Visible String	2	11; 3	R	Firmware version	0000-00-00; --
000D	PChVersion	Record	Visible String	2	11; 6	R	Parameter channel version	2010-01-08; V1.00
0037	DeviceType	Var	Octet string	1	8	R	Module identification	00 40 00 04 00 00 00 $D3_{hex}$

Table 127. Objects for Identification (Device Rating Plate) (Continued)

Index (hex)	Object Name	Object Type	Data Type	A	L	Rights	Meaning	Contents
Use of the Device								
0014	Location	Var	Visible String	1	59	R/W	Location	Can be filled out by the user.
0015	EquipmentIdent	Var	Visible String	1	59	R/W	Equipment identifier	Can be filled out by the user.
0016	ApplDeviceAddr	Var	Unsigned 16	1	2	R/W	Application device address	Can be filled out by the user.

Table 128. Object for Multilingual Capacity

Index (hex)	Object Name	Object Type	Data Type	A	L	Rights	Meaning	Contents
0017	Language	Record	Visible String	2	6; 8	R	Language	en-us; English

Table 129. Diagnostics Objects

Index (hex)	Object Name	Object Type	Data Type	A	L	Rights	Assignment/content
0018	DiagState	Record	—	6	2; 1; 1; 2; 1; 1	R	Diagnostic state

Diagnostics State (0018_{hex}: DiagState)

This object is used for a structured message of an error.

Table 130. 0018_{hex}: DiagState (Read)

Subindex	Data Type	Length in Bytes	Meaning	Contents	
0	Record	8	Diagnostic state	Complete diagnostics information	
1	Unsigned 16	2	Error number	0 to 65535_{dez}	
2	Unsigned 8	1	Priority	00_{hex}	No error
				01_{hex}	Error
				02_{hex}	Warning
				81_{hex}	Error removed
				82_{hex}	Warning eliminated
3	Unsigned 8	1	Channel/group/ module	00_{hex}	No error
				FF_{hex}	entire device
4	Unsigned 16	2	Error code	See table below	
5	Unsigned 8	1	More follows	00_{hex}	
6	Visible String	1	Text	00_{hex}	

Note The message with the priority 81_{hex} or 82_{hex} is a one-time internal message to the bus coupler that is implemented onto the error mechanisms of the higher-level system by the bus coupler.

Note After all errors have been eliminated, it is automatically reset.

Table 131. Error and Status of the Local Status and Diagnostics Indicators

Subindex	2	3	4					
	Priority	Channel/ group/ module	Error Code		LED			
Error	hex	hex	hex	dec	D	U_O	E1	xx
No error	00	00	0000	0	Green ON	ON	OFF	OFF
Short-circuit/ overload of an output	02	FF	2344	9028	Green ON	ON	Red ON	Red ON
Actuator supply not present	01	FF	3422	13346	Flashing green or green/ yellow	OFF	OFF	OFF

xx LED Diagnostics of the output
xx 00 to 07, 10 to 17, 20 to 27, 30 to 37

The behavior of LED D during an “Actuator supply not present” error depends on whether you have switched error reporting via the $FF8F_{hex}$ object on or off.

Parameterization in $FF8F_{hex}$	D LED
Do not report error to the controller	Green
Report error to the controller	Flashing green/yellow

Table 132. Objects for Process Data Management

Index (hex)	Object Name	Object Type	Data Type	A	L	Rights	Assignment
0026	PDOUT	Var	Octet string	1	4	R	Output process data
003B	PDIN_ Descr	Array of Records	—	3	8; 2; 2	R	Description of the IN process data
003C	PDOUT_ Descr	Array of Records	—	3	8; 2; 2	R	Description of the output process data

The objects $003B_{hex}$ and $003C_{hex}$ are only applicable to tools.

OUT Process Data (0026_{hex}: PDOUT)

You can read the OUT process data of the module with this object.

The structure corresponds to the representation in the “Process data” section.

Table 133. 0026_{hex}: PDOUT (Read)

Subindex	Data Type	Length in Bytes	Meaning
0	Octet string	4	Output process data

Application Objects

Index (hex)	Object Name	Object Type	Data Type	A	L	Rights	Assignment
FF8D	PD Output Substitute Configuration	Var	Unsigned 8	1	1	R/W	Substitute value behavior
FF8F	DiagOut	Var	Unsigned 8	1	1	R/W	Message “Actuator supply not present”

In the case of valid parameters, the parameterization is stored in the module permanently.

Substitute Value Behavior ($FF8D_{hex}$: PD Output Substitute Configuration)

With this object, you parameterize the behavior of the module so that an application reset can be detected if necessary.

Table 134. $FF8D_{hex}$: PD Output Substitute Configuration (Read, Write)

Subindex	Data Type	Length in Bytes	Contents	
0	Var	1	00_{hex} (Default)	“0” output to all output bits
			01_{hex}	Hold last value

Message “Actuator Supply Not Present” ($FF8F_{hex}$: DiagOut)

With this object, you parameterize whether the “Actuator supply missing” error is reported to the controller or not.

If you parameterize the module so that the error is not reported to the controller, the corresponding indicator in LED D (flashing green/yellow) is suppressed and the LED lights up green.

Table 135. $FF8F_{hex}$: DiagOut (Read, Write)

Subindex	Data Type	Length in Bytes	Contents	
0	Var	1	00_{hex} (Default)	Do not report error to the controller
			01_{hex}	Report error to the controller

NI REM-11180

Object Dictionary

The bus coupler object dictionary contains objects which can be addressed via SDO services. These are defined in the ETG standards. Objects with a module-specific design are subsequently described in detail.

The objects are addressed using a combination of index and subindex. Subindex 0 lists the number of subindexes.

The following applies for the tables below:

Length	Length of the elements in bytes
Rights	Access rights
R	Read
W	Write
nn	Module number in an NI Remote I/O system, beginning with 01

Table 136. CoE Standard Objects

Index (hex)	Name	Defined in standard
1000	Device type	ETG.1000.6
1008	Device name	ETG.1000.6
1009	HardwareVersion	ETG.1000.6
100A	Software Version	ETG.1000.6
1018	Identify	ETG.1000.6
10F1	Error settings	ETG.1020
10F3	Diagnosis history	ETG.1020
10F8	Timestamp	ETG.1020
1C00	SyncManager type	ETG.1000.6

Table 136. CoE Standard Objects (Continued)

Index (hex)	Name	Defined in standard
1C12	RxPDO assign	ETG.1000.6
1C13	TxPDO assign	ETG.1000.6
1C32	SM output parameter	ETG.1020
1C33	SM input parameter	ETG.1020
F000	Modular device profile	ETG.5000.1
F030	Configured module ident list	ETG.5000.1
F050	Detected module ident list	ETG.5000.1

ETG.1000.6 Application Layer protocol specification
ETG.1020 EtherCAT® Protocol Enhancements
ETG.5000.1 Modular Device Profile Part 1

Module-specific CoE Objects

In the table below, nn is the number of the module that is to be addressed. The numbering starts with 01.

Index (hex)	Subindex	Object Name	Data Type	Length	Rights	Meaning	
6nn0	01	Inputs	Octet string	Depending on module	R	nn module input process data	
7nn0	01	Outputs	Octet string	Depending on module	R	nn module output process data	
16nn	01	RxPDO mapping	—	4	R	Bit 31 to 16	Index of the associated input data object (e.g., 6010_{hex})
						Bit 15 to 8	Subindex of the associated input data object
						Bit 7 to 0	Subindex length of the associated input data object
1Ann	01	TxPDO mapping	—	4	R	Bit 31 to 16	Index of the associated output data object (e.g., 7010_{hex})
						Bit 15 to 8	Subindex of the associated output data object
						Bit 7 to 0	Subindex length of the associated output data object

Index (hex)	Subindex	Object Name	Data Type	Length	Rights	Meaning	
9nn0	—	Module nn identification	Record	—	—	Identification of module nn	E.g., module 1: 9010_{hex}, module 2: 9020_{hex} etc.
	0A	Module ident	Unsigned 32	4	R	Unique number for module identification (connection to device description)	
	0B	Slot	Unsigned 16	2	R	Location of the module in the NI Remote I/O system, beginning with 1	
Ann0	—	DiagState	Record	—	—	Diagnostics	Read access to PDI object 0018_{hex} in the Remote I/O nn module via the PDI channel
	01	No	Unsigned 16	2	R	Error number	See data sheet on the module.
	02	Prio	Unsigned 8	1	R	Priority	See data sheet on the module.
	03	Channel/group/ module	Unsigned 8	1	R	Channel/group /module	See data sheet on the module.
	04	Code	Unsigned 16	2	R	Error code	See data sheet on the module.
	05	MoreFollows	Unsigned 8	1	R	More follows	See data sheet on the module.
	06	Text	Visible String	51	R	Text	See data sheet on the module.

CoE Objects for Identification (Device Rating Plate)

PDI objects are stored on each Remote I/O module for identification purposes. They contain information about the manufacturer and module and make up the device rating plate.

This information can be accessed using the bus coupler via EtherCAT®.

The following tables describe the detail on the device rating plate on objects in EtherCAT®.

Table 137. Detail of Manufacturer-specific Information

Index (hex)	Subindex	Object Name	Data Type	Length	Rights	Meaning (Code in hex)	
9nn1	—	Manufacturer information	—	—	—	Detail of manufacturer-specific information from the PDI objects for identification (device rating plate)	
	01	VendorName	Visible String	15	R	0001	Vendor name
	02	Vendor ID	Visible String	6	R	0002	Vendor ID
	03	VendorText	Visible String	48	R	0003	Vendor text
	04	VendorURL	Visible String	29	R	0012	Vendor URL

Table 138. Detail of Module-specific Information

Index (hex)	Subindex	Object Name	Data Type	Length	Rights	Meaning (Code in hex)	
9nn2	—	Information on module	—	—	—	Detail of module-specific information from the PDI objects for identification (device rating plate)	
	01	ProductName	Visible String	Max. 58	R	0007	Product name
	02	Serial number	Visible String	11	R	0008	Serial number
	03	ProductText	Visible String	Max. 58	R	0009	Product text
	04	OrderNumber	Visible String	8	R	000A	Order No.
	05	HW BuildDate	Visible String	10	R	000B.1	Hardware version, date of version
	06	HW Version	Visible String	Max. 40	R	000B.2	Hardware version, version ID
	07	FW BuildDate	Visible String	10	R	000C.1	Firmware version, date of version
	08	FW Version	Visible String	Max. 40	R	000C.2	Firmware version, version ID
	09	PDI BuildDate	Visible String	10	R	000D.1	Parameter channel version, date of version
	0A	PDI Version	Visible String	Max. 40	R	000D.2	Parameter channel version, version ID
	0B	DeviceType	Octet string	8	R	0037	Module identification

Objects for Access to PDI Objects (Tunnel Objects)

Parameter and diagnostic data as well as other information is transmitted via the PDI channel of the NI Remote I/O system.

You can access the PDI objects of the modules of a station via EtherCAT®. Objects $20nn_{hex}$ and $30nn_{hex}$ are used, with which a tunnel method can be implemented.

Index (hex)	Subindex	Object Name	Data Type	Length	Rights	Meaning	
20nn	—	Remote I/O module nn PDI write tunnel object	Record	—	—	Write access to the PDI objects in Remote I/O module nn via the PDI channel Mapping to PDI write service (service code 01_{hex}) at slot nn	
	01	Command	Octet string	250	R/W	Data for the PDI write request	
						Byte 0	Subslot
						Byte 1, 2	PDI object index
						Byte 3	PDI object subindex
						Byte 4	Length of the data to be written
						Byte 5 to n	User data (max. 245 bytes)
	02	Status	Unsigned 8	1	R	Status of the last write access	
						01_{hex}	Last access completed successfully (positive confirmation received)
						03_{hex}	Last access not completed successfully (negative confirmation received)
	03	Response	Octet string	9	R	Result of the last write access Data for PDI write response	
						Byte 0	Subslot
						Byte 1, 2	PDI object index
						Byte 3	PDI object subindex
						Byte 4	Length (= 0)
						Positive confirmation	
						Byte 5 to 8	0
						Negative confirmation	
						Byte 5	Error class
						Byte 6	Error code
						Byte 7, 8	Additional error code

Index (hex)	Sub-index	Object Name	Data Type	Length	Rights	Meaning	
30nn	—	Remote I/O module nn PDI read tunnel	Record	—	—	Read access to PDI objects in Remote I/O module nn via the PDI channel Mapping to PDI read service (service code 00_{hex}) at slot nn	
	01	Command	Octet string	4	R/W	Data for PDI read request	
						Byte 0	Subslot
						Byte 1, 2	PDI object index
						Byte 3	PDI object subindex
	02	Status	Unsigned 8	1	R	Status of the last read access	
						01_{hex}	Last access completed successfully (positive confirmation received)
						03_{hex}	Last access not completed successfully (negative confirmation received)
	03	Response	Octet string	250	R	Result of the last read access Data for PDI read response	
						Byte 0	Subslot
						Byte 1, 2	PDI object index
						Byte 3	PDI object subindex
						Byte 4	Length
						Positive confirmation	
						Byte 5, 6	0
						Byte 7 to n	Data for PDI read response
						Negative confirmation	
						Byte 5	Error class
						Byte 6	Error code
						Byte 7, 8	Additional error code

Objects for Remote I/O Bus Diagnostics

CoE object $F100_{hex}$ can be used to request the status information of the Remote I/O master.

Index (hex)	Subindex	Object Name	Data Type	Length	Rights	Meaning
F100		Remote I/O Bus Coupler Diag Info	Record	—	—	Read access to diagnostic information of the Remote I/O master
	01	Remote I/O Bus State	Unsigned 16	2	R	Current state of the Remote I/O local bus
	02	Remote I/O Error_ Code	Unsigned 16	2	R	Error code according to the current bus state
	03	Remote I/O Add_Error Info	Unsigned 16	2	R	Additional error information

“Remote I/O Bus State” mirrors the diagnostic status register. For more detailed information on this, please refer to the *NI REM-11180 User Manual*.

“Remote I/O Error_Code” indicates the error code of module errors. For the meaning of the error code, please refer to the data sheet for the module in question or the *NI REM-11180 User Manual*.

“Remote I/O Add_Error Info” indicates the position of the module in question.

The data for object $F100_{hex}$ is additionally provided in the cyclic input data of the NI Remote I/O system (see also “Process data of the bus coupler”).

Objects for the Status of Bus-synchronous Operation

This object contains information about which local bus modules operate bus-synchronously.

Index (hex)	Subindex	Object Name	Data Type	Length	Rights	Meaning
F102	—	Remote I/O modules used for synchronization	Record	—	—	During operation in DC Synchronous mode, indicates which Remote I/O modules are operated bus-synchronously
	01	—	Unsigned 8	1	R	Position of the modules that are operated bus-synchronously in the local bus starting with 1; n ≤ 63
	...	—	Unsigned 8	1	R	
	n	—	Unsigned 8	1	R	

Objects for Bus Coupler Configuration

The bus coupler has objects which are used for the configuration of the bus coupler. Write access to these objects is only possible in the PREOP state.

The contents of the objects are stored retentively in the bus coupler and are therefore still available after the bus coupler is restarted.

When reset to the default settings, these objects return to their default values.

Object $F800_{hex}$ can be used to configure the byte sequence of the transmitted process data.

Index (hex)	Subindex	Object Name	Data Type	Length	Rights	Meaning	
F800	—	Endian settings	Record	—	—	Byte sequence setting for a process data length of 16, 32 or 64 bits. The EtherCAT® standard specifies Little Endian format, Remote I/O uses Big Endian.	
	01	Swap Word	Bit	1	R	Byte sequence for a process data length of 16 bits	
						True	Little endian (default)
						False	Big endian
	02	Swap DWord	Bit	2	R	Byte sequence for a process data length of 32 bits	
						True	Little endian (default)
						False	Big endian
	03	Swap LWord	Bit	2	R	Byte sequence for a process data length of 64 bits	
						True	Little endian (default)
						False	Big endian

Object $F801_{hex}$ can be used to specify the bus coupler response in the event of a bus error.

Index (hex)	Subindex	Object Name	Data Type	Length	Rights	Meaning	
F801	—	Leave OP on Remote I/O busfail	Record	—	—	Parameterization of the response to an Remote I/O bus error	
	00	—	Bit	0.1	W	—	
						True	In the event of an Remote I/O bus error, the bus coupler switches to the SAFEOP ERR state, in addition a diagnosis is entered.
						False	(default) In the event of an Remote I/O bus error, the bus coupler remains in the OP state, only a diagnosis is entered.

Object $F802_{hex}$ can be used to check the connected module configuration.

Index (hex)	Subindex	Object Name	Data Type	Length	Rights	Meaning	
F802	—	Validate module configuration	Record	—	—	Validation of the module configuration	
	00		Bit	0.1	W	True	(default) During the transition from PREOP to SAFEOP, the bus coupler checks the module configuration.
						False	The bus coupler does not check the module configuration.

In order for the module configuration to be checked, the master must write object F030hex with the expected module configuration during the state transition from PREOP to SAFEOP. If this is not done, validation is not carried out. When the object is written, it must be done so correctly and consistently. The contents of object F030 are reset on a state transition from SAFEOP to PREOP.

By writing to object $F803_{hex}$, the cycle time of the Remote I/O local bus can be changed.

Index (hex)	Subindex	Object Name	Data Type	Length	Rights	Meaning
F803	—	Remote I/O bus cycle time	Record	—	—	Current Remote I/O bus cycle time in nanoseconds
	00	—	Unsigned 32	4	R	Current bus cycle time in nanoseconds
					W	Changing the bus cycle time 0: sets the minimum possible cycle time

Process Data

Process Data of the Bus Coupler

In addition to the cyclic IN and OUT process data, which is defined by the connected Remote I/O modules, the bus coupler itself has data which is inserted in the cyclic process image. This data has a total length of 8 bytes.

In accordance with the EtherCAT® standard, this data appears before the IN process data of the first Remote I/O module in the process image (SyncManager 3 bytes 0 to 8). The objects for the corresponding PDO mapping can be found in $1AFF_{hex}$.

Process data byte 0 and 1 (word 0) are assigned the “New diag massage bit” (index $10F3_{hex}$, subindex 04) of the “Diagnosis history” object.

Process data words 1 to 3 contain status and diagnostic information for the Remote I/O bus coupler and can also be called via acyclic services using CoE. They appear in the form of object $F100_{hex}$.

Table 139. Word 0, Byte 0

7	6	5	4	3	2	1	0
							New Diagnosis Message

Table 140. Word 0, Byte 1

7	6	5	4	3	2	1	0

Table 141. Word 1

Byte 3	Byte 2
Remote I/O bus state	

Table 142. Word 2

Byte 5	Byte 4
Remote I/O Error_Code	

Table 143. Word 3

Byte 7	Byte 6
Remote I/O Add_Error Info	

“Remote I/O Bus State” mirrors the diagnostic status register. For more detailed information on this, please refer to the *NI REM-11180 User Manual*.

“Remote I/O Error_Code” indicates the error code of module errors. For the meaning of the error code, please refer to the data sheet for the module in question or the *NI REM-11180 User Manual*.

“Remote I/O Add_Error Info” indicates the position of the module in question.

Process Data of the Local Bus Modules

The IN and OUT process data of the modules appear according to their process data description (PDI objects $003B_{hex}$ and $003C_{hex}$ on the module).

For mapping, object $F800_{hex}$ can be used to configure whether process data with a length of 16, 32, and 64 bits is to be transmitted in Big Endian format (Remote I/O standard) or in Little Endian format. The configuration is stored retentively in the bus coupler.

Diagnostics Strategy

Mechanisms

Different mechanisms are used to diagnose the bus coupler.

Mechanism	Diagnostics
EtherCAT® state machine	EtherCAT system diagnostics
EtherCAT hardware watchdog	
Emergency messages	Errors are indicated to the master
Diagnostic objects in the CoE object dictionary	Advanced diagnostics, e.g., of I/O errors
10F1	Error settings
F100	Remote I/O Bus Coupler Diag Info
F101	Remote I/O bus error counters
F102	Remote I/O modules used for synchronization
F802	Validate module configuration
Diagnosis history object	16 diagnostic messages could not be stored
10F3	Diagnosis history

EtherCAT State Machine

An error is indicated as follows:

- Error bit in the “AL status” register is set.
- An error code is written in the “AL status code” register by the slave.

The following codes are implemented on the bus coupler:

AL Status Code [hex]	Meaning
0000	No error: There is no error.
0011	Invalid requested state change: The state change requested is invalid.
0012	Unknown requested state: The state requested does not exist.
0016	Invalid mailbox configuration: Error when configuring the SyncManager for mailbox communication.
001B	SyncManager watchdog: The hardware watchdog which monitors the SyncManager process data has expired.
001D	Invalid output configuration: Error in the SyncManager configuration for output process data.
001E	Invalid input configuration: Error in the SyncManager configuration for input process data.
0028	SyncMode not supported: There is no module in the NI Remote I/O system that supports local bus synchronization.

Emergency Messages

Emergency messages are an unverified service based on CoE. As such, all errors can be indicated to the master by the slave, taking the form of messages which are specified in ETG.1000.6.

Detail of Remote I/O bus and I/O errors on a CoE emergency message:

CoE emergency message	2 bytes	1 byte	5 bytes			
	Error code	Error reg	Data			
Remote I/O bus errors	2 bytes	1 byte	2 bytes	2 bytes		1 byte
	1000_{hex}	80_{hex}	Slot number	Error code		0
Remote I/O errors	2 bytes	1 byte	2 bytes	1 byte	1 byte	1 byte
	Error code	80_{hex}	Slot number	Location	Priority	0

Table 144. CoE Emergency Message

Error Code (hex)	Meaning
00xx	Error reset or no error
10xx	Generic error
20xx	Current
21xx	Current, device input side
22xx	Current inside the device
23xx	Current, device output side
30xx	Voltage
31xx	Mains voltage
32xx	Voltage inside the device
33xx	Output voltage
40xx	Temperature
41xx	Ambient temperature
42xx	Device temperature
50xx	Device hardware
60xx	Device software
61xx	Internal software
62xx	User software
63xx	Data set

Table 144. CoE Emergency Message (Continued)

Error Code (hex)	Meaning
70xx	Additional modules
80xx	Monitoring
81xx	Communication
82xx	Protocol error
8210	PDO not processed due to length error
8220	PDO length exceeded
90xx	External error
A0xx	ESM transition error
F0xx	Additional functions
FFxx	Device specific

The errors which could occur in the Remote I/O system are separated into two groups with different message designs.

Remote I/O Errors

For the error codes for Remote I/O errors, please refer to the data sheets for the I/O modules.

Remote I/O Bus Errors

The error codes for Remote I/O bus errors have the emergency error code 1000_{hex} (generic error) as standard.

The Remote I/O error code is displayed in the “Emergency message” data area.

Note For the meaning of the error codes for the Remote I/O bus errors and Remote I/O errors, please refer to the *NI REM-11180 User Manual*.

Diagnosis History $10F3_{hex}$

The object $10F3_{hex}$ is implemented as a ring memory in Overwrite mode. The last 16 diagnostic messages are always stored; older messages are deleted.

The error codes of the Remote I/O bus and I/O errors are stored in the object’s diagnostic messages.

The following table shows the design of a diagnostic message from the Remote I/O bus coupler for EtherCAT® as well as detailing specific Remote I/O information.

Index (hex)	Subindex	Object Name	Data Type	Length	Rights	Meaning
10F3	—	Diagnosis history	Record	—	—	Diagnostic statistics
	01	Maximum messages	Unsigned 8	1	R	Maximum number of messages
	02	Newest message	Unsigned 8	1	R	Newest message
	03	Newest acknowledged message	Unsigned 8	1	R/W	Newest acknowledged message
	04	New message available	Bit	0.1	R	New message present
	05	Flags	Unsigned 16	2	R/W	Setting for the behavior of the object. See ETG.1020

Diagnostic Objects in the CoE Object Dictionary

The Diagnosis History Object enables a diagnosis station-wide.

For module-specific diagnostics, the module diagnostics objects (PDI object 0018_{hex}) are displayed in the CoE object dictionary of the bus coupler (CoE objects $A000_{hex}$ to $A3F0_{hex}$).