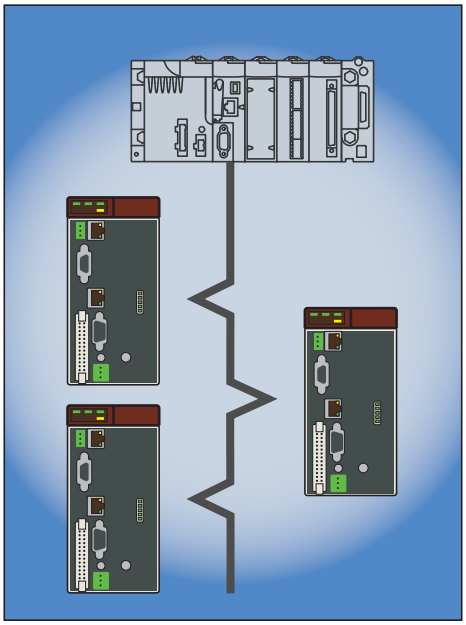
Lexium Controller

User’s manual

Retain for future use

PROFIBUS DP

LMC20A 1307



Schneider Electric

Contents

Important information

PLEASE NOTE

Please read these instructions carefully and examine the equipment in order to familiarize yourself with the device before installing, operating or carrying out any maintenance work on it.

The following special messages that you will come across in this document or on the device are designed to warn you about potential risks or draw your attention to information that will clarify or simplify a procedure.

The addition of this symbol to a "Danger" or "Warning" safety label indicates that there is an electrical risk that will result in injury if the instructions are not followed.

This is a safety warning symbol. It warns you of potential risks of injury. All safety messages that follow this symbol must be complied with in order to avoid any risk of injury or death.

⚠ DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, **will result in** death, serious injury or equipment damage.

⚠ WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, **can result in** death, serious injury or equipment damage.

⚠ CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, **can result in** injury or equipment damage.

PLEASE NOTE:

Only qualified staff are authorized to carry out maintenance work on electrical equipment. Schneider Electric accepts no responsibility for the consequences of using this device. This document does not constitute an instruction manual for inexperienced people.

Documentation structure

Installation Manual

This manual describes:
- How to install the controller
- How to connect the controller

Optional Graphic Display Terminal User's Manual

This manual describes:
- How to install the graphic display terminal
- How to connect the graphic display terminal
- How to program the controller via the graphic display terminal

Easy Motion - Programming Manual

Supplied preinstalled in the Lexium Controller, the application model associated with Easy Motion mode is a user-friendly tool that can be used for:
- Rapid axis configuration
- Use of Manual/Automatic mode
- Creating positioning tasks
- Editing cam profiles
- Backup and recovery of the machine parameters
- Diagnostics of the motion controller and the various axes

This programming manual also contains a table of the parameters that can be accessed via the communication protocols.

Motion Pro - Programming Manual

The Motion Pro Programming Manual is included in the software online help.
This online help describes:
- The software interface
- IEC 1131 programming
- The function libraries (standard functions, motion control functions, application functions)
- The Lexium controller configuration screens

Modbus, Ethernet, PROFIBUS DP, and DeviceNet manuals

These manuals describe:
- Connection to the bus or network
- Diagnostics
- Software setup
- The protocol communication services

Introduction

The purpose of this document is to help you use the PROFIBUS DPV1 bus.

Presentation

The PROFIBUS DP communication bus is used to connect a LMC20A1307 controller to a PROFIBUS DPV1 bus. The data exchanges permit full functionality of the Lexium Controller:

- %MW access
- Monitoring
- Diagnostics

The slave address is configured using switches

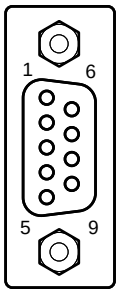
The speed of the PROFIBUS network is automatically detected by the card.

Connection to the bus

Connector pinout

The transmission interface conforms to the RS 485 standard and is electrically isolated from the Lexium Controller.

Female SUB-D connector.



Terminal	Description
1	not connected
2	not connected
3	RxD/TxD-N (Reception/Transmission -)
4	not connected
5	DGND (ground)
6	VP (5 volts)
7	not connected
8	RxD/TxD-P (Reception/Transmission +)
9	not connected

Connection accessories

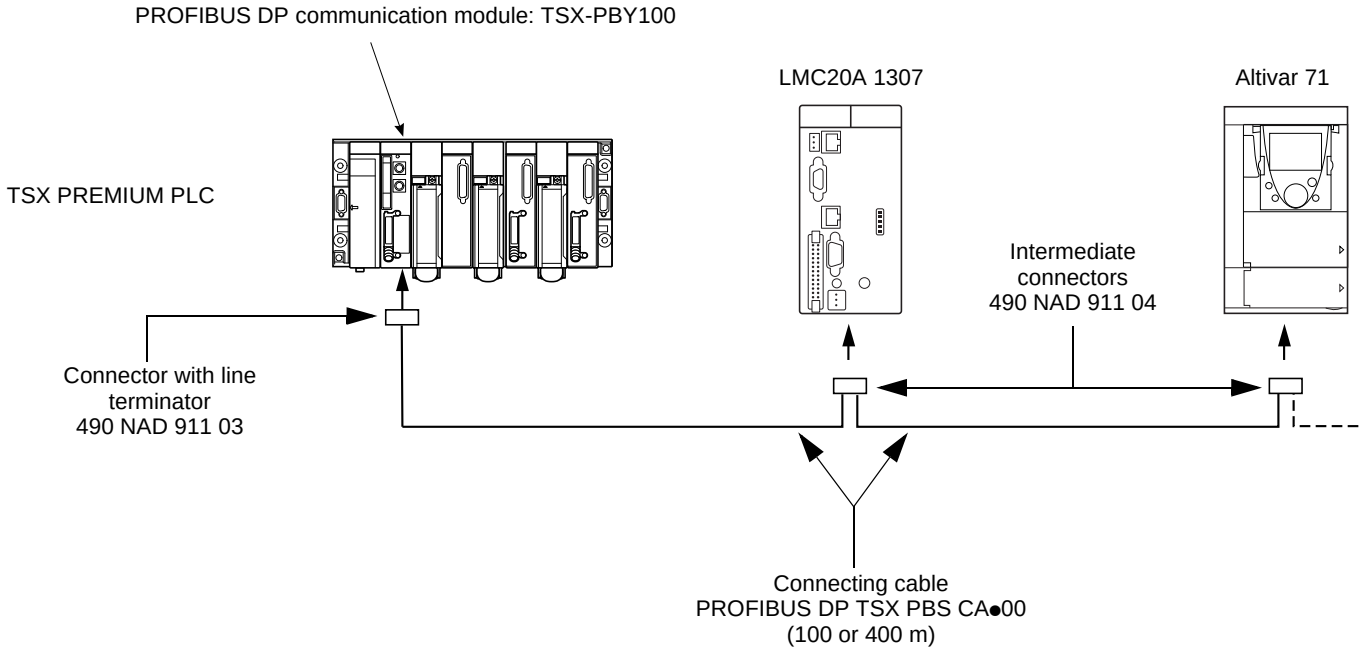
PROFIBUS DP bus connection elements

Description	Use	Reference
Connectors	With line terminator	490 NAD 911 03
	Intermediate connection	490 NAD 911 04
	Intermediate connection and terminal port	490 NAD 911 05

PROFIBUS DP bus connection cables

Description	Length	Reference
PROFIBUS DP connection cables	100 m	TSX PBS CA 100
	400 m	TSX PBS CA 400

Example of connection:



Recommendations

- The user can select the data rate, ranging from 9.6 kbps to 12 Mbps. This selection, made when starting up the network, applies to all the bus subscribers.
- The maximum segment length is in inverse proportion to the data rate.

Data rate (kbps)	9.6	19.2	93.75	187.5	500	1500	3000	6000	12000
Distance/segment (m)	1200	1200	1200	1000	400	200	100	100	100

Repeaters can be used to cover greater distances.

- The bus ends with a line terminator at each end of each segment.
- Do not connect more than 32 stations per segment without a repeater, or more than 127 with a repeater.
- Keep the bus away from the power cables (clearance of at least 30 cm).
- If it is necessary for the bus to cross the power cables, be sure they cross at right angles.

Configuring the switches

The address of the Lexium Controller and the selection of the operating mode are only taken into account the next time the Lexium Controller is turned on.

Coding the Lexium Controller address

A Lexium Controller is identified on the bus by its address, coded between 0 and 126.
The address corresponds to the binary number given by position 0 (up/OFF) or 1 (down/ON) of the 7 switches.

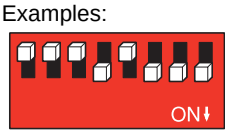
The least significant bits are on the right.

The table below indicates the positions of the switches for all configurable addresses:

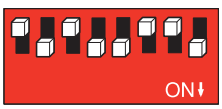
Addr.	Switches	Addr.	Switches	Addr.	Switches	Addr.	Switches
0 (1)	0000 0000	32	0010 0000	64	0100 0000	96	0110 0000
1 (1)	0000 0001	33	0010 0001	65	0100 0001	97	0110 0001
2	0000 0010	34	0010 0010	66	0100 0010	98	0110 0010
3	0000 0011	35	0010 0011	67	0100 0011	99	0110 0011
4	0000 0100	36	0010 0100	68	0100 0100	100	0110 0100
5	0000 0101	37	0010 0101	69	0100 0101	101	0110 0101
6	0000 0110	38	0010 0110	70	0100 0110	102	0110 0110
7	0000 0111	39	0010 0111	71	0100 0111	103	0110 0111
8	0000 1000	40	0010 1000	72	0100 1000	104	0110 1000
9	0000 1001	41	0010 1001	73	0100 1001	105	0110 1001
10	0000 1010	42	0010 1010	74	0100 1010	106	0110 1010
11	0000 1011	43	0010 1011	75	0100 1011	107	0110 1011
12	0000 1100	44	0010 1100	76	0100 1100	108	0110 1100
13	0000 1101	45	0010 1101	77	0100 1101	109	0110 1101
14	0000 1110	46	0010 1110	78	0100 1110	110	0110 1110
15	0000 1111	47	0010 1111	79	0100 1111	111	0110 1111
16	0001 0000	48	0011 0000	80	0101 0000	112	0111 0000
17	0001 0001	49	0011 0001	81	0101 0001	113	0111 0001
18	0001 0010	50	0011 0010	82	0101 0010	114	0111 0010
19	0001 0011	51	0011 0011	83	0101 0011	115	0111 0011
20	0001 0100	52	0011 0100	84	0101 0100	116	0111 0100
21	0001 0101	53	0011 0101	85	0101 0101	117	0111 0101
22	0001 0110	54	0011 0110	86	0101 0110	118	0111 0110
23	0001 0111	55	0011 0111	87	0101 0111	119	0111 0111
24	0001 1000	56	0011 1000	88	0101 1000	120	0111 1000
25	0001 1001	57	0011 1001	89	0101 1001	121	0111 1001
26	0001 1010	58	0011 1010	90	0101 1010	122	0111 1010
27	0001 1011	59	0011 1011	91	0101 1011	123	0111 1011
28	0001 1100	60	0011 1100	92	0101 1100	124	0111 1100
29	0001 1101	61	0011 1101	93	0101 1101	125	0111 1101
30	0001 1110	62	0011 1110	94	0101 1110	126 (2)	0111 1110
31	0001 1111	63	0011 1111	95	0101 1111		0111 1111

(1) Addresses 0 and 1 are usually reserved for the PROFIBUS-DP masters and must not be used to configure the PROFIBUS DP address on a Lexium Controller.
(2) We do not recommend using address 126, as it is not compatible with the SSA (Set Slave Address) service and with some network configuration software (Sycon, etc).

Examples:



Address 23



Address 89

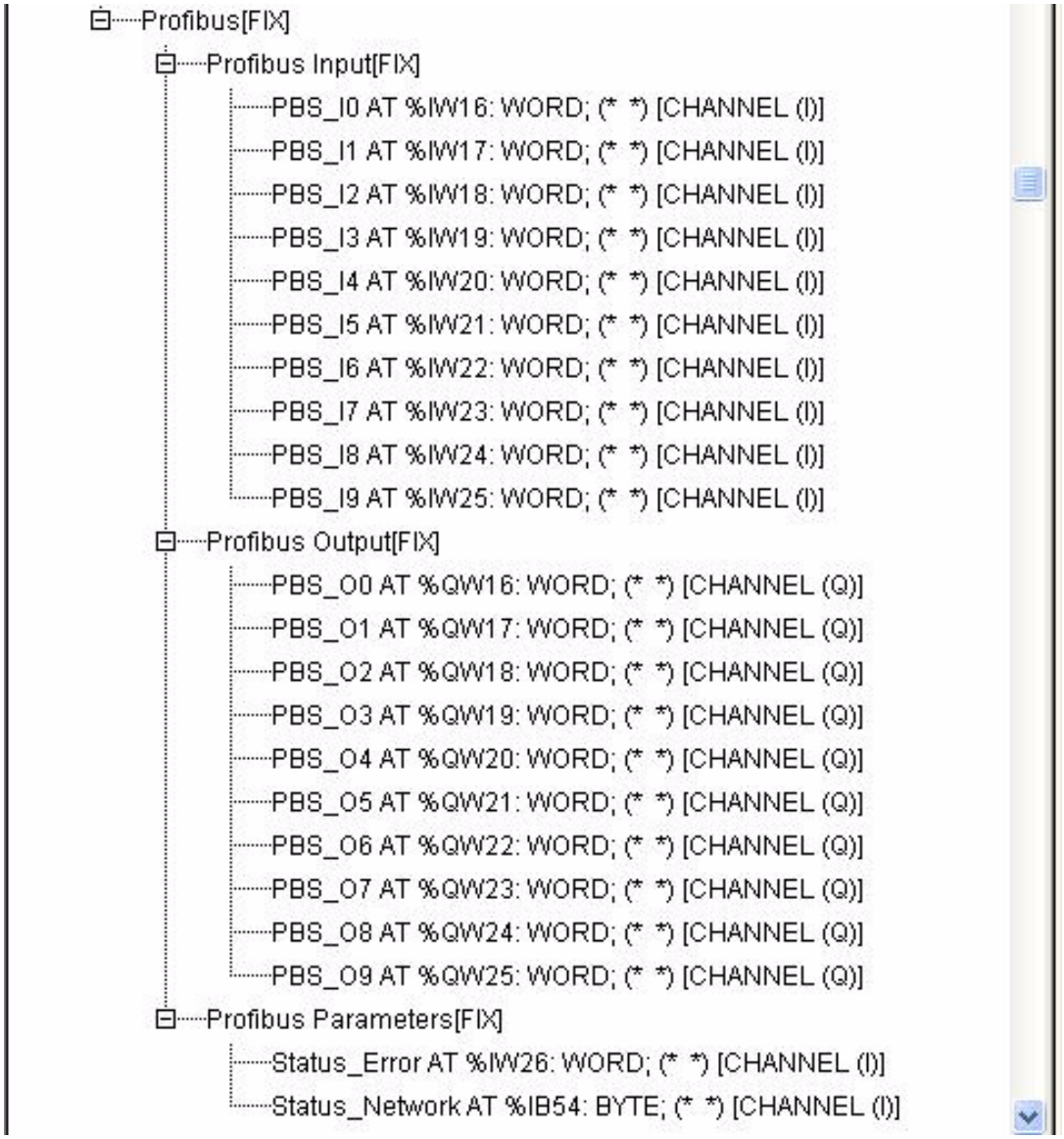
Configuring the control signals

The LMC20A1307 can be used to access the following functions:

- Control of the Lexium Controller on PROFIBUS DP
- Cyclic parameter exchanges
- %MW access

To do this:
- Go to Motion Pro/CoDeSys
- Tab ➡ Resource
- Click on PLC configuration
- Go to PROFIBUS

The input words, output words and status words can be accessed via Motion Pro/ CoDeSys and are given by:



Configuring PZDs (communication scanner)

The program freely accesses PZDs.
The 10 periodic output variables are assigned by means of parameters %QW33 to %QW42.

Assigning the parameter name PROFIBUS variable

Access to the scanner parameters depends on the choice of PPO

[Scan. Out1 address] (%QW33) PZD1
[Scan. Out2 address] (%QW34) PZD2
[Scan. Out3 address] (%QW35) PZD3
[Scan. Out4 address] (%QW36) PZD4
[Scan. Out5 address] (%QW37) PZD5
[Scan. Out6 address] (%QW38) PZD6
[Scan. Out7 address] (%QW39) PZD7
[Scan. Out8 address] (%QW40) PZD8
[Scan. Out9 address] (%QW41) PZD9
[Scan. Out10 address] (%QW42) PZD10

The 10 periodic input variables are assigned by means of parameters %IW16 to %IW25.

Assigning the parameter name PROFIBUS variable

Access to the scanner parameters depends on the choice of PPO

[Scan. In1 address] (%IW16) PZD1
[Scan. In2 address] (%IW17) PZD2
[Scan. In3 address] (%IW18) PZD3
[Scan. In4 address] (%IW19) PZD4
[Scan. In5 address] (%IW20) PZD5
[Scan. In6 address] (%IW21) PZD6
[Scan. In7 address] (%IW22) PZD7
[Scan. In8 address] (%IW23) PZD8
[Scan. In9 address] (%IW24) PZD9
[Scan. In10 address] (%IW25) PZD10

Configuring communication fault management

A PROFIBUS DP communication fault triggers a data bit in the Lexium Controller status word.

When a PROFIBUS DP communication fault occurs, the Lexium Controller program must take account of this event and react according to the requirements of the application (stop, maintain, emergency, etc).
The response of the Lexium Controller in the event of a PROFIBUS DP communication fault can be managed.
Information on the PROFIBUS communication status is available so that the Motion Pro/CoDeSys program can manage and detect these faults.

Communication can be divided into 2 types. Recoverable faults and non-recoverable faults occurring following serious electronic problems.

Recoverable communication fault

A recoverable fault is generated when one of the following events occurs:
- Receipt of a SET_PRM/CHK_CFG request that is not OK
- Time out on the output data reception watchdog

The user is informed of the fault via the **STATUS_Error** parameter word on the high order byte.

Value	Description of parameter values
0	No fault
1	Time out on the reception of periodic variables destined for the Lexium Controller. This time out can be set by the network configuration software.
2	Identification fault between the Lexium Controller PROFIBUS card and the PROFIBUS master.
3	Initialization fault on the Lexium Controller PROFIBUS card (hardware problem).

Non-recoverable communication fault

A non-recoverable fault is generated when one of the following events occurs:
- Dialog fault between the PROFIBUS communication module and the Lexium Motion Controller CPU
- Hardware fault if it can be tested.

The user is informed of the fault via the **STATUS_Error** parameter word on the low order byte.

Value	Description of parameter values
0	No fault
1	Loss of Lexium Controller internal communication
2	Hardware fault detected
3	Error in the EEPROM checksum
4	Faulty EEPROM
5	Faulty Flash memory
6	Faulty RAM memory
7	Faulty NVRAM memory
8	Faulty analog input
9	Faulty analog output
10	Faulty logic input
11	Faulty logic output
101	Unknown card
102	Exchange problem on the Lexium Controller internal bus
103	Time out on the Lexium Controller internal bus (500 ms)

The values are:
- **//→0 DPS2_DP_STATE_WAIT_PRM**
- **//→1 DPS2_DP_STATE_WAIT_CFG**
- **//→2 DPS2_DP_STATE_DATA_EX**
- **//→3 DPS2_DP_STATE_ERROR**

Controlling the address and speed of the bus

The PROFIBUS configuration parameters can be displayed using the Motion Pro/CoDeSys software via the PLC_Browser commands. The command is as follows: **optioncardinf**

The information given by the **optioncardinf** command in the PLC browser is (by way of example + other information is possible):

- **Soft Version**: Gives information on the software version of the PROFIBUS communication interface integrated in the Lexium Controller
- **Address**: Address configured on the Lexium Controller switches on the PROFIBUS bus
- **BaudRate**: Bus speed set by the PROFIBUS DP master
- **PPO Type**: Gives the PPO configured for PROFIBUS communication between the Lexium Controller and the PROFIBUS master PLC

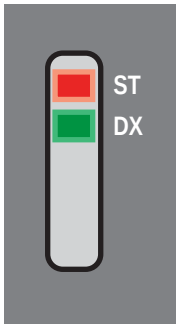
These parameters cannot be modified.

PROFIBUS Configuration Info

Soft Version: 1.1ie1
Varies according to the version of the software
Hard Version: 1.0
BaudRate: 0 → Unknown
28 → 9600 Bauds
32 → 19200 Bauds
37 → 45450 Bauds
42 → 93750 Bauds
54 → 187500 Bauds
68 → 500000 Bauds
80 → 1.5 MBauds
82 → 3 MBauds
83 → 6 MBauds
88 → 12 MBauds
Address: 7
From 1 to 125
PPO Type: 0 Unknown
1 → Periodic(10-10) Aperiodic(4-4)
2 → Periodic(10-10)
3 → Periodic(2-2)
4 → Periodic(6-6)
Status Error: 0 No Error
1 → Time out on the reception of periodic variables
2 → Identification Error
Status Network: 0 Wait Parameters
1 → Wait Configuration
2 → Data Exchanges
3 → Error
End of PROFIBUS Configuration Info

Diagnostics

LEDs



The PROFIBUS DP card has two LEDs, **ST** and **DX**, visible through the window on the cover of the Lexium Controller:

- The status of the PROFIBUS DP card is indicated by the red **ST** (status) LED.
- The status of the PROFIBUS DP communication link is indicated by the green **DX** (data exchange) LED.

The table below gives the meanings of the various states of these two LEDs:

Red ST LED	Green DX LED	Meaning	Corrective actions in the event of malfunction
⊗		The card has been configured and its parameters set correctly by the master.	
✳		The card is in Idle state, awaiting configuration.	Enter a value between 1 and 126 using the switches.
✳		The card is in the following state: Wait_Prm or Wait_Cfg.	Check the connection to the PROFIBUS DP bus, then start up the PLC. If the Lexium Controller has a communication card fault, reset it.
●		The card is in fault mode.	Turn off and then on again. If the problem persists, replace the Lexium Controller.
	●	The card is in "data exchange" state, and error-free data exchange is taking place.	
	⊗	No communication on the bus, no data being exchanged.	Check the connection to the PROFIBUS DP bus, start up the PLC.

LED states

⊗	LED off	✳	Slow flashing (0.5 s)
●	LED on	✳	Quick flashing (0.1 s)

PROFIBUS DPv1 protocol

Data is exchanged according to the master-slave principle.

Only the master can initialize communication. The slaves behave like servers, responding to requests from masters.

Several masters can coexist on the same bus. In this case, the slave I/O can be read by all the masters.

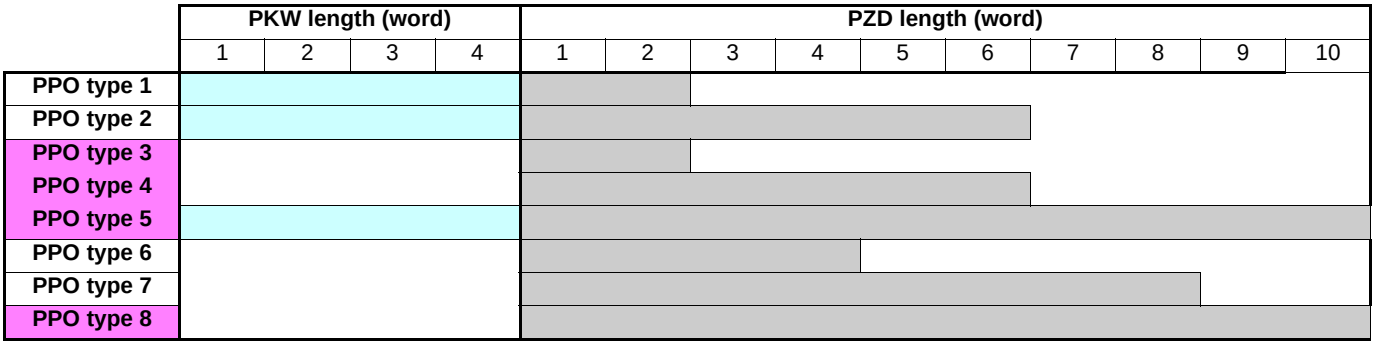
However, only one master has write access to the outputs. The number of data items exchanged is defined at the time of configuration.

A GSD file contains the configuration data for the Lexium Controller using PROFIBUS DPv1 (TELE0AAF.gsd).

This file is used by the PLC during the configuration phases.

There is one GSD file for the whole Lexium Controller range. It does not describe the parameters of the Lexium Controller, just the communication data. This file is on the CD-ROM supplied with the Lexium Controller.

The PROFIBUS DPv1 card for the Lexium Controller supports types 3, 4, 5 and 8 PPO format (Parameter-Process Data-Object) cyclic frames.



PPO cyclic frames contain the periodic variables that are used for 2 types of service:
- I/O exchanges (PZD)
- Aperiodic exchanges (PKW) for parameter setting, configuration and diagnostics

PKW aperiodic exchanges are included in the cyclic frames and do not require special frames. An aperiodic exchange is used to read or write a parameter.

Software setup of DPv1 messaging

Several types of DPv1 master can currently be used:
- Some masters require the exclusive use of slot 1, which requires an **indirect access mechanism**.
- Others allow the data to be accessed directly using **direct access.**

Indirect access (use of SLOT 1 only)

To use PROFIBUS DPv1 messaging the following sequence must be used:

Step 1: The PROFIBUS DPv1 master must firstly give the slave the modbus offset of the parameter to be read or written:

	Function	Slot	Index	Length	Data	Data
	0x5F	0x01	0xE9	0x02	Offset	Offset
Example with ACC (offset 9001)	0x5F	0x01	0xE9	0x02	**0x2329**	

Step 2 (read): The PROFIBUS DPv1 master must give the length to be read starting from the offset indicated in step 1:

	Function	Slot	Index	Length	Data	Data
	0x5E	0x01	0xEA	<0x3C		
Example with ACC (length 1 word: length = 0x2 bytes)	0x5E	0x01	0xEA	**0x02**		

The response to this request contains the data to be read.

Step 2 (write): The PROFIBUS DPv1 master must give the value to be written at the offset indicated in step 1:

	Function	Slot	Index	Length	Data	Data
	0x5F	0x01	0xEA	0x02	Value	Value
Example with ACC (write at 1.6 s)	0x5F	0x01	0xEA	**0x02**	**0x0010**	

To check what offset has been configured, it is possible to interrogate the slave:

Function	Slot	Index	Length	Data	Data
0x5E	0x01	0xE9	0x02	Offset	Offset

Direct access (using the SLOT INDEX)

Direct access is available from slot 2 on:

Read

	Function	MSB slot	LSB index	Length	Data	Data
Example with ACC (offset 9001 = Ox2329)	0x5E	0x23	0x29	0x02		

The response to this request contains the data to be read:

	Function	MSB slot	LSB index	Length	Data	Data
Value read	0x5E	0x23	0x29	0x02	**Value**	

Write

	Function	MSB slot	LSB index	Length	Data	Data
Example with ACC (offset 9001 = Ox2329)	0x5F	0x23	0x29	0x04	**0x0011**	

Irrespective of the type of access used (direct or indirect)

Read report:

	Function	Slot	Index	Length	Data	Data
	0xDF	0x80	**0xXX**	**0xYY**	0	

Write report:

	Function	Slot	Index	Length	Data	Data
	0xDE	0x80	**0xXX**	**0xYY**	0	

With error types:

0xXX - 0xYY	**Type of error**	**Meaning**
0xC2 - 0x00	Resource	SAP not available (in use)
0xB7 - 0x00	Access	Incorrect length (= 0 or > 60)
0xA0 - 0x00	Application	Read failed (time out, etc)

Output PZDs

The first eight bytes contain an aperiodic request (PKW) to write or read a parameter.

1	2	3	4	5	6	7	8	9	10	11	12	13	14
PKW								PZD1		PZD2		PZD3	
PKE		0	R/W	PWE				%QW33		%QW34		%QW35	

15	16	17	18	19	20	21	22	23	24	25	26	27	28
PZD4		PZD5		PZD6		PZD7		PZD8		PZD9		PZD10	
%QW36		%QW37		%QW38		%QW39		%QW40		%QW41		%QW42	

The 20 other bytes contain the PZD outputs

PKW request	
PKE	Parameter logic address
RIW	Request code: 0: No request 1: Read 2: Write
PWE	For a read request: Not used For a write request: Parameter value

Input PZDs

The first eight bytes contain the response (PKW) to the read/write request.

The 20 other bytes contain the PZD inputs (in read mode).

1	2	3	4	5	6	7	8	9	10	11	12	13	14
PKW								PZD1		PZD2		PZD3	
PKE		0	R/W/N	PWE				%IW16		%IW17		%IW18	

15	16	17	18	19	20	21	22	23	24	25	26	27	28
PZD4		PZD5		PZD6		PZD7		PZD8		PZD9		PZD10	
%IW19		%IW20		%IW21		%IW22		%IW23		%IW24		%IW25	

PKW request	
PKE	Parameter logic address
R/W/N	Response code: 0: No request 1: Successful read report 2: Successful write report 7: Error report
PWE	For a successful request: Parameter value For an incorrect request: 0: Incorrect address 1: Write access denied

PKW aperiodic service

The PKW service, consisting of PKE, R/W, R/W/N, and PWE, enables %MW aperiodic access to the Lexium Controller parameters in read and write mode.

Output PKWs

PKE

Parameter logic address

R/W

0: No request
1: Read
2: Write

One-off read and write requests can be triggered continuously while R/W equals 1 or 2.

PWE

For a write operation: Value to be written

Input PKWs

PKE

Copies the output PKE value

R/W/N

0: No request
1: Read operation correct
2: Write operation correct
7: Read or write error

PWE

- If correct read operation: Parameter value. This can be limited by the Lexium Controller if the maximum value is exceeded by the write operation.
- If correct write operation: Value of the write PWE.
- If there is an error:
  0: Incorrect address
  1: Write operation refused

Note:
The parameters in the output PZDs must not be changed by the PKW service.
Parameters linked to output PZDs must not be changed by the PKW service.

Examples of PKW aperiodic exchanges

Example of aperiodic write operation: Parameter %Mw9001 (address 9001) = 10 (values in hexadecimal).

1	2	3	4	5	6	7	8	
23	29	00	02	00	00	00	64	etc.

%MW9001 = 10

Write request

Address 9001 = 2329h

The positive response is identical to the aperiodic part of the write request (bytes 1 to 8).

Example of negative response:

1	2	3	4	5	6	7	8	
23	29	00	07	00	00	00	0	etc.

0 (incorrect address)

Negative response