

System specification



Signal Telegram

V 3.2

Approved for release: 5.12.2019

San Ramon, CA, USA, TBD

EXECUTIVE SUMMARY

This document is owned by the Technical Working Group (TWG) of the EnOcean Alliance. It is maintained and will be progressed within the authority of the Chairman of the TWG.

Following approval, this specification is now in the status PRELIMINARY.

Changes to this document have to be proposed to the EAC for review and to the TWG for decision.

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REVISION HISTORY

Ver.	Editor	Change	Date
2.3	TMe, Mho	Conclusion of discussion during TWG-Workshop at Oberhaching, Germany; version for TWG-review	Dec 04, 2017
2.4	Mho	Modifications following TWG-review; approved version (TWG-Call Jan 25, 2018)	Jan 25, 2018
2.5	Nme	Official version following TWG-approval	Feb 01, 2018
2.6	Nme	Errors corrected (MID 0x07, MID 0x0A), column Bitrange removed from each table;	Mar 14, 2018
2.7	Mho	Added MID 0x0E, 0x0F – TX mode on/off	Dec 10, 2018
3.0	AP	Creating own specification of signal telegrams	Aug 22, 2019
3.1	LC	Added proposal for MID 0x10 – Backup battery status	Oct 24, 2019
3.2	AP	Added proposal for MID 0x11 – Learn Mode Status	May 08, 2020
	TR	Update for MID 0x11 – Learn Mode Status	May 13, 2020
	AP	Update learn time out and prepare for review	May 18, 2020
	AP	Incorporated clarifications MID 0x11 after review	June 19, 2020

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1. INTRODUCTION

1.1. General

Signal Telegram as a feature is dedicated to signalize special events with optional data, trigger actions or request responses. It extends the functionality of the device independently of used EEPs or other communication profiles.

Target key functional fields are:

- Communication flow control
- Energy harvesting and reporting
- Failure & issues reporting
- Radio link quality reporting

Signal telegram has a dedicated RORG defined (0xD0). The payload definition of its content is depended on the first payload byte – message identifier - MID. Specific MID values define all aspects of the meaning of the payload data, following actions and resulting conclusions for the device application.

Signal telegram can be transmitted in both directions. Communication direction, addressing and other underlying protocol features are defined based on specific MID case by case.

Signal telegram transmission and features can be executed at any time of the device operation. Specific rules or aspects are defined case by case by MID or device application.

1.2. Interaction to other protocols

Feature definition and use cases of signal telegram shall not interfere or redefine application use cases defined in EEPs or other specifications (e.g. ReCom, REMAN and Security). Signal telegram is aimed to extend and enable specialized use cases or boundary use cases not fitting to a major protocol definition.

All features and actions defined in this document shall have, however, a closed character inside this specification to the highest possible degree. Meaning responses or actions shall be described in this document (e.g. request level status & response energy level) or clearly referencing interfaces to other specification (e.g. Smart ACK Mailbox empty signal).

Signal telegram definition does not follow the EEP Structure of FUNC & TYPE and it does not rely on the teach-in / data telegram concept. Signal telegram does not define and/or require a teach-in.

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1.3. Requirements on devices supporting Signal telegram features

Each device supporting the Signal telegram features has to state it inside the Device Description file (DDF) and list the specific MID which are supported by the device, if DDF is available.

1.4. Signal Telegram approval process

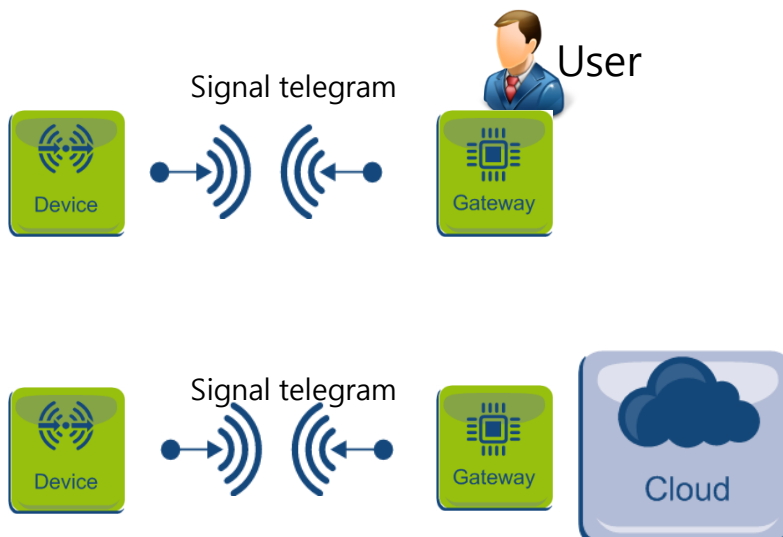
Definition of new MID and new use cases is matter of a TWG approval. New submissions have to be submitted to the EAC for quality assurance.

Adding additional data fields or redefining structurally existing fields of MID already defined is not allowed.

An allowed extension - after approval of EAC ! - is to extend lists with reserved fields (e.g. IDX4 trigger request).

1.5. Typical use case scenario

There is no strict rule which device may or may not send or receive Signal telegrams. However, the typical use case is between a field-end device and constantly powered gateway device working autonomously or constantly powered commissioning device operated by a user.



1.6. Terms & Abbreviations

1BS – EnOcean 1 Byte Communication

4BS – EnOcean 4 Byte Communication

Client – Bidirectional SMART ACK Device

Data – Payload of ERP telegrams or ESP packets

DDF – Device description file

EAC – EnOcean Equipment Profiles Approval Committee

EEP – EnOcean Equipment Profiles

ERP – EnOcean Radio Protocol

EURID – EnOcean Unique Radio Identifier, a unique and non-changeable identification number assigned every EnOcean transmitter during its production process.

MID – Message index

MSC – Manufacturer Specific Communication

RECOM – Remote Commissioning

REMAN – Remote Management

RMCC – Remote Management Control Commands

RORG – Radio ORG = organization number for EnOcean radio telegram types

RPC – Remote Procedure Calls, used in Remote Management

RPS – EnOcean telegram type for Repeated Switch Communication

SMART ACK – SMART Acknowledge EnOcean standard for energy-optimized bidirectional transmission

TWG – EnOcean Alliance Technical Working Group

VLD – EnOcean Variable Length Data telegram

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1.7. References

[1] EnOcean Equipment Profiles 2.6.8, EnOcean Alliance
<https://www.enocean-alliance.org/eep/>

[2] Smart Acknowledge specification, EnOcean Alliance
<https://www.enocean-alliance.org/smartack/>

[3] Security of EnOcean Networks specification, EnOcean Alliance
<https://www.enocean-alliance.org/sec/>

[4] Remote Management, EnOcean Alliance
<https://www.enocean-alliance.org/reman/>

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2. Signal Telegram definitions

Telegram Definition: R-ORG 0xD0

RORG	MID	Optional Data	Sender ID				Status	CRC8
D0	Message index 1 byte	Defined by MID 0 ... 13 bytes	ID_3	ID_2	ID_1	ID_0	1 byte	1 byte

Defined MID overview:

MID	Name	Optional Data
0x00	Reserved	
0x01	SMART Ack Mailbox empty	NO
0x02	SMART ACK Mailbox does not exist	NO
0x03	SMART ACK Reset: Trigger LRN Request	NO
0x04	Trigger status message of device	YES
0x05	Last unicast-message acknowledge.	NO
0x06	Energy status of device	YES
0x07	Revision of device	YES
0x08	Heartbeat,	NO
0x09	RX-window open	NO
0x0A	RX-channel quality	YES
0x0B	Duty-cycle status	YES
0x0C	Configuration of device changed	NO
0x0D	Energy delivery of the harvester	YES
0x0E	TX Mode off	NO
0x0F	TX Mode on	NO
0x10	Backup battery status	YES
0x11	Learn mode status	YES
0x12 - 0xFF	Reserved	

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2.1. MID 0x01 SMART ACK Mailbox empty

Originator: Constantly powered SMART Acknowledge Postmaster

Addressing: Broadcast / Unicast

For details, refer to the SMART Acknowledge specification [2].

Offset	Size	Data	Description
0	8	Message index	<u>Enumeration:</u> 0x01: SMART ACK Mailbox empty

2.2. MID 0x02 SMART ACK Mailbox does not exist

Originator: Constantly powered SMART Acknowledge Postmaster

Addressing: Broadcast / Unicast

For details, refer to the SMART Acknowledge specification [2].

Offset	Size	Data	Description
0	8	Message index	<u>Enumeration:</u> 0x02: SMART ACK Mailbox does not exist

2.3. MID 0x03 SMART ACK Reset: Trigger LRN Request

Originator: Constantly powered device

Addressing: Unicast (addressed to Sensor)

For details, refer to the SMART Acknowledge specification [2].

Offset	Size	Data	Description
0	8	Message index	<u>Enumeration:</u> 0x03 – SMART ACK Reset: Trigger LRN Request

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2.4. MID 0x04 Trigger status message of device

Originator: Constantly powered device

Addressing: Unicast - addressed to End Device

(Because after broadcasting this message all sensors would try to answer and jam the channel)

With this telegram an explicit request of a status message is triggered. Various status messages can be triggered. Which status is requested is explicitly listed in the optional data. See table below.

When triggering RX channel quality the receiver shall take the telegram request itself as the subject of evaluation. The dBm value is the RSSI-value of the request received.

With EEP status message specific data content is defined by the used EEP and depends on the device. Trigger EEP Status shall NOT replace requests messages in EEP Telegrams.

Responses triggered by this request shall be addressed to the requesting EURID device. If requested message is not available, there is no RESPONSE.

Offset	Size	Data	Description
0	8	Message index	<u>Enumeration:</u> 0x04: Trigger status message of device
8	8	Trigger details	<u>Enumeration:</u> 0x00: EEP Status. (Response: Defined by device) 0x01: Energy status (Response: MID 0x06) 0x02: Revision of device (Response: MID 0x07) 0x03: RX Level of received request (this) telegram (Response: MID 0x0A) 0x04: Energy current harvested reporting (MID 0x0D) 0x05 ... 0xFF – RESERVED

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2.5. MID 0x05 Last unicast-message acknowledge

Originator: Device
Addressing: Unicast – addressed to originator

This message is sent after a unicast message addressed to the device was successfully received. Turning off / on of this debug reporting is executed via RECOM configuration parameters.

NOTE: This ACK reports last unicast received and the HASH check was successful.

Offset	Size	Data	Description
0	8	Message index	Enumeration: 0x05: Last unicast-message acknowledge

2.6. MID 0x06 Energy status of the device

Originator: Device
Addressing: Recommend broadcast

The value in optional data corresponds to the typical operating time of this device.

Offset	Size	Data	Description		
0	8	Message index	Enumeration: 0x06: Energy status of device		
8	8	Energy	Valid Range	Scale	Unit
			1..100	1..100	%
			0: last message due to power loss. Gasp of death. 101 ... 255: Reserved.		

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2.7. MID 0x07 Revision of the device

Originator: Device
Addressing: Recommend broadcast

Value in optional data corresponds to the HW and SW version of this device. HW version and SW tracking is manufacturer specific.

Offset	Size	Data	Description
0	8	Message index	<u>Enumeration:</u> 0x07: Revision of the device
8	32	SW Version	SW version of the device. VA.B.C.D = 0xAABBCCDD (e.g. V 1.2.3.4 = 0x01020304) AA- Most significant (Major version)
40	32	HW Version	HW version of the device. VA.B.C.D = 0xAABBCCDD (e.g. V 1.2.3.4 = 0x01020304) AA- Most significant (Major version)

2.8. MID 0x08 Heartbeat

Originator: Device
Addressing: Recommended broadcast

This is the “still alive message”, only for devices not transmitting information via EEPs/GP, e.g. repeater, tag. Trigger events of heartbeat and periods between heartbeat is described inside the DDF.

Offset	Size	Data	Description
0	8	Message index	<u>Enumeration:</u> 0x08: Heartbeat

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2.9. MID 0x09 RX Window open

Originator: Device

Addressing: Recommended broadcast.

Inform the receiver in radio coverage that the device is available for RX Period. RX Period might end earlier because an addressed message was received or out of energy reasons. Exact RX period is application specific and is defined in the DDF of the device.

RX windows is started after first sub telegram was transmitted.

Offset	Size	Data	Description
0	8	Message index	<u>Enumeration:</u> 0x09: RX Window open

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2.10. MID 0x0A RX-channel quality

Originator: Device
Addressing: Recommend broadcast

This telegram provides debug information about the link quality of a specific radio link. Which radio link (Device A to Device B) is reported depends on the device application. It can report all received telegrams or only telegrams in filter list or Inbound or Outbound link table.

With signal telegram (MID 0x04) request / response can be triggered to report the link quality of the request.

Turning off / on of this debug reporting is executed via RECOM configuration parameters.

Offset	Size	Data	Description		
0	8	Message index	<u>Enumeration:</u> 0x0A: RX-channel quality		
8	32	ID	32 bit communication EURID of the telegram the quality is reported		
40	8	DBM Worst	Valid Range	Scale	Unit
			0..254	127...-127	dBm Worst
			255: Value UNKNOWN		
48	8	DBM Best	Valid Range	Scale	Unit
			0..254	127...-127	dBm Best
			255: Value UNKNOWN		
56	4	Subtelegram count	<u>Enumeration:</u> 0x0: VALUE UNKNOWN 0x1 One sub telegram received during RX maturity time defined in ERP. ... 0xF Fifteen or more sub telegrams received during RX maturity time defined in ERP.		
60	4	Max Repeater Level	<u>Enumeration:</u> 0x0: Max Repeater Level 0 received 0x1: Max Repeater Level 1 received 0x2: Max Repeater Level 2 received 0x3 ... 0xE: reserved 0xF: VALUE UNKNOWN		

2.11. MID 0x0B Duty cycle status

Originator: Device
Addressing: Recommended broadcast

This is the flag to signal the device status of duty cycle lock / limit on radio communication due to limitation of the TX duty cycle lock requested by the radio certification authorities. Once the device will resumes its operation, it may send “TX Duty cycle status” message with corresponding payload.

Offset	Size	Data	Description
0	8	Message index	<u>Enumeration:</u> 0x0B: Duty cycle exceeded
8	4	Status flag	0x0:TX Duty cycle limit exceeded. Further communication is not possible. 0x1: TX Duty cycle is available. Communication can resume. 0x2...0xF: Reserved.
12	4	Not used	

2.12. MID 0x0C Configuration of device changed

Originator: Device
Addressing: Recommended broadcast

Once the device is configured by local user interface, this command informs surrounding gateway about this event. Fetching the changes/updates is then the matter of EEP related communication or RECOM. This is solely the signal to the connected gateway something has changed.

Offset	Size	Data	Description
0	8	Message index	<u>Enumeration:</u> 0x0C: Configuration of device changed

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2.13. MID 0x0D Energy delivery of the harvester

Originator: Device
Addressing: Recommend broadcast

The value in optional data reports the energy output from the energy harvester (e.g. from a solar cell or thermos harvester) at this time. It provides an indication on how good the current position of the EH device is and provides an indication of the performance for future operation. Therefore, only a simple indication is provided.

During operation mode the MID 0x06 should be used to monitor energy status.

Offset	Size	Data	Description
0	8	Message index	<u>Enumeration:</u> 0x0D: Current delivery of the harvester
8	4	Charging capabilities	<u>Enumeration:</u> 0x0: Energy provided from harvester is very good for future operation. 0x1: Energy provided from harvester is good for future operation. 0x2: Energy provided from harvester is average for future operation. 0x3: Energy provided from harvester is bad for future operation. 0x4: Energy provided from harvester is very bad for future operation. 0x5...0xF: Reserved.
12	4		<u>Not used</u>

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2.14. MID 0x0E TX Mode OFF

Originator: Device
Addressing: Recommend broadcast

This message informs about the fact that the device is entering a mode where no further radio communication will be executed until the device exits this mode.

The use case is for example:

- transport regulations (no radio communication during air transport)
- the device is put to storage without continuous source of ambient energy source.
- EH device is entering power save mode
- or others

Exit of transport / storage mode is application specific

Offset	Size	Data	Description
0	8	Message index	Enumeration: 0x0E: TX MODE OFF

2.15. MID 0x0F TX Mode ON

Originator: Device
Addressing: Recommend broadcast

This message informs about the fact that the device is now exiting a previous TX MODE OFF. TX Mode will be now available as in normal operation.

The usage of this MID is optional and mandatory connected to the MID 0x0E. Device which send MID 0x0E are not required to send MID 0x0F.

Offset	Size	Data	Description
0	8	Message index	Enumeration: 0x0F: TX Mode ON

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2.16. MID 0x10 Backup battery status

Originator: Device.

Addressing: Recommend broadcast.

This message is intended to inform the receiver about the status of an installed backup battery. The optional data is used to report the charge level of the battery as a percentage of its remaining operating time.

If no backup battery was detected, the optional data field will be set to its maximum value (255).

Offset	Size	Data	Description		
0	8	Message index	Enumeration: 0x10: Backup Battery Status		
8	8	Energy	Valid Range	Scale	Unit
			0..100	0..100	%
			101...254: Reserved		
			255: This value will be reported if no backup battery was detected.		

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2.17. MID 0x11 Learn Mode Status

Originator: Device handling Teach-Request Messages from other devices

Addressing: Broadcast

Learn Mode Status of a device informs about the capability to handle Teach Request Messages and about Teach Results derived hereof. Typical message sequences, e.g. pressing a rocker 3 times within 2 seconds, shall be treated as Teach Request Messages.

Learn Mode Status may be sent at any time of device operation. However, due to the message length, intensive use should be limited to Teach-In and Teach-Out activities.

Offset	Size	Data	Description
0	8	Message Index	<u>Enumeration:</u> 0x11: Learn mode status
8	1	Link Table Full	<u>Enumeration:</u> 0: False = Space available in the link table 1: True = No more space in link table available
9	1	Reception of Teach Request Message	<u>Enumeration:</u> 0: Disabled 1: Enabled
10	2	Learn Mode Type	<u>Enumeration:</u> 0b00: Standard Learn Mode = Binding of devices without further activity 0b01: Extended Learn Mode #1 0b10 : Extended Learn Mode #2 0b11 : Not applicable <u>REMARK:</u> Extended Learn Mode #1 / #2 indicate application specific functionality and need to be described and made public (e.g. in the user manual) by the device manufacturer.
12	4	Teach Result	<u>Enumeration:</u> 0x0 : Tech-In of Device-ID successful 0x1 : Tech-In of Device-ID failed, Device-EEP not supported 0x2 : Tech-In of Device-ID failed, Number of devices of Device-EEP exceeded 0x3 : Tech-In of Device-ID failed, Number of devices exceeded 0x4 : Tech-Out of Device-ID successful



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			0x5 : Tech-Out of Device-ID failed, Device-ID unknown 0x6 ... 0xE : Reserved 0xF : Not applicable		
16	8	Remaining Learn Mode Timeout	Valid Range	Scale	Unit
			1 ... 254	10 ... 2540	[sec]
			0x00 : Not defined 0xFF : Not applicable (device is not accepting Teach Request Messages. REMARK: This parameter specifies the remaining time period in which Teach Request Messages are accepted till the device disables the reception of Teach Request Messages.		
24	32	Device-ID	32bit Source-ID from Teach Request Message received 0xFFFFFFFF : Not applicable		
56	24	Device-EEP	24bit RORG-FUNC-TYPE derived from Teach Request Message received 0FFFFFFF : Not applicable		