

# PROFIBUS Attachment

## User's manual





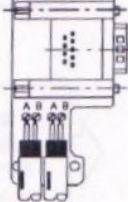
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Following the standards regarding the communication profile for drives (PROFIDrive), the Profibus message is divided into two independent parts: parametrization data and process data. This makes it possible to work at different speeds on two types of data. The card and the Profibus are connected by means of a DB9 female connector pinned in accordance with the Profibus standard:

Scelta preferenziale: 9 pin D-sub



| Pin n. | Name   | Description                 |
|--------|--------|-----------------------------|
| 1      | SHIELD | Protection shield           |
| 2      |        |                             |
| 3      | A      | Positive Rx/Tx data         |
| 4      | DE     | Control signal for repeater |
| 5      | GNDISO | 0V power                    |
| 6      | +5VISO | Outgoing power +5V          |
| 7      |        |                             |
| 8      | B      | Negative Rx/Tx data         |
| 9      |        |                             |

The C64 connection makes it possible to enable either the old management which is compatible with the OPD line (C64=2), or the new management (C64=1) allowing for greater flexibility.

## 1 OLD MANAGEMENT (C64=2)

With this system, the process part has to be set up using the “setup data” variable choosing between five different possibilities; the first two only require a 2-word exchange, the others 6 words. The drive parametrization component is always included and it also allows for the process part configuration.

### 1.1 APPLICATION CONFIGURATION

#### 1.1.1 Node Configuration

The Profibus node number is the same as that of the serial slave which is set on the drive. To change the node number:

- Set the parameter P92: drive number.
- Save the data on FLASH (C63=1).
- Switch the drive off and then on again.

Please refer to the drive user manual for parameter matching and how to save the parameters on FLASH.

| Name | Description           | Range | Default |
|------|-----------------------|-------|---------|
| P92  | Profibus node address | 1÷255 | 1       |

The converter, seen as the slave Profibus node, is able to automatically search for the transmission speed of the Profibus master among the values shown in the table; each speed also includes an indication of the maximum length of each segment in the Profibus network:

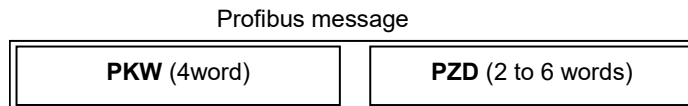
|        |         |          |          |          |        |        |       |       |       |
|--------|---------|----------|----------|----------|--------|--------|-------|-------|-------|
| 9,6kBd | 19,2kBd | 45,45kBd | 93,75kBd | 187,5kBd | 500kBd | 1,5MBd | 3 MBd | 6 MBd | 12MBd |
| 1200 m | 1200 m  | 1200 m   | 1200 m   | 1000 m   | 400 m  | 200 m  | 200 m | 200 m | 100 m |

## 1.2 MANAGED SERVICES

A cyclical exchange of data has been implemented based on a specific Profibus message according to the indications regarding the standard communication profile for PROFIDrive.

### 1.2.1 Profibus Message Description

The profibus message is sent cyclically from the master to the drive.  
The request to the drive consists of two parts:



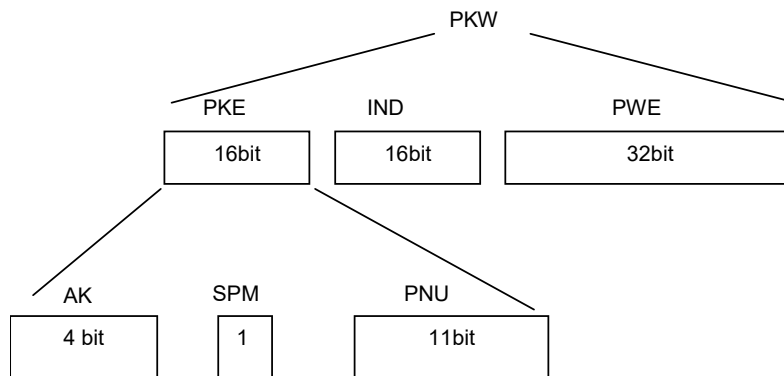
- 1) PKW : parametrization data
- 2) PZD : process data

The response from the drive to the master is composed in the same way.  
The PZD part can be chosen dynamically between various configurations (see paragraph below).

### 1.2.2 Parametrization Data: PKW

The PKW message part has a fixed length (4 words), and makes it possible to change the drive parameters. If the application does not require any parameter change, it is sufficient to set the field AK = 0 (No Task). The other fields are automatically disregarded.

The PKW message is composed as follows:



The following description includes all the functions and parameter types allowed by the OPEN DRIVE series.

## AK

The AK field contains the operation to be performed.  
Valid values for the request from the master to the drive:

| AK | Description         |
|----|---------------------|
| 0  | No task             |
| 2  | Word reading        |
| 3  | Double word reading |
| 5  | Word writing        |
| 6  | Double word writing |

Valid values for the request from the drive to the master:

| AK | Description           |
|----|-----------------------|
| 0  | No task               |
| 2  | Word reading          |
| 3  | Double word reading   |
| 5  | Word writing          |
| 6  | Double word writing   |
| 14 | Operation not allowed |

If the drive responds with a code **14** (operation not allowed), the PWE field also includes an error code:

| PWE | Description                   |
|-----|-------------------------------|
| 4   | Non-existent parameter        |
| 5   | Type of operation not allowed |

## PNU

The PNU field contains the type of parameter involved. For parameter descriptions, please refer to the control core bundle. The following table shows the values of the AK and PNU fields of the profibus message for reading and writing operations:

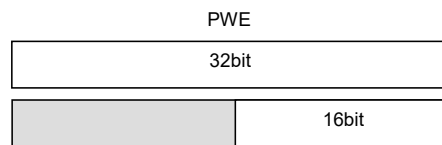
| Description   | bit no. | Read (AK) | Write (AK) | PNU |
|---------------|---------|-----------|------------|-----|
| Parameters P  | 16 o 32 | 2         | 5          | 1   |
| Connections C | 16      | 2         | 5          | 2   |
| Internal d    | 16 o 32 | 2         | -          | 3   |
| Alarms A      | 16      | 2         | -          | 4   |
| Inputs I      | 16      | 2         | 5          | 5   |
| Outputs O     | 16      | 2         | -          | 6   |
| data setup    | 16      | 2         | 5          | 10  |

## IND

The value of the IND field is the order number of the size selected in the case of Parameters P, Connections C and internal sizes d. For alarms A the field IND is disregarded, if the selected PNU = 4, the response will be a 16-bit response where the bit by bit logic status matches the status of the corresponding alarm. For logic inputs I and logic outputs O, the bit by bit correspondence applies and the IND field can only have the values 0 and 1 to select the more or less significant 16-bit words. For a description of all the internal sizes, please refer to the control core bundle.

## PWE

The PWE field contains the values of the size selected. For a description of all the internal sizes and their allowed range value, please refer to the control core bundle. The fields within the 32 bits are aligned as follows:

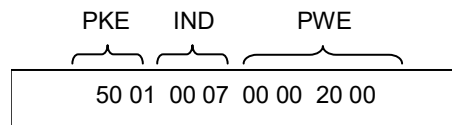


### Examples:

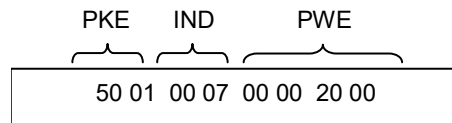
#### Example no.1: P7 writing = 50%

| field | decimal value                    | hexadecimal value | Description    |
|-------|----------------------------------|-------------------|----------------|
| AK    | = 5                              | = 05H             | (word writing) |
| PNU   | = 1                              | = 01H             | (parameter P)  |
| IND   | = 7                              | = 00 07H          |                |
| PWE   | = $16383 \times 50 / 100 = 8192$ | = 00 00 2000 H    |                |

Request MS -> SL:



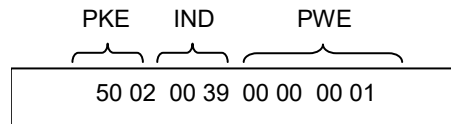
Response SL -> MS:



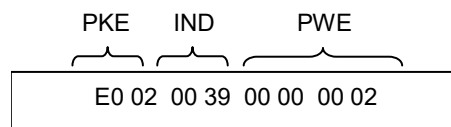
### Example no.2: C57 writing =1

| Field | dec. value | hexadec. Value | Description    |
|-------|------------|----------------|----------------|
| AK    | = 5        | = 05H          | (word writing) |
| PNU   | = 2        | = 02H          | (connection C) |
| IND   | = 57       | = 00 39H       |                |
| PWE   | = 1        | = 00 00 00 01H |                |

Request MS -> SL:



Response SL -> MS:

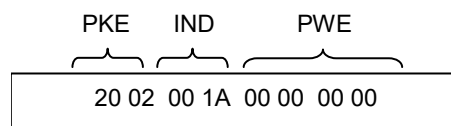


The drive responds with a 0EH code (operation not allowed) because the connection C57 is key-protected (PWE = 02). The key P60=95 has to be set. Connection C57 remains not set.

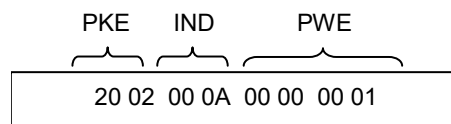
### Example no.3: C26 reading

| Field | dec. value | hexadec. value | Description    |
|-------|------------|----------------|----------------|
| AK    | = 2        | = 02H          | (word reading) |
| PNU   | = 2        | = 02H          | (connection C) |
| IND   | = 26       | = 1AH          |                |

Request MS -> SL:



Response SL -> MS:

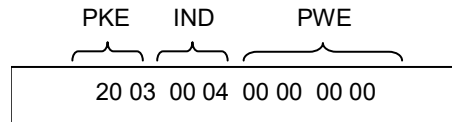


Hence the connection C26 = 1

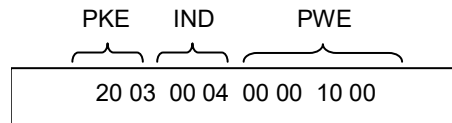
#### Example no.4: d4 reading (rotation speed)

| Field | dec. value | hexadec. value | Description       |
|-------|------------|----------------|-------------------|
| AK    | = 2        | = 02H          | (word reading)    |
| PNU   | = 3        | = 03H          | (d internal size) |
| IND   | = 4        | = 04H          |                   |

Request MS -> SL:



Response SL -> MS:



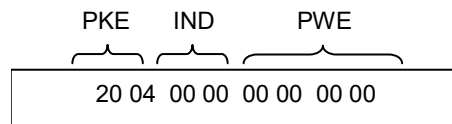
Therefore the value read is 1000H = 4096. The user manual shows that d4 is a full-scale 16383 percentage, hence

$$V6 = 4096 * 100 / 16383 = 25.0\%$$

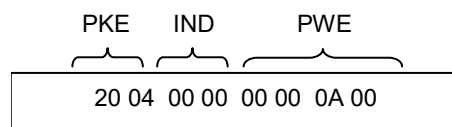
#### Example no.5: alarm status reading

| Field | dec. value | hexadec. value | Description    |
|-------|------------|----------------|----------------|
| AK    | = 2        | = 02H          | (word reading) |
| PNU   | = 4        | = 04H          | (alarms A)     |

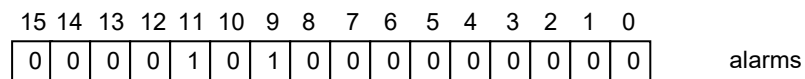
Request MS -> SL:



Response SL -> MS:



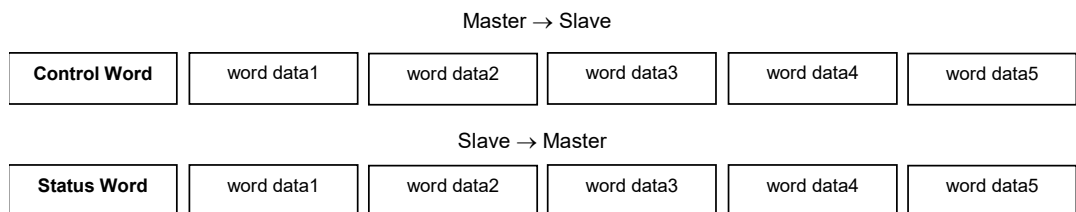
Therefore the value read is 0A00H: there are two active alarms, more specifically A9 and A11



### 1.2.3 Process Data: PZD

The PZD message part contains the data which have to be exchanged cyclically between master and slave: I/O, diagnostics, set point, measured speed, etc. these references are taken into consideration only if the connection "Abilitazione riferimenti da Fieldbus" ["Enable references from Fieldbus"] is on; in any case the converter responds with the current value of the sizes in question.

The control and status words are listed in the following table:



Control Word:

| bit | Description |
|-----|-------------|
| 0   | Input L.I.1 |
| 1   | Input L.I.2 |
| 2   | Input L.I.3 |
| 3   | Input L.I.4 |
| 4   | Input L.I.5 |
| 5   | Input L.I.6 |
| 6   | Input L.I.7 |
| 7   | Input L.I.8 |
| 8   | *** N.U.    |
| 9   | *** N.U.    |
| 10  | *** N.U.    |
| 11  | *** N.U.    |
| 12  | *** N.U.    |
| 13  | *** N.U.    |
| 14  | *** N.U.    |
| 15  | *** N.U.    |

Status Word:

| bit | description   |
|-----|---------------|
| 0   | Output L.O.1  |
| 1   | Output L.O.2  |
| 2   | Output L.O.3  |
| 3   | Output L.O.4  |
| 4   | *** N.U.      |
| 5   | *** N.U.      |
| 6   | *** N.U.      |
| 7   | *** N.U.      |
| 8   | Drive ready   |
| 9   | Drive running |
| 10  | *** N.U.      |
| 11  | *** N.U.      |
| 12  | *** N.U.      |
| 13  | *** N.U.      |
| 14  | *** N.U.      |
| 15  | *** N.U.      |

Note1: The RUNinput (di default L.I.4) is in series with that on the terminal board and of the serial (logic AND); the other inputs are read in parallel with those on the terminal board and of the serial (logic OR).

Note2: the meaning of the 8 logic inputs and of the 4 logic outputs is the same as the corresponding inputs/outputs available on the terminal board. Please refer to the control core bundle for an explanation of the meaning of the various inputs/outputs and their configuration.

For the DATA part it is possible to choose one of the following configurations:

|    |                |                  |                     |                            |
|----|----------------|------------------|---------------------|----------------------------|
| 0) | Speed (16bit)  |                  |                     |                            |
| 1) | Torque (16bit) |                  |                     |                            |
| 2) | Speed (16bit)  | Torque (16bit)   | N.U.                | Application inputs (32bit) |
| 3) | Speed (16bit)  | Position (32bit) |                     | Application inputs (32bit) |
| 4) | Speed (16bit)  | Torque (16bit)   | Max. torque (16bit) | Application inputs (32bit) |

The full-scales of the previous sizes are:

| Data         | Standardisation | Meaning                      |
|--------------|-----------------|------------------------------|
| Speed        | 16384           | = 100% maximum working speed |
| Torque       | 4095            | = 100% nominal motor torque  |
| Position     | 65536           | = 1 mechanical turn          |
| Torque limit | 4095            | = 100% nominal motor torque  |

In cases 0, 1 the DATA field is 2-byte long, in cases 2, 3, 4 it is 10-byte long.  
The data from the master are references, while the data sent by the drive are the current values of the corresponding adjusted sizes.

The configuration is chosen dynamically and it can be changed only with the motor in "Stop" position.  
To modify the chosen configuration, use the parameter part which contains the "**setup data**" (PNU = 10), setting to the required value (0÷4) the 0-byte index (AK = 5, IND = 0).

It is also possible to configure the same "setup data" variable using OPDExplorer and then save it in the permanent memory always using the command C63.

| Name           | Description            |
|----------------|------------------------|
| PDP_SETUP_DATA | Profibus DP setup data |

#### Application inputs

In the configurations from 2) to 4) with word data4 and word data5 it is possible to write the logic status of the inputs. With the same reading words, the standard 32 logic output status of the converter is available.

### 1.2.4 Profibus DP Device Description: GSD File

Each Profibus DP device is associated to a file with the extension GSD which specifies all its characteristics, such as allowed transmission speed, maximum message length, meaning of diagnostics messages ...

The GSD is used by the Profibus master to understand the slave characteristics.

The GSD file OPEN DRIVE is available: OpenDr.gsd

## 2 NEW MANAGEMENT (C64=2)

With this new management, the drive parametrization part may be present or not; for the rest it manages exactly the same services as the old version, plus possible access to the sizes in the Dictionary of CAN objects.

The process part can be configured completely up to 10 words incoming or outgoing. The mapping reference is the Dictionary of CAN objects in the drive: to select an internal size it is sufficient to indicate its index and subindex.

### 2.1 APPLICATION CONFIGURATION

#### 2.1.1 Node Configuration

Through OPDEplorer it is possible to set the following parameters:

| Name             | Description                                                                 |
|------------------|-----------------------------------------------------------------------------|
| NODE_SLAVE_ADDR  | number of the Profibus node                                                 |
| DATA_CONSISTANCE | Consistency of the data exchanged                                           |
| EN_ACYCLIC_DATA  | enable PKW parametrization or not                                           |
| EN_BIG_ENDIAN    | With this representation the first byte transmitted is the most significant |

And check the status of the profibus slave node

|                 |                                                                                                                                                                                  |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FLDB_ERROR_CODE | Fieldbus error code                                                                                                                                                              |
| FLDB_STATE      | Fieldbus node status:<br><br>WAIT_PRM = waiting for programming<br><br>WAIT_CFG = waiting for configuration<br><br>DATA_EX = data exchange in progress<br><br>ERROR = node error |

After completing the configuration:

- Save the data in FLASH (C63=1)
- Switch the drive off and then on again.

The converter, seen as the slave Profibus node, is able to automatically search for the transmission speed of the Profibus master among the values shown in the table; each speed also includes an indication of the maximum length of each segment in the Profibus network:

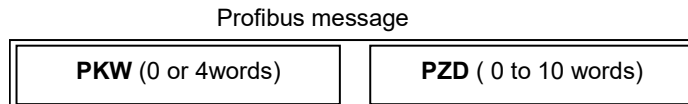
|        |         |          |          |          |        |        |       |       |       |
|--------|---------|----------|----------|----------|--------|--------|-------|-------|-------|
| 9,6kBd | 19,2kBd | 45,45kBd | 93,75kBd | 187,5kBd | 500kBd | 1,5MBd | 3 MBd | 6 MBd | 12MBd |
| 1200 m | 1200 m  | 1200 m   | 1200 m   | 1000 m   | 400 m  | 200 m  | 200 m | 200 m | 100 m |

## 2.2 MANAGED SERVICES

A cyclical exchange of data has been implemented based on a specific Profibus message according to the indications regarding the standard communication profile for PROFIDrive.

### 2.2.1 Profibus Message Description

The profibus message is sent cyclically from the master to the drive.  
The request to the drive consists of two parts:

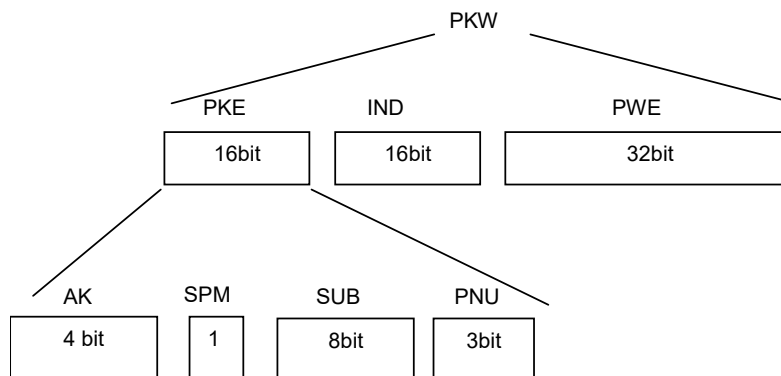


- 3) PKW: parametrization data
- 4) PZD: process data

The response from the drive to the master is composed in the same way.  
The PKW part may be enabled or not.  
The PZD part may be completely programmed in terms of word number and meaning.

### 2.2.2 Parametrization Data: PKW

The PKW message part has a fixed length (4 words), and makes it possible to change the drive parameters. If the application does not require any parameter change, it is sufficient to set the field AK = 0 (No Task). The other fields are automatically disregarded.  
The PKW message is composed as follows:



The following description includes all the functions and parameter types allowed by the OPEN DRIVE series.

## AK

The AK field contains the operation to be performed.  
Valid values for the request from the master to the drive:

| AK | Description         |
|----|---------------------|
| 0  | No task             |
| 2  | Word reading        |
| 3  | Double word reading |
| 5  | Word writing        |
| 6  | Double word writing |

Valid values for the response from the drive to the master:

| AK | Description           |
|----|-----------------------|
| 0  | No task               |
| 2  | Word reading          |
| 3  | Double word reading   |
| 5  | Word writing          |
| 6  | Double word writing   |
| 14 | Operation not allowed |

If the drive responds with a code **14** (operation not allowed), the PWE field specifies an error code:

| PWE | Description                   |
|-----|-------------------------------|
| 4   | Non-existent parameter        |
| 5   | Type of operation not allowed |

## PNU

The PNU field contains the type of parameter involved. For parameter descriptions, please refer to the control core bundle. The following table shows the values of the AK and PNU fields of the profibus message for reading and writing operations:

| Description    | bit no. | Read (AK) | Write (AK) | PNU |
|----------------|---------|-----------|------------|-----|
| Parameters P   | 16 o 32 | 2         | 5          | 1   |
| Connections C  | 16      | 2         | 5          | 2   |
| Internal d     | 16 o 32 | 2         | -          | 3   |
| Alarm A        | 16      | 2         | -          | 4   |
| Inputs I       | 16      | 2         | 5          | 5   |
| Outputs O      | 16      | 2         | -          | 6   |
| Dictionary CAN | 16      | 2         | 5          | 7   |

## IND

The value of the IND field is the serial number of the size selected in the case of Parameters P, of Connections C and internal sizes d.

For alarms A the field IND is disregarded, if the selected PNU = 4, the response will be a 16-bit response where the bit by bit logic status corresponds to the status of the corresponding alarm.

For logic inputs I and logic outputs O, the bit by bit correspondence applies and the IND field can only have the values 0 and 1 to select the more or less significant 16-bit words.

For a description of all the internal sizes, please refer to the control core bundle.

## SUB

If PNU is set = 7, in order to access required object in the Dictionary CAN it is necessary to set the index in the IND field and the subindex in the SUB field.

## PWE

The PWE field contains the selected size value.

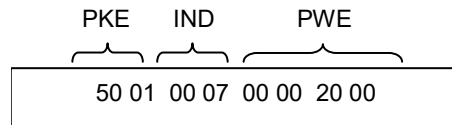
It is possible to send the most significant (Big-Endian) or the least significant (Little-Endian) byte first, using the configuration parameter "EN\_BIG\_ENDIAN" of OPDExplorer.

## Examples:

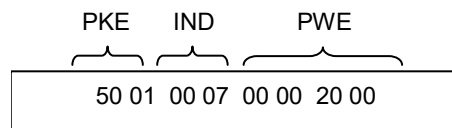
### Example no.1: P7 writing = 50%

| Field | decimal value                    | hexadecimal value | Description    |
|-------|----------------------------------|-------------------|----------------|
| AK    | = 5                              | = 05H             | (word writing) |
| PNU   | = 1                              | = 01H             | (parameter P)  |
| IND   | = 7                              | = 00 07H          |                |
| PWE   | = $16383 \times 50 / 100 = 8192$ | = 00 00 2000 H    |                |

Request MS -> SL:



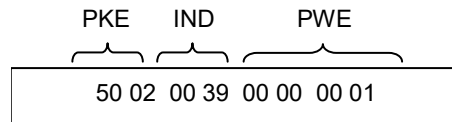
Response SL -> MS:



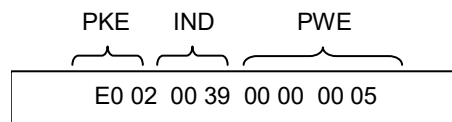
### Example no.2: C57 writing = 1 (enable radiator thermal probe management)

| Field | dec. value | hexadec. Value | Description    |
|-------|------------|----------------|----------------|
| AK    | = 5        | = 05H          | (word writing) |
| PNU   | = 2        | = 02H          | (connection C) |
| IND   | = 57       | = 00 39H       |                |
| PWE   | = 1        | = 00 00 00 01H |                |

Request MS -> SL:



Response SL -> MS:

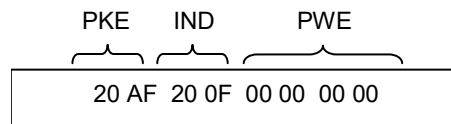


The drive responds with a 0EH code (operation not allowed) because the connection C57 is key-protected (PWE = 02). The key P60=95 has to be set.  
La connection C57 remains not set.

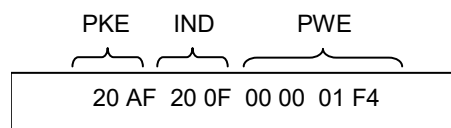
**Example no.3: reading of the rotation speed d21 from the CAN Dictionary (Index 0x200F, Sub=21)**

| Field | dec. value | hexadec. value | Description      |
|-------|------------|----------------|------------------|
| AK    | = 2        | = 02H          | (word reading)   |
| PNU   | = 7        | = 07H          | (CAN Dictionary) |
| IND   | = 8207     | = 200FH        | object Index     |
| SUB   | = 21       | = 15H          | object Subindex  |

Request MS -> SL:



Response SL -> MS:

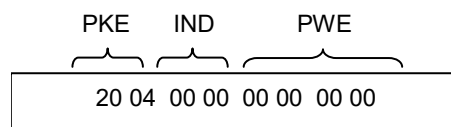


Therefore the read value is 1F4H = 500. The user manual shows that d21 is a direct value, so the speed is 500rpm.

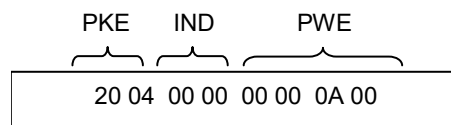
**Example no.4 : alarm status readings**

| Field | dec. value | hexadec. value | Description    |
|-------|------------|----------------|----------------|
| AK    | = 2        | = 02H          | (word reading) |
| PNU   | = 4        | = 04H          | (alarms A)     |

Request MS -> SL:



Response SL -> MS:



Therefore the read value is 0A00H: there are 2 active alarms, more specifically alarms A9 and A11

|    |    |    |    |    |    |   |   |   |   |   |   |   |   |   |   |        |
|----|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|--------|
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |        |
| 0  | 0  | 0  | 0  | 1  | 0  | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | alarms |

### 2.2.3 Process Data: PZD

The PZD message part contains the data which have to be exchanged cyclically between master and slave: I/O, diagnostics, set point, measured speed, etc. these references are taken into consideration only if the connection “Abilitazione riferimenti da Fieldbus” [“Enable references from Fieldbus”] is on. Through the configuration page of the OPDExplorer or by accessing the item 0x2027 in the CAN Dictionary through PKW, it is possible to select which and how many words to exchange, bearing in mind that the items that can be mapped are listed in the CAN Dictionary.

| Name          | Description                |
|---------------|----------------------------|
| RX0_INDEX     | Receive Object0 Index      |
| RX0_SUB_INDEX | Receive Object0 Sub-Index  |
| RX1_INDEX     | Receive Object1 Index      |
| RX1_SUB_INDEX | Receive Object1 Sub-Index  |
| .....         |                            |
| .....         |                            |
| RX9_INDEX     | Receive Object9 Index      |
| RX9_SUB_INDEX | Receive Object9 Sub-Index  |
| -----         |                            |
| TX0_INDEX     | Transmit Object0 Index     |
| TX0_SUB_INDEX | Transmit Object0 Sub-Index |
| TX1_INDEX     | Transmit Object1 Index     |
| TX1_SUB_INDEX | Transmit Object1 Sub-Index |
| .....         |                            |
| .....         |                            |
| TX9_INDEX     | Transmit Object9 Index     |
| TX9_SUB_INDEX | Transmit Object9 Sub-Index |

For the process area configuration:

- Programme the objects being received and transmitted by indicating the index and sub-index of the objects in the Dictionary CAN (the sub-index is the array index).
- Save the data in FLASH (C63=1).
- Switch the drive off and then on again.

After it has been turned on again, verify the mapping outcome by checking in the OPDExplorer the following internal sizes:

| Name           | Display              | Description                                                                      |
|----------------|----------------------|----------------------------------------------------------------------------------|
| MAP_ERROR_CODE | Ok                   | successful configuration                                                         |
|                | OBJ_NOTFOUND         | the object listed in the following MAP_ERROR_OBJ was not found in the dictionary |
|                | OBJ_NOTMAPPABLE      | the object listed in the following MAP_ERROR_OBJ is not mappable                 |
|                | OBJ_INVDATASIZE      | the object listed in the following MAP_ERROR_OBJ has sizes exceeding long        |
|                | OBJ_NOTWRITABLE      | the object listed in the following MAP_ERROR_OBJ is not writable                 |
|                | OBJ_NOTREADABLE      | the object listed in the following MAP_ERROR_OBJ is not readable                 |
|                | MAXRX_DATA           | Too many words to read (more than 10)                                            |
|                | MAXTX_DATA           | Too many words to write (more than 10)                                           |
| MAP_ERROR_OBJ  | Mapping Error Object |                                                                                  |

The following table shows the CAN Dictionary with the relevant sizes.  
At application level it is possible to extend the Dictionary objects.

## 2.2.4 Dictionary of Canopen Objects

The variables shown in bold are mappable in the process area.

| Index (hex) | Object | Type       | Name                        | Description                                       | Access          |
|-------------|--------|------------|-----------------------------|---------------------------------------------------|-----------------|
| 200D        | ARRAY  | INTEGER16  | Tab_par [200]               | Current parameter values                          | reading/writing |
| 200E        | ARRAY  | INTEGER16  | Tab_con [100]               | Current connection values                         | reading/writing |
| 200F        | ARRAY  | INTEGER16  | Tab_int [128]               | Current internal size values                      | reading         |
| 2010        | ARRAY  | INTEGER16  | Tab_inp_dig [32]            | Current values of standard input logic functions  | reading         |
| 2011        | ARRAY  | INTEGER16  | Tab_out_dig [32]            | Current values of standard output logic functions | reading         |
| 2012        | ARRAY  | INTEGER16  | Tab_osc [100]               | Current monitorable size values                   | reading         |
| 2013        | VAR    | UNSIGNED16 | ingressi                    | Logic 8 input status to terminal board            | reading         |
| 2014        | VAR    | UNSIGNED16 | ingressi_hw                 | Logic 3 input status from power                   | reading         |
| 2015        | VAR    | UNSIGNED16 | uscite_hw                   | Logic 4 digital output status                     | reading         |
| 2016        | VAR    | UNSIGNED32 | Out_dig_appl                | Application output function reading via fieldbus  | reading         |
| 2017        | VAR    | UNSIGNED16 | Stato                       | Converter variable status                         | reading         |
| 2018        | VAR    | UNSIGNED16 | allarmi                     | Converter alarm status                            | reading         |
| 2019        | VAR    | UNSIGNED16 | abilitazione_allarmi        | Converter alarm enabling word                     | reading         |
| 201A        | VAR    | INTEGER16  | f_fieldbus                  | Speed reference as % of n <sub>MAX</sub> in 16384 | reading/writing |
| 201B        | VAR    | INTEGER16  | Limit_fieldbus              | Torque limit as % of T <sub>nom</sub> in 4095     | reading/writing |
| 201C        | VAR    | INTEGER16  | trif_fieldbus               | Torque limit as % of T <sub>nom</sub> in 4095     | reading/writing |
| 201D        | VAR    | INTEGER16  | Theta_fieldbus              | Speed reference as impulses                       | reading/writing |
| 201E        | ARRAY  | INTEGER16  | Tab_dati_applicazione [100] | Available data area for application               | reading/writing |
| 201F        | VAR    | UNSIGNED32 | Inp_dig_field               | Input logic function writing via fieldbus         | writing         |
| 2020        | VAR    | UNSIGNED32 | Inp_dig                     | Input logic function reading via fieldbus         | reading/writing |
| 2021        | VAR    | UNSIGNED32 | Out_dig                     | Standard logic output reading via fieldbus        | reading         |
| 2022        | VAR    | UNSIGNED16 | Word_vuota                  | Unused word                                       | reading/writing |
| 2023        | VAR    | UNSIGNED32 | double_vuota                | Unused double word                                | reading/writing |
| 2025        | ARRAY  | INTEGER16  | Tab_codice_allarmi [16]     | Subcode table of active alarms                    | reading         |
| 2026        | VAR    | INTEGER32  | Quota_att                   | Current position                                  | reading         |
| 2027        | ARRAY  | UNSIGNED16 | tabProcessData              | Process variable mapping                          | reading/writing |

The content of some objects is shown more specifically below:

- Index 0x200F "Tab\_int" on the internal sizes (word)

| Name                | Description                                         | UM            | Scale  |
|---------------------|-----------------------------------------------------|---------------|--------|
| FW_REV              | D00 – Software version                              |               | 256    |
| ACTV_POW            | D01 – Active power generated                        | kW            | 16     |
| PRC_TOT_APP_SPD_REF | D02 – Speed reference before the ramps              | % MOT_SPD_MAX | 163.84 |
| PRC_END_SPD_REF     | D03 – Speed reference after the ramps               | % MOT_SPD_MAX | 163.84 |
| PRC_MOT_SPD         | D04 – Measured speed                                | % MOT_SPD_MAX | 163.84 |
| PRC_T_REF           | D05 – Torque request                                | % MOT_T_NOM   | 40.96  |
| PRC_IQ_REF          | D07 – Torque current request                        | % DRV_I_NOM   | 40.96  |
| PRC_ID_REF          | D08 – Reactive current request                      | % DRV_I_NOM   | 40.96  |
| V_REF               | D09 – Maximum voltage reference                     | % MOT_E_NOM   | 40.96  |
| PRC_APP_T_REF       | D10 – Torque request from application               | % MOT_T_NOM   | 40.96  |
| MOT_I               | D11 – Current module                                | A rms         | 16     |
| REF_FRQ_IN          | D12 – Input frequency                               | KHz           | 16     |
| EL_FRQ              | D13 – Electric size frequencies                     | Hz            | 16     |
| PRC_APP_FRQ_SPD_REF | D14 – Speed reference in frequency from application | % MOT_SPD_MAX | 163.84 |
| PRC_IQ              | D15 – Measured torque current                       | % DRV_I_NOM   | 40.96  |
| PRC_ID              | D16 – Measured reactive current                     | % DRV_I_NOM   | 40.96  |
| MOT_V               | D17 – Generated statoric voltage                    | V rms         | 16     |
| PRC_MOT_V           | D18 – Generated statoric voltage                    | % MOT_E_NOM   | 40.96  |
| MOD_INDEX           | D19 – Modulation index                              |               | 40.96  |
| PRC_VQ_REF          | D20 – Statoric voltage reference axis Q             | % DRV_E_NOM   | 40.96  |
| MOT_SPD             | D21 – Motor rotation speed                          | rpm           | 1      |
| PRC_VD_REF          | D22 – Statoric voltage reference axis D             | % DRV_E_NOM   | 40.96  |
| MOT_POS             | D23 – Current position on the turn                  | ±16384        | 1      |
| DC_BUS              | D24 – DC Bus voltage                                | V             | 16     |
| DRV_TEMP            | D25 – Radiator temperature                          | °C            | 16     |
| MOT_TEMP            | D26 – Motor temperature                             | °C            | 16     |
| PRC_DRV_I_THERM     | D28 – Motor thermal current                         | % soglia All  | 40.96  |
| PRC_DRV_I_MAX       | D29 – Current limit                                 | % DRV_I_NOM   | 40.96  |
| PRC_DRV_T_MAX       | D30 – Maximum positive torque                       | % MOT_T_NOM   | 40.96  |
| PRC_DRV_I_T_MAX     | D31 – Maximum torque from positive limit            | % MOT_T_NOM   | 40.96  |

|                   |                                                                      |               |        |
|-------------------|----------------------------------------------------------------------|---------------|--------|
| PRC_APP_T_MAX     | D32 – Maximum torque from application                                | % MOT_T_NOM   | 40.96  |
| PRC_APP_SPD_REF   | D33 – Speed reference from application                               | % MOT_SPD_MAX | 163.84 |
| PRC_MOT_T         | D35 – Torque produced                                                | % MOT_T_NOM   | 40.96  |
| MOT_TURN_POS      | D36 – Absolute mechanical position on current turn                   | ±16384        | 1      |
| MOT_N_TURN        | D37 – Number of turns completed                                      |               | 1      |
| OFFSET_SINCOS_ENC | D38 – Analogue/digital compensation term of the Sin/Cos              | impulses      | 1      |
| SENSOR_FRQ_IN     | D39 – Sensor input frequency                                         | kHz           | 16     |
| REG_CARD_TEMP     | D40 – Adjustment card temperature                                    | °C            | 16     |
| MOT_PRB_RES       | D41 – Measured motor thermal resistance                              | Ohm           | 1      |
| AI1               | D42 – Analogue input AI1                                             | %             | 163.84 |
| AI2               | D43 – Analogue input AI2                                             | %             | 163.84 |
| AI3               | D44 – Analogue input AI3                                             | %             | 163.84 |
| SPD_ISR           | D45 – Speed routine duration                                         | us            | 64     |
| I_ISR             | D46 – Current routine duration                                       | us            | 64     |
| I_LOOP_BAND       | D47 – Current ring passing band                                      | Hz            | 1      |
| PRC_APP_T_MIN     | D48 – Minimum torque from the application                            | % MOT_T_NOM   | 40.96  |
| WORK_HOURS        | D49 – Working hours                                                  | hours         | 1      |
| ENC_HALL_SECTOR   | D50 – Encoder-read sensor and Hall probes                            |               | 1      |
| SENS2_SPD         | D51 – Rotation speed of sensor two                                   | rpm           | 1      |
| SENS2_TURN_POS    | D52 – Absolute mechanical position on the current turn of sensor two | ±16384        | 1      |
| SENS2_N_TURN      | D53 – Number of turns completed by sensor two                        |               | 1      |
| SENS2_FRQ_IN      | D54 – Input frequency of sensor two                                  | KHz           | 16     |
| SENS1_ZERO_TOP    | D55 – Sensor1 Top Zero                                               | impulses      | 1      |
| SENS2_ZERO_TOP    | D56 – Sensor2 Top Zero                                               | impulses      | 1      |
| SYNC_DELAY        | D57 – Synchronisation of the SYNC                                    | us            | 1      |
| PWM_SYNC_OFFSET   | D58 – PWM offset for SYNC control                                    | pulses        | 1      |
| SERIAL_NUMBER     | D59 – Drive Serial Number                                            |               | 1      |
| FLD_CARD          | D60 – Fieldbus card present                                          |               | 1      |
| APPL_REV          | D61 – Revision of the application                                    |               | 40.96  |
| HW_SENSOR2        | D63 – Decoding card Sensor 2                                         |               | 1      |
| HW_SENSOR1        | D63 – Decoding card Sensor 1                                         |               | 1      |

At application level it is possible to define another 64 internal sizes from D64 to D127.

- Index 0x2012 “Tab\_osc” on monitor sizes

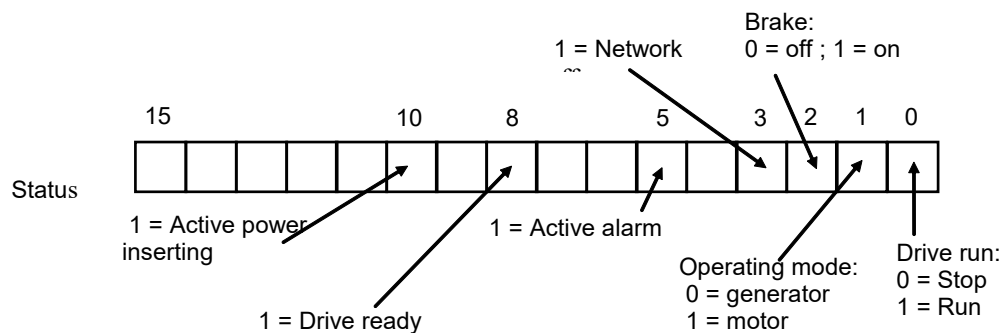
| Name                | Description                               | UM            | Scale  |
|---------------------|-------------------------------------------|---------------|--------|
| ACT_POS             | O00 – Current position read by the sensor |               | 327.67 |
| ELECTRIC_POS        | O01 – Current electric power              |               | 327.67 |
| PRC_TOT_APP_SPD_REF | O02 – Speed reference before the ramps    | % MOT_SPD_MAX | 163.84 |
| PRC_END_SPD_REF     | O03 – Speed reference after the ramps     | % MOT_SPD_MAX | 163.84 |
| PRC_MOT_SPD         | O04 – Measured speed                      | % MOT_SPD_MAX | 163.84 |
| PRC_T_REF           | O05 – Torque request                      | % MOT_T_NOM   | 40.96  |
| PRC_IQ_REF          | O07 – Torque current request              | % DRV_I_NOM   | 40.96  |
| PRC_ID_REF          | O08 – Reactive current request            | % DRV_I_NOM   | 40.96  |
| PRC_V_REF           | O09 – Maximum voltage reference           | % MOT_E_NOM   | 40.96  |
| ALARMS              | O10 – Active alarms                       |               | 1      |
| PRC_MOT_I           | O11 – Current module                      | % DRV_I_NOM   | 40.96  |
| ZERO_TOP            | O12 – Zero top                            | pulses        | 1      |
| PRC_IU              | O13 – Phase current U                     | % DRV_I_MAX   | 40.96  |
| INPUTS              | O14 – Physical input                      |               | 1      |
| PRC_IQ              | O15 – Measured torque current             | % DRV_I_NOM   | 40.96  |
| PRC_ID              | O16 – Measured reactive current           | % DRV_I_NOM   | 40.96  |
| TU                  | O17 – Duty cycle phase U                  |               | 327.67 |
| PRC_MOT_V           | O18 – Generated statoric voltage          | % MOT_E_NOM   | 40.96  |
| MOD_INDEX           | O19 – Modulation index                    |               | 40.96  |
| PRC_VQ_REF          | O20 – Statoric voltage reference axis Q   | % DRV_E_NOM   | 40.96  |
| PRC_POWER           | O21 – Supplied power                      | %MOT_POW_NOM  | 40.96  |
| PRC_VD_REF          | O22 – Statoric voltage reference axis D   | % DRV_E_NOM   | 40.96  |
| PRC_T_OUT           | O23 – Supplied torque                     | % MOT_T_NOM   | 40.96  |
| PRC_DC_BUS          | O24 – DC Bus voltage                      | %900V         | 40.96  |
| PRC_DRV_TEMP        | O25 – Radiator temperature                | %37.6°        | 40.96  |
| PRC_MOT_TEMP        | O26 – Motor temperature                   | % 80°         | 40.96  |
| PRC_DRV_I_THERM     | O28 – Motor thermal current               | % soglia AI1  | 40.96  |
| PRC_DRV_I_MAX       | O29 – Current limit                       | % DRV_I_NOM   | 40.96  |
| PRC_DRV_T_MAX       | O30 – Maximum torque                      | % MOT_T_NOM   | 40.96  |

|               |                        |             |        |
|---------------|------------------------|-------------|--------|
| PRC_DRV_T_MIN | O31 – Minimum torque   | % MOT_T_NOM | 40.96  |
| OUTPUTS       | O32 – physical outputs |             | 1      |
| PRC_IV        | O34 – Phase current V  | % DRV_I_MAX | 40.96  |
| PRC_IW        | O35 – Phase current W  | % DRV_I_MAX | 40.96  |
| ALFA_FI       | O36 – Electric angle   |             | 327.67 |

| Name             | Description                                               | UM                | Scale  |
|------------------|-----------------------------------------------------------|-------------------|--------|
| AI1              | O37 – AI1                                                 |                   | 163.84 |
| AI2              | O38 – AI2                                                 |                   | 163.84 |
| AI3              | O39 – AI3                                                 |                   | 163.84 |
| SYS_SPD_PERC_REF | O41 – Speed reference from application                    | % MOT_SPD_MAX     | 163.84 |
| SYS_T_PERC_REF   | O42 – Torque reference from application                   | % MOT_T_NOM       | 40.96  |
| SYS_T_MAX        | O43 – Maximum torque limit from application               | % MOT_T_NOM       | 40.96  |
| SYS_SPD_REF_PULS | O44 – Speed reference as impulses from the application    |                   | 1      |
| SYS_POS_REF_PULS | O45 – Position reference as impulses from the application |                   | 1      |
| RES_AMPLITUDE    | O46 – Resolver retroaction amplitude                      |                   | 1      |
| RES_SIN          | O47 – Resolver sine/absolute sin cos                      |                   | 1      |
| RES_COS          | O48 – Resolver cosine /absolute sin cos                   |                   | 40.96  |
| PRC_MOT_SPD      | O49 – Unfiltered measured speed                           | % MOT_SPD_MAX     | 163.84 |
| PULSES_RD        | O50 – Delta impulses read at frequency input              |                   | 1      |
| MEM_POS_LSW      | O51 – Overlapping space ring memory (lsw)                 | electric impulses | 1      |
| MEM_POS_MSW      | O52 – Overlapping space ring memory (msw)                 |                   | 1      |
| INCR_SIN         | O53 – Sine in the incremental sin cos                     |                   | 1      |
| INCR_COS         | O54 – Cosine in the incremental sin cos                   |                   | 1      |
| INIT_RESET       | O55 – Initial reset cycle                                 |                   | 1      |
| PTM_TH_PRB       | O56 – Motor thermal Pellet                                |                   | 40.96  |
| PTR_TH_PRB       | O57 – Radiator thermal Pellet                             |                   | 40.96  |
| SENS_PULSES_RD   | O58 – Delta impulses read by the sensor                   |                   | 1      |
| PRC_SENS2_SPD    | O59 – Unfiltered measured speed according to sensor       | % MOT_SPD_MAX     | 163.84 |
| ACT_SENS2_POS    | O60 – Current position read by the second sensor          |                   | 327.67 |
| SENS2_SIN        | O61 – Sensor two sine                                     |                   | 1      |
| SENS2_COS        | O62 – Sensor two cosine                                   |                   | 1      |
| SYNC_DELAY       | O63 – Delay in receiving SYNC                             |                   | 1      |
| SYS_T_MIN        | O64 – Minimum torque limit from the application           | % MOT_T_NOM       | 40.96  |
| BRAKE_EN         | O65 – Energy dissipated while braking                     |                   | 1      |

At application level, it is possible to define another 32 monitor sizes from O68 to O99.

- Index 0x2017 a converter status variable is available with the following meaning:



- Index 0x2018 shows the status of the various converter alarms bit per bit, that is to say A8 is associated with bit 8.
- Index 0x2019 is the alarm enabling mask, also here the meaning is bit by bit.

- Index 0x201A “f\_fieldbus” = speed reference as a percentage of the maximum set speed. The representation basis is 16384: therefore 16384 equals 100%
- Index 0x201D “theta\_fieldbus” = speed reference as impulses per PWM period, considering that there are 65536 impulses on the turn.
- Index 0x201C trif\_fieldbus = torque reference as percentage of the nominal motor torque. The representation basis is 4095: therefore 4095 equals 100%
- Index 0x201A limit\_fieldbus = torque limit as percentage of the nominal motor torque (which will be an alternative to the other existing limits, the most restrictive applies). The representation basis is 4095: therefore 4095 equals 100%

#### Configuration example

At drive level, in order to receive in the process part in the first 2 words the logic input function command and in the third word the speed reference and to have as output in the first 2 words the logic output function status and the current speed, it is necessary to set:

|               |      |                              |
|---------------|------|------------------------------|
| RX0_INDEX     | 201F | input logic function writing |
| RX0_SUB_INDEX | 0    |                              |
| RX1_INDEX     | 201A | speed reference writing      |
| RX1_SUB_INDEX | 0    |                              |

|               |      |                               |
|---------------|------|-------------------------------|
| TX0_INDEX     | 2021 | output logic function reading |
| TX0_SUB_INDEX | 0    |                               |
| TX1_INDEX     | 2012 | current speed reading         |
| TX1_SUB_INDEX | 4    |                               |

### 2.2.5 Profibus DP Device Description: GSD File

Each Profibus DP device is associated to a file with the extension GSD which specifies all its characteristics, such as allowed transmission speed, maximum message length, meaning of diagnostics messages ...

The GSD is used by the Profibus master to understand the slave characteristics.

With the new management the parametrization part (PKW) can be enabled or not and the process part (PZD) can be completely configured; therefore our gsd file includes a series of possible configurations from which the active one shall have to be selected.

The GSD file OPEN DRIVE: opd.gsd is available.

The GSD file OPDE: opde.gsd is available





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