

ifm electronic



Operating instructions  
RFID read/write head  
with J1939 interface

UK

**efector190<sup>®</sup>**

**DTM426**  
**DTM427**  
**DTM436**  
**DTM437**

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## 1 Preliminary note



This document applies to the device of type "RFID read/write head with J1939 interface" (art. article no.: DTM426 / DTM427 / DTM436 / DTM437). This document is part of the device.

This document is intended for specialists. These specialists are people who are qualified by their appropriate training and their experience to see risks and to avoid possible hazards that may be caused during operation or maintenance of the device. The document contains information about the correct handling of the device.

Read this document before use to familiarise yourself with operating conditions, installation and operation. Keep this document during the entire duration of use of the device.

Adhere to the safety instructions.

### 1.1 Symbols used

- ▶ Instructions
- > Reaction, result
- [...] Designation of keys, buttons or indications
- Cross-reference
-  Important note  
Non-compliance may result in malfunction or interference.
-  Information  
Supplementary note

## 2 Safety instructions

### 2.1 General

These instructions are an integral part of the device. They contain texts and figures concerning the correct handling of the device and must be read before installation or use.

Observe the operating instructions. Non-observance of the instructions, operation which is not in accordance with use as prescribed below, wrong installation or incorrect handling can seriously affect the safety of operators and machinery.

### 2.2 Target group

These instructions are intended for authorised persons according to the EMC and low-voltage directives. The device must be installed, connected and put into operation by a qualified electrician.

### 2.3 Electrical connection

Disconnect the unit externally before handling it.

The connection pins may only be supplied with the signals indicated in the technical data and/or on the device label and only the approved accessories of ifm may be connected.

## 2.4 Tampering with the device

In case of malfunctions or uncertainties please contact the manufacturer. Any tampering with the device can seriously affect the safety of operators and machinery. This is not permitted and leads to the exclusion of any liability and warranty claims.

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## 3 Functions and features

The RFID read/write heads are used for reading and describing RFID tags. The read/write head is configured and data is exchanged via the integrated J1939 interface.



Typical applications are for example the identification of interchangeable tools and attachments on mobile machines.

## 4 Installation

### 4.1 General installation instructions

-  Observe the separate mounting instructions.
-  When mounting several read/write heads adhere to the minimum distances between the systems.
-  The immediate vicinity of powerful HF emission sources such as welding transformers or converters can affect operation of the read/write heads.

### 4.2 Notes on the tag installation

-  Installation of the tags in or on metal reduces the read and write distances.
-  The orientation of the read/write head antenna axis must correspond with the axis of the tag coil.

### 4.3 Avoiding interference

The RFID read/write head generates a modulated electrical field with a frequency of 13.56 MHz. To avoid interference of the data communication no other devices generating interference emission in this frequency band must be operated in its vicinity. Such devices are for example frequency converters and switched-mode power supplies.

## 5 Indicators

Operating status	LED green	LED yellow	LED red
Ready	On	Off	Off
Deactivated	Flashing (every 1 s)	Off	Off
ID tag detected	Off	On	Off
Reading/writing of ID tag data successful	Off	Flashing (0.25 s)	Off
Error while reading or writing ID tag data	Off	Flashing (every 1 s for 0.125 s)	Off
CAN communication error	Off	Off	On
Hardware failure	Off	Off	Flashing (every 1 s)

## 6 SAE J1939 interface

The RFID read/write heads have a standardised SAEJ1939 interface. All measured values and parameters can be accessed via the J1939 protocol. The individual configuration can be saved in the internal permanent memory.

### 6.1 Structure of the SAE J1939 protocol

The SAE J1939 protocol uses a 29-bit CAN identifier (extended frame format CAN 2.0B). A J1939 message has the following structure:

J1939 message			
29-bit CAN identifier			Data
Priority	PGN	Source address	User data of the message
28..26	25..8	7..0	0...8 bytes



Parameter Group Number (PGN)			
Ext. Data page	Data Page	PDU Format (PF)	Target Address / Group Extension (PS)
25	24	23..16	15..8



PDU format 1 (specific)	
00h - EFh	Target Address (DA)
23..16	15..8

PDU format 2 (global)	
F0h - FFh	Group Extension (GE)
23..16	15..8

#### 6.1.1 PDU format 1

This format defines a message which is sent to a defined device. In this case the PDU-specific byte (PS) is the target address (DA) of the device. If the value of the PDU format field (PF) is between 0x00 and 0xEF, it is a PDU format 1 message.

For proprietary messages (manufacturer-specific) the PDU format value 0xEF is defined.

Ext. data page bit = 0 and data page bit = 0.

## 6.1.2 PDU format 2

This format defines a message which is sent globally. In this case the PDU specific byte (PS) corresponds to the group extension (GE). If the value of the PDU format field (PF) is between 0xF0 and 0xFF, it is a PDU format 2 message.

For proprietary messages (manufacturer-specific) the area PDU format (PF) and group extension (GE) 0xFF00 – 0xFFFF is defined.

Ext. data page bit = 0 and data page bit = 0.

## 6.2 Proprietary protocol in PDU format 1

The parameters of the device are listed in a table that is accessed per 16-bit index. To access the sensor parameters in reading or writing the proprietary PDU format 1 message is used. PDU format (PF) corresponds to the value 0xEF. In this case the PDU-specific byte (PS) is the target address (DA) of the device which is to receive the message. If more than 4 bytes are transferred, the J1939 transport protocol must be used.

Example:

Address target unit (ECU): 0x3B

Address control unit / master: 0x14

Priority of the message: 3

CAN identifier	8-byte data frame			
ID	Parameter index	Read/Write	Status	4-byte data
29 bits	2 bytes	1 byte	1 byte	

Requirement: Master → ECU

0xCEFEB14	LSB	MSB	RW	0	LSB	..	..	MSB
-----------	-----	-----	----	---	-----	----	----	-----

Response: Master ← ECU

0xCEF14EB	LSB	MSB	RW	SC	LSB	..	..	MSB
-----------	-----	-----	----	----	-----	----	----	-----

**Parameter index:** 2-byte parameter index.

**RW:** Read parameter → 0x00 / write parameter → 0x01

**SC:** Status code

0x00: OK

0x01: Parameter value too small

0x02: Parameter value too big

0x03: Parameter index does not exist

0x04: Parameter can only be read

0x05: Parameter can only be written



0x06: No access to parameter

0x07: Invalid data size

0x08: Parameter writing blocked

(example: The value to be written is already set in the sensor)

0x09: Invalid command

0x0A: Unknown error

0x0B: Error while reading or writing from ID tag

### 6.3 Configuration examples

Address target unit (ECU): 0xEB

Address control unit / master: 0x14

Priority of the message: 3

Example: Set block size of ID tag to 8, index 0x2800

Requirement: Master → ECU

CAN identifier	8-byte data frame							
0xCEFEB14	0x00	0x28	0x01	0x00	0x08	0x00	0x00	0x00

Response: Master ← ECU

CAN identifier	8-byte data frame							
0xCEF14EB	0x00	0x28	0x01	0x00	0x08	0x00	0x00	0x00

## 7 Parameter mapping

Index	Type	Value	R/W	Saved	Preset
0x0500	Byte stream	Device name	ro		
0x0501	Byte stream	Software version	ro		
0x2000	Unsigned8	Default device address (may be changed after address claiming)	rw	X	235
0x2001	Unsigned16	Baud rate in kBit/s	rw	X	250
0x2002	Boolean	Device reset	rw		
0x2080	Unsigned8	Device status	ro		
0x2800	Unsigned8	Block size	rw	X	4
0xA000	Byte stream	ID tag UID	ro		
0xA001	Byte stream	ID tag data	rw		

## 8 Device status

The parameter with the index 0x2080 represents the current device status:

Bit	31	30	29	28	27	26	25	24
Status	tag_err							

Bit	23	22	21	20	19	18	17	16
Status	acc_err							

Bit	15	14	13	12	11	10	9	8
Status	r	r	r	r	r	r	r	J1939_err

Bit	7	6	5	4	3	2	1	0
Status	claim	r	buf_ovfl	fr_err	r	present	ant	pow

Status	Value	Description
pow	1	Power enabled (value always 1)
ant	0	Antenna disabled
	1	Antenna enabled
Present	0	No ID tag present
	1	ID tag present
fr_err	0	Front end OK
	1	Front end error detected (hardware problem)
buf_ovfl	0	Buffer OK
	1	Buffer overflow detected
claim	0	Address claiming OK
	1	Address claiming not successful
J1939_err	0	No J1939 error occurred
	1	J1939 error occurred
acc_err		Error of last write operation
tag_err		Error message ID tag for last operation

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Access error codes: (updated after each write or read access of the ID tag)

Index	Value	Description
0x00	ISO_COMMAND_ERROR_NO_ERROR	No error, command successfully executed
0x01	ISO_COMMAND_ERROR_NO_RESPONSE	ID tag did not answer; maybe ID tag is not in the field anymore?
0x02	ISO_COMMAND_ERROR_RX_ERROR	Error while receiving the answer from the ID tag (CRC error, framing error, collision, etc.)

ID tag error codes: (updated after each read or write access of the ID tag)

Index	Value	Description
0x00	ISO_TAG_ERROR_NO_ERROR	No error from ID tag
0x01	ISO_TAG_ERROR_COMMAND_NOT_SPECIFIED	The command is not supported. Exp.: Command code error
0x02	ISO_TAG_ERROR_COMMAND_SYNTAX	Cannot recognise the command. The number of blocks is too high. Exp.: Format error
0x03	ISO_TAG_ERROR_OPTION_NOT_SUPPORTED	Option is not supported
0x0F	ISO_TAG_ERROR_OTHER	Other error
0x10	ISO_TAG_ERROR_BLOCK_NOT_USABLE	The specified block cannot be used (or was not found)

Index	Value	Description
0x11	ISO_TAG_ERROR_BLOCK_ALREADY_BLOCKED	The specified block is locked and cannot be locked again
0x12	ISO_TAG_ERROR_BLOCK_NOT_UPDATEABLE	The specified block is locked and its contents cannot be updated
0x13	ISO_TAG_ERROR_BLOCK_WRITE_VERIFY	The specified block cannot be programmed (a write verify error occurred)
0x14	ISO_TAG_ERROR_BLOCK_LOCK_VERIFY	The specified block cannot be locked (a lock verify error occurred)

## 9 ID tag data access

### 9.1 Read data from ID tag

The data is read by the ID tag by sending a "read parameter" frame with the following information:

- Data address
- Data length

CAN identifier	8-byte data frame							
ID	Parameter index		Read/Write	Status	ID tag		ID tag	
29 bits	2 bytes		1 byte	1 byte	Data address		Data length	
	0x01	0xA0	0x00	0x00	LSB	MSB	LSB	MSB

Example:

Read 8 bytes of data from ID tag address 4

Requirement: Master → ECU

0xCEFEB14	0x01	0xA0	0x00	0x00	0x04	0x00	0x08	0x00
-----------	------	------	------	------	------	------	------	------

Response: Master ← ECU

0xCEF14EB	0x01	0xA0	0x00	0x00	Data[0]	Data[1]	Data[2]	...
-----------	------	------	------	------	---------	---------	---------	-----



Make sure, that the ID tag is in the range of the RFID read/write head. If there was an error while reading data, the status byte of the response is 0x0B.

## 9.2 Write data to ID tag

The data is written to the ID tag by sending a "write parameter" frame with the following information:

- Data address
- Data length
- Data

CAN identifier	x-byte data frame									
ID	Parameter index		Read/Write	Status	ID tag		ID tag		ID tag	
29 bits	2 bytes		1 byte	1 byte	Data address		Data length		Data	
	0x01	0xA0	0x00	0x00	LSB	MSB	LSB	MSB	<b>Data[0]</b>	<b>Data[x]</b>

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Example:

Write 4 bytes of data (0xAA,0xBB,0xCC,0xDD) to ID tag address 2

Requirement: Master → ECU

0xCEFEB14	0x01	0xA0	0x01	0x00	0x02	0x00	0x04	0x00	0xAA	0xBB	0xCC	0xDD
-----------	------	------	------	------	------	------	------	------	------	------	------	------

Response: Master ← ECU

0xCEF14EB	0x01	0xA0	0x01	0x00
-----------	------	------	------	------



Make sure, that the ID tag is in the range of the RFID read/write head. If there was an error while reading the data, the status byte of the response is 0x0B.

## 10 Settings

### 10.1 Device address (0x2000) and baud rate (0x2001)

Valid values for the device address are: 0 to 253.

The preset device address should be preferably used. Via "address claiming" the device address can be changed.

Valid values for the baud rate are: 250 kBits/s and 500kBits/s.



The RFID device is supplied with the following default settings:

- Device address (ECU) 235
- Baud rate 250 kbit/s



Make sure that the set device address is used only once in the CAN network. Use "address claiming" in the CAN network to avoid conflicts (→ 10.2).



The changed device address and baud rate become effective after reset of the RFID read/write head. Reset read/write head via reset command or hardware reset (→ 10.3).

### 10.2 Address claiming

The RFID read/write head supports "dynamic address claiming". The RFID read/write head has the default address 235.

With this device address, the sensor logs in to the network during start-up. Unless there is an address conflict with other network participants, the sensor starts communication automatically.

Arbitrary address capable (CA):

If the set address of the device is already used in the network, the participant with a higher priority will be accepted by the network. The rejected network participant with a lower priority will be assigned another valid device address.



The RFID read/write head tries to claim the preferred device address first. If a participant with higher priority claims this device address, the RFIED read/write head will look for another valid device address.

### 10.3 Reset RFID read/write head

By writing the value "1" to the parameter index 0x2002 the read/write head is reset.



It is reset immediately. There is no response frame from the read/write head for this command.

## 11 Maintenance, repair and disposal

- ▶ Do not open the housing as the device does not contain any components which can be maintained by the user. The device must only be repaired by the manufacturer.
- ▶ Dispose of the device in accordance with the national environmental regulations.

## 12 Glossary

Term	Description
ID tag	RFID tag
UID	Unique identification number of an ID tag
J1939	SAE J1939 communication protocol for vehicle components
LED	Light emitting diode
ECU	Electronic Control Unit, device participating in the CAN network