Pioneering for You

Strategic Business Unit OEM

Wilo-Para **/LIN

Technical guide

Ready for smart integrated solutions

LiN

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Description of content evolution	Version	Date
Initial release	V01.00	*19/06/2019*
Renamed Vbat by Vbus for standardization Correction of data position on Vendor specific part More details about Wilo pumps identification and traceability Correction of LEN byte value of DID 1036 on SID 0x2E service Updated of DID 4098 write trigger time on SID 0x2E service Specify NAD range assignment for SID 0xB0 service Specify frame identification range assignment for SID 0xB7 service Correction of PCI byte value of SID 0xB7 service Update Wilo LIN identification for ΔP-c and ΔP-v More details on LIN Transfer function Update LIN Warning/Error information mainly Blocked rotor, overvoltage...	V01.01	*05/06/2020*
Specifying voltage range for Wilo-Para R serie Figures n°7 and n°8 updated	V01.02	*21/09/2020*

LIN Bus generalities

Context

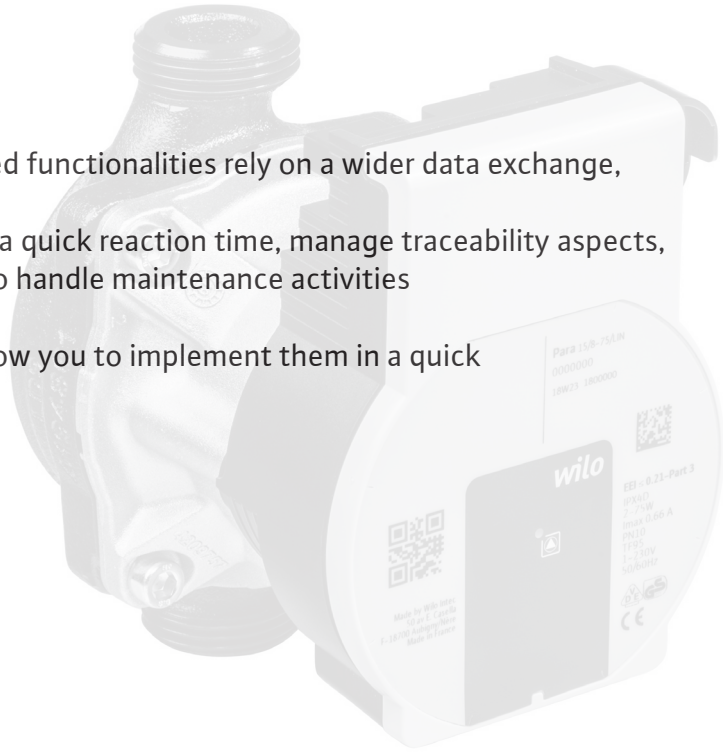
Some of the latest Premium heating systems used on the market rely on deeper data exchange in order to improve their global performances.
In this context, there are needs to place smart products able to provide data about their settings and status, and also have the ability to adapt their setting to fit with specific customer expectations. For this reason, Wilo, as a leader in developing the LIN communicating pumps, proposes its full range of pumps for OEM small applications, from 6m up to 8m head usable for heating, sanitary, solar and geothermal needs.

LIN Bus background

This communication bus has been developed by the automotive industry and is a well-established standard in industry.
Fully specified in the ISO 17987, this independent bus is now personalized for the pump use in heating OEM (for more details about the VDMA definition, see "Referenced Documents" on page 36).

Benefits

The LIN Bus pump becomes the obvious candidate for integration into appliances where advanced functionalities rely on a wider data exchange, not limited to just one information.
Via this local bus, our customers will be able to monitor and control the running application with a quick reaction time, manage traceability aspects, handle commissioning activities, make late customization of pump functionalities, collect data to handle maintenance activities (status, history data...), and many others things...
The next pages will provide the detailed description of Wilo pumps' characteristics in order to allow you to implement them in a quick and proper way in your system.



Hardware definition

The **pin out** for the signal cable used on Wilo pumps is defined as follow:

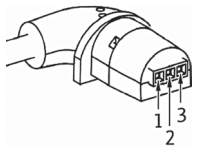


figure n°1

Core no. 1 (brown) → Vbus
Core no. 2 (blue or grey) → GND
Core no. 3 (black) → LIN signal

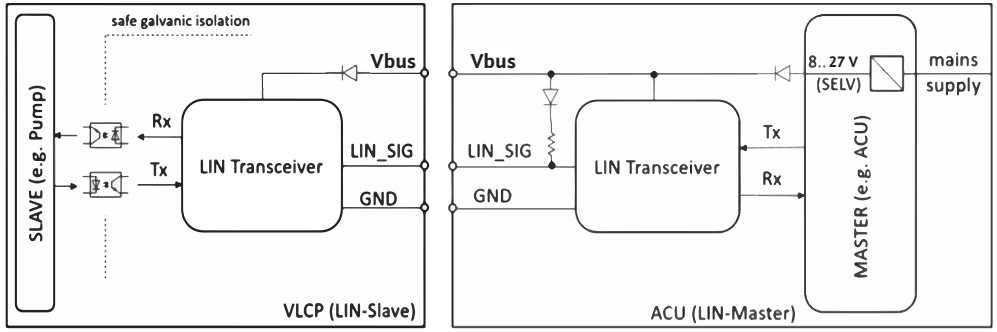


figure n°2

Standard cable length for LIN: due to EMC requirement the maximum cable length of the VLCP bus considered is < 3m.
The pump interface (LIN-Slave) and the master interface (LIN-Master) are defined according to VDMA description and as shown in figure n°2
NB: Wilo LIN transceiver is based on TJA 1021

The bus power supply has to be handled by the master and must follow the below definition:

- 12 to 24 V (typical) : the absolute allowed working range for any voltage at the LIN interface is between 8V to 27V
- each VLCP pump bus slave shall not consume more current than 25mA maximum for LIN communication

WARNING !

For Wilo-Para R (with refrigerant gas use), to ensure to not exceed the maximum temperature allowed on the product, the maximum voltage used on the LIN bus must not overtake 20V

LIN Frames generalities

The handled frames are:

→ **Unconditional frames**
→ **Diagnostic frames**

Frames structures :

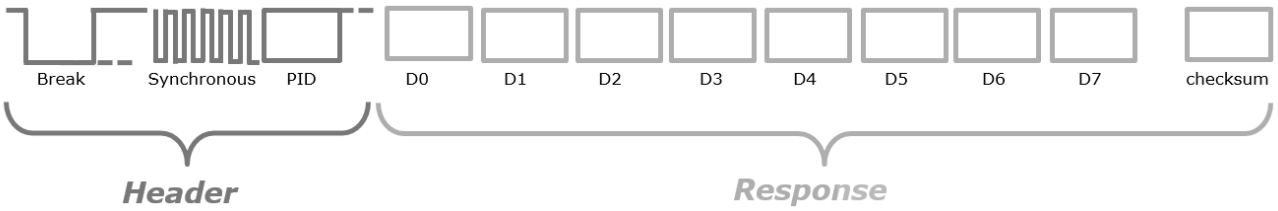


figure n°3

The **header** starts with the break field and ends with the Identifier. The header is **always** sent by the master. It is composed of :

- The Break field which signals the beginning of a new frame. It shall be at least 13 nominal bit times of dominant value followed by at least one recessive bit.
- The Synchronous field which is a byte with the value 0x55. Synchronisation is needed due to missing clock.
- The PID refers to the frame that will be sent.

The **message response** can be filled either by the master or a slave node.

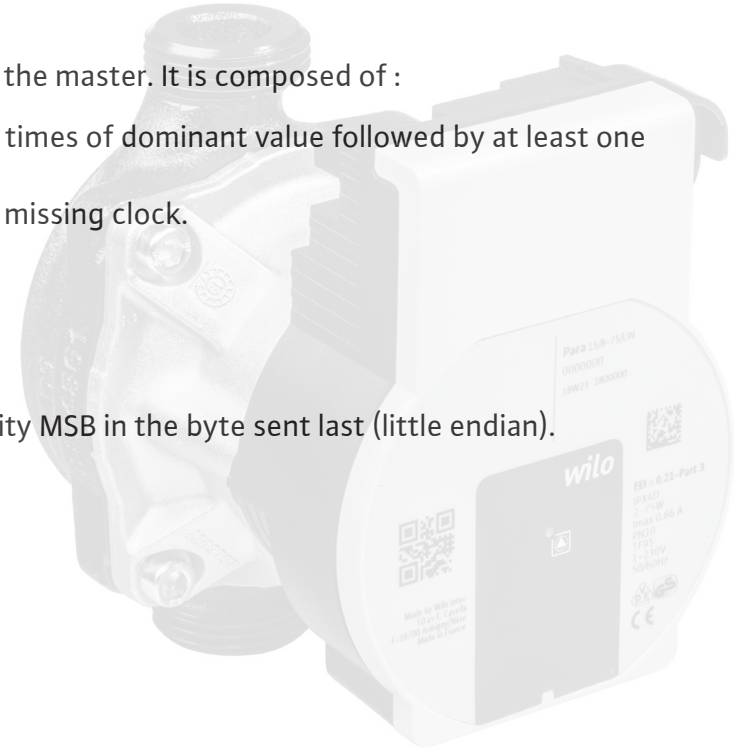
A frame carries between 1 to 8 bytes of data.

For data entities longer than 1 byte, the entity LSB is contained in the byte sent first and the entity MSB in the byte sent last (little endian).

Unconditional frames have frame ID 0–59
Diagnostic frames have frame ID 60–61
Reserved frames are 62–63

The checksums to be used are:

- Diagnostic frames → classic checksum
- Unconditional frames → enhanced checksum



The baud rate to be used for driving a pump is **19200 bps.**

The master shall not request data from the pump slave, with a period lower than **20 ms**

For diagnostic frames, the maximum time in between 2 frames according to **Transport Protocol ISO 17987-2** applies, which specifies a timeout of **1000 ms.**
For unconditional frames, any interval < **4 sec** is OK.
At any time, the bus idl period (without any unconditional or diagnostic frames) > 4 sec may be considered as Bus Sleep by any slave node.

Unconditional frames can be split into 2 types:
- Frame from the master to set the pump
- Frame from the master to get data from the pump

PID : The Protected identifier is a byte divided into 2 parts:
the frame identifier and the parity. Bits 0 to 5 are the frame identifier and bits 6 and 7 are the parity.

Categories short description

VDMA Status	Wilo Status	Pump reaction
Mandatory It is mandatory that the signal takes a valid value (according to VDMA current definition) even if only a single valid value or only a part of the valid values is handled	✓ : Wilo handles all signal values	*Pump must handle all valid signal values*
	(✓) : Wilo only handles some of the values	*Pump must handle all valid signal values except the resricted values*
Optional It is not mandatory to provide the signal or to provide a valid signal value (according to VDMA current definition). If the signal cannot get a valid value, the signal must get the « not handled value » defined into the VDMA	✓ : Wilo handles all signal values	*Pump must handle all valid signal values*
	(✓) : Wilo only handles some of the values	*Pump must handle all valid signal values except the resricted values*
	– : Not handled by Wilo	*Pump will not react to demands and/or must provide the « not handled » value of the corresponding signal*
Reserved Signal is reserved for other device or other standards	**X** : Wilo is not using this signal or only for Wilo internal use	*Pump will not react to demand*

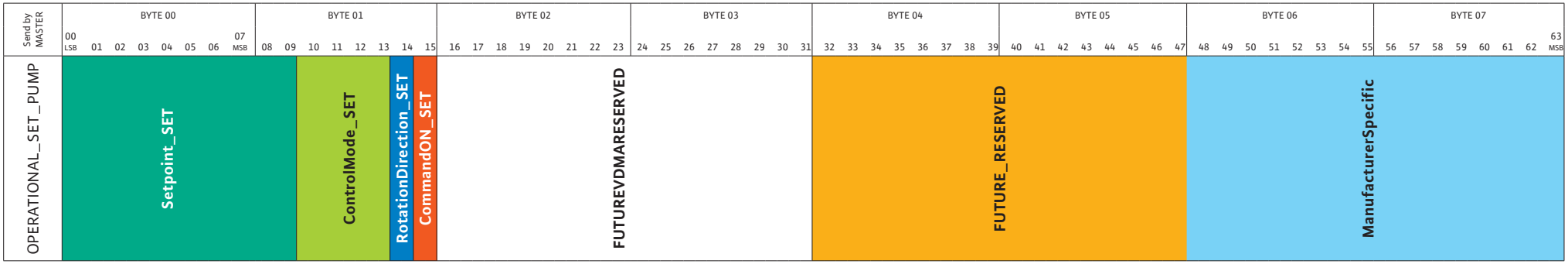
Unconditional frames

Frame from the master to set the pump

Initial frame ID = 1 (Operational_SET_PUMP)	VDMA status	Wilo status	Note
Operational_SET_PUMP_**Setpoint_SET**	Optional	✓	
Operational_SET_PUMP_**ControlMode_SET**	Mandatory	(✓)	*Cst speed handled as a standard on basis version, Cst speed, ∆p-c, ∆p-v on extended version, ∆t not handled*
Operational_SET_PUMP_**RotationDirection_SET**	Mandatory	(✓)	*Rotation inversion is available only on extended version*
Operational_SET_PUMP_**CommandON_SET**	Mandatory	✓	
Operational_SET_PUMP_**FUTUREVDMARESERVED**	Optional	-	*If not defined, the value 0xFFFF shall be transmitted*
Operational_SET_PUMP_**FUTURE_RESERVED**	Optional	-	*If not defined, the value 0xFFFF shall be transmitted*
Operational_SET_PUMP_**ManufacturerSpecific**	Optional	-	*If not defined, the value 0xFFFF shall be transmitted*

✓ = All signal values handled - = Signal not handled (✓) = Some signal values handled **X** = Not usable

Unconditional frames structures

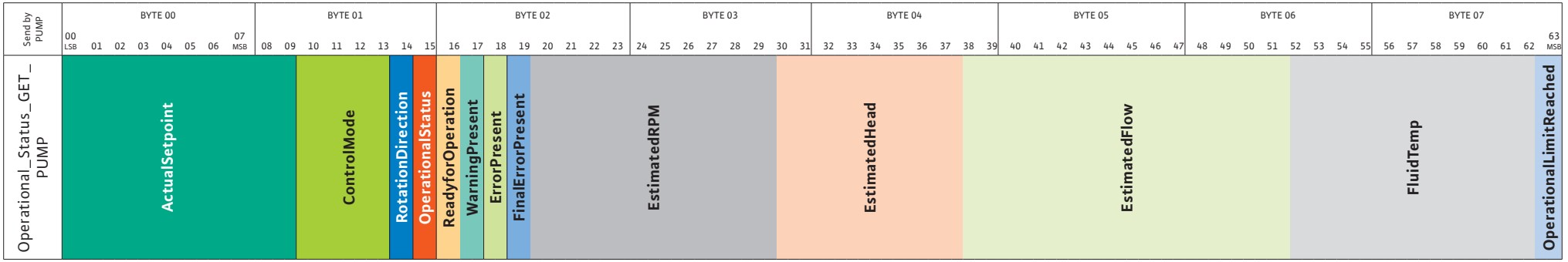


Frame from the master to get data from the pump

Initial frame ID = 2 (Operational_Status_GET_PUMP)	VDMA status	Wilo status	Note
Operational_Status_GET_PUMP_**ActualSetpoint**	Optional	✓	
Operational_Status_GET_PUMP_**ControlMode**	Mandatory	✓	*Cst speed handled as a standard on basis version, Cst speed, Δp-c, Δp-v on extended version, Δt not handled*
Operational_Status_GET_PUMP_**RotationDirection**	Mandatory	✓	*Rotation inversion is available only on extended version*
Operational_Status_GET_PUMP_**OperationalStatus**	Mandatory	✓	
Operational_Status_GET_PUMP_**ReadyforOperation**	Mandatory	✓	
Operational_Status_GET_PUMP_**WarningPresent**	Mandatory	✓	
Operational_Status_GET_PUMP_**ErrorPresent**	Mandatory	✓	[Only one of these bits can be set at a time]
Operational_Status_GET_PUMP_**FinalErrorPresent**	Mandatory	✓	
Operational_Status_GET_PUMP_**EstimatedRPM**	Optional	✓	
Operational_Status_GET_PUMP_**EstimatedHead**	Optional	✓	
Operational_Status_GET_PUMP_**EstimatedFlow**	Optional	✓	
Operational_Status_GET_PUMP_**FluidTemp**	Optional	✓	Not handled value : 0x7FE
Operational_Status_GET_PUMP_**OperationalLimitReached**	Mandatory	✓	

✓ = All signal values handled - = Signal not handled (✓) = Some signal values handled X = Not usable

Unconditional frames structures

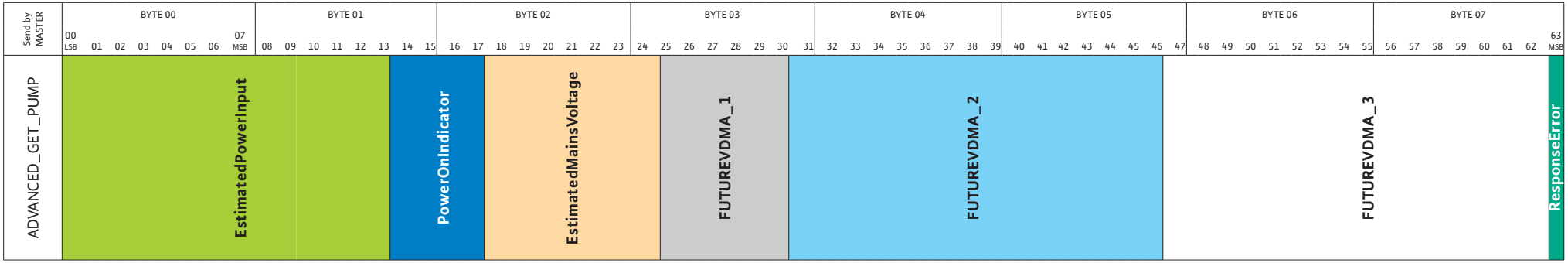


Frame from the master to get data from the pump

Initial frame ID = 3 (ADVANCED_GET_PUMP)	VDMA status	Wilo status	Note
ADVANCED_GET_PUMP_**EstimatedPowerInput**	Optional	✓	
ADVANCED_GET_PUMP_**PowerOnIndicator**	Optional	✓	
ADVANCED_GET_PUMP_**EstimatedMainsVoltage**	Optional	✓	
ADVANCED_GET_PUMP_**FUTUREVDMA_1**	Optional	–	*Default value : 0x3F*
ADVANCED_GET_PUMP_**FUTUREVDMA_2**	Optional	–	*Default value : 0xFFFF*
ADVANCED_GET_PUMP_**FUTUREVDMA_3**	Optional	–	*Default value : 0xFFFF*
ADVANCED_GET_PUMP_**ResponseError**	Mandatory	✓	

✓ = All signal values handled – = Signal not handled (✓) = Some signal values handled **X** = Not usable

Unconditional frames structures



Frame from the master to get data from the pump

Initial frame ID = 4 (MANU_SPECIFIC_GET_PUMP)	VDMA status	Wilo status	Notes
MANU_SPECIFIC_**GET_PUMP**	Optional	–	*0xFFFF FFFF FFFF FFFF*

✓ = All signal values handled - = Signal not handled (✓) = Some signal values handled **X** = Not usable

Unconditional frames structures

Send by MASTER	BYTE 00	BYTE 01	BYTE 02	BYTE 03	BYTE 04	BYTE 05	BYTE 06	BYTE 07
	00 LSB 01 02 03 04 05 06 07 MSB	08 09 10 11 12 13 14 15	16 17 18 19 20 21 22 23	24 25 26 27 28 29 30 31	32 33 34 35 36 37 38 39	40 41 42 43 44 45 46 47	48 49 50 51 52 53 54 55	56 57 58 59 60 61 62 63 MSB
MANU_SPECIFIC_GET_PUMP	**GET_PUMP**							

Diagnostic frames

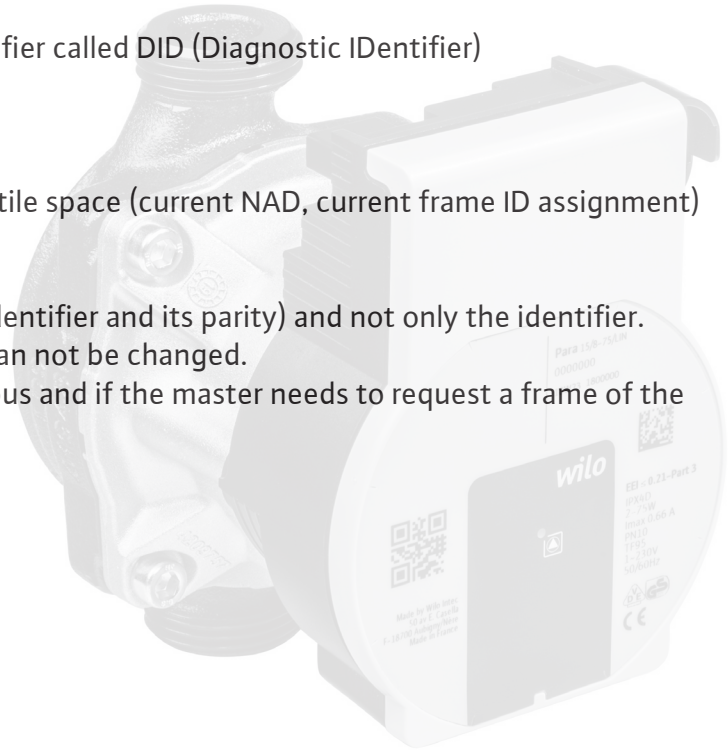
The VLCP devices handle 6 SID accessible by diagnostic request:

- **0xB0:** Assign NAD is used to resolve conflicting NADs into the LIN bus.
  This conflict could happen if there are 2 or more VLCP devices on the LIN bus.
  This service uses the initial NAD which is the last one stored in the pump with the 0xB6 Save Configuration service.

The NAD change is immediately taken into account by the pump. It must be recorded using SID 0xB6 to retain it in case of power off (see page 28).
In the case of several pumps being used, the frame IDentifier range can be changed accordingly using SID 0xB7 (see later on page 28).

- **0xB2**: Read information service
- **0x22:** Read information service : The service 0x22 addresses certain data with an IDentifier called DID (Diagnostic IDentifier)
- **0x2E:** Write information service
- **0xB6:** The service enables the current device configuration to be saved into a non-volatile space (current NAD, current frame ID assignment)
- **0xB7:** Assign frame ID range is used to set or disable PIDs up to 4 frames.
  It is important to notice that the request provides the protected identifier (the identifier and its parity) and not only the identifier.
  Furthermore, frames with frame identifiers 0x3C and 0x3D (diagnostic frames) can not be changed.
  Assign frame ID range could be used if there are 2 or more VLCP devices on the bus and if the master needs to request a frame of the VDMA only from one of them.

For diagnostic messages, the requests or the responses can be:
- Single frame (SF) response
- First frame (FF) / Consecutive(s) frame(s) (CF) response.



NAD : The NAD is the specific address number of a device connected to the LIN bus.

LIN addressing is achieved with NAD values in the range of 1 to 127.
All pumps handling the VDMA standards have the initial NAD of 0x02, and this value can be changed at any time with the 0xB0 Assign NAD service.
All diagnostic frames use a NAD to communicate with a device connected to the LIN bus.

SID : The Service IDentifier specifies the service requested by the master into a diagnostic frame. The SID identifies the service used.

RSID : The Response Service IDentifier specifies the content of the response to the diagnostic service requested by the master.
For a positive response, the RSID is always SID + 0x40.

Those frames handle the below services:

Diagnostic frames and services overview

SID	Name	VDMA status	Wilo status	Note
0x22	Diagnostic Service read data by IDentifier	Mandatory	(✓)	
0x2E	Diagnostic Service write data by IDentifier	Mandatory	(✓)	
0xB0	AssignNAD	Mandatory	✓	
0xB2	Read by identifier	Mandatory	(✓)	
0xB6	Save Configuration	Mandatory	✓	
0xB7	AssignFrameIdentifierRange	Mandatory	✓	

✓ = All signal values handled - = Signal not handled (✓) = Some signal values handled X = Not usable

Service for reading data (SID 0x22)

The service 0x22 enables data to be read from the pump. The diagnostic data to read is identified by a data identifier (DID).

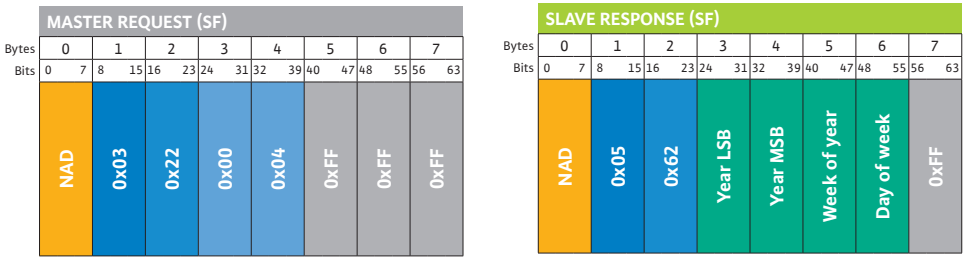
The following data can be read:

Read requests overview

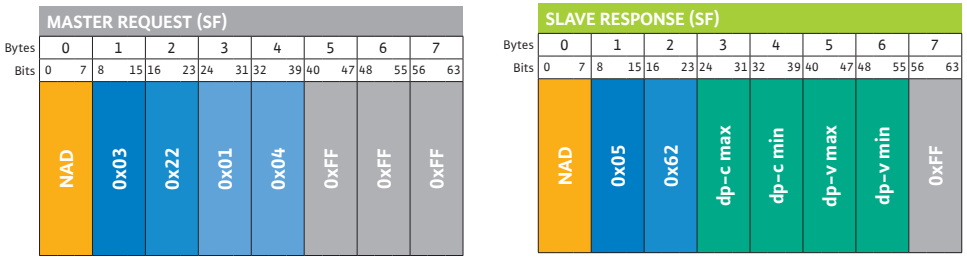
DID	Requested slave data	VDMA status	Wilo status	Note
0 .. 1023	Reserved (ISO 14229-1)	Reserved	X	*Not to be used*
1024	Manufacturing date and time	Optional	✓	
1025	Pressure control (dpc dpv) max and min pressure	Optional	✓	*Data delivered only if Δp-c / Δp-v are handled*
1026	Speed max and min information	Optional	✓	
1027	Flow max and min information	Optional	✓	*Data delivered optionally*
1028	Accumulated energy consumption	Mandatory	✓	
1029	Accumulated operation time	Mandatory	✓	
1030	Accumulated ON Time	Mandatory	✓	
1031	Power on counter	Mandatory	✓	
1032	Fallback settings	Mandatory	✓	*See "Fallback mode and Bus sleep" (p.19)*
1033	Product serial number string	Mandatory	✓	
1034	Operation limitation details	Optional	(✓)	*See "Operation limitation details" (p.18)*
1035	Read optional feature support	Mandatory	✓	
1036	Read OEM production information	Mandatory	✓	
1037	Delta T max min information	Optional	–	*Data provided only if dT control is handled*
1038 .. 4095	Reserved for future VLCP use	Optional	–	
4096 .. 4097	Vendor specific product/unit information	Optional	–	
4098 .. 8191	Reserved for VLCP vendor specific use	Optional	✓	*Wilo specific use :* *DID4098 "Fallback mode and Bus sleep" (p.19)* *DID4099 "Wilo part traceability " (p.22)*
8192 .. 65535	Reserved for use by other devices on the VLCP bus	Reserved	X	

✓ = All signal values handled – = Signal not handled (✓) = Some signal values handled X = Not usable

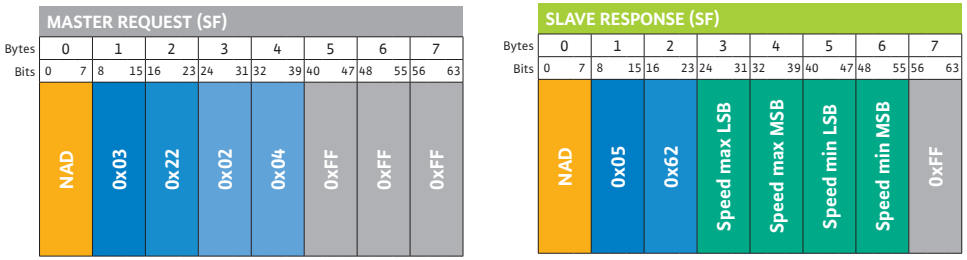
DID 1024 means: manufacturing date and time



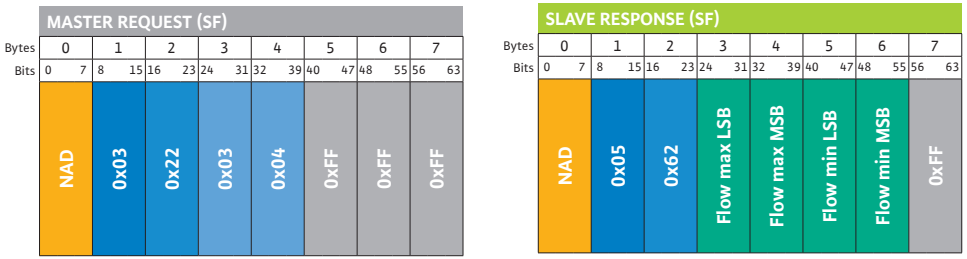
DID 1025 means: maximum and minimum head



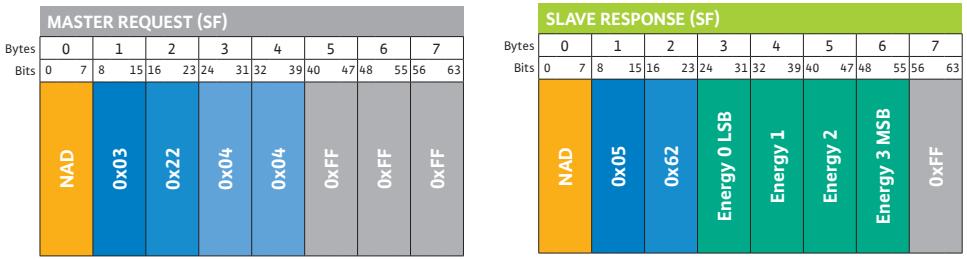
DID 1026 means: maximum and minimum speed



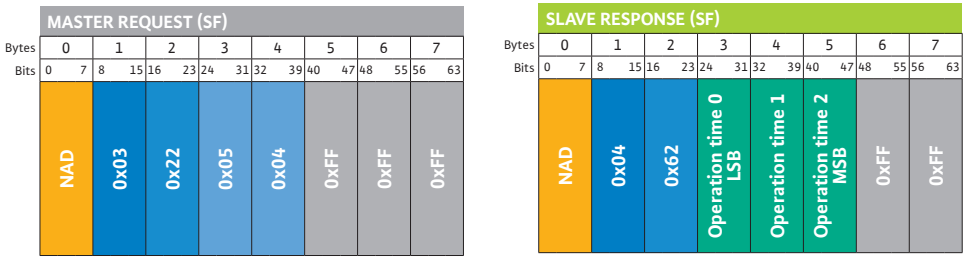
DID 1027 means: maximum and minimum flow



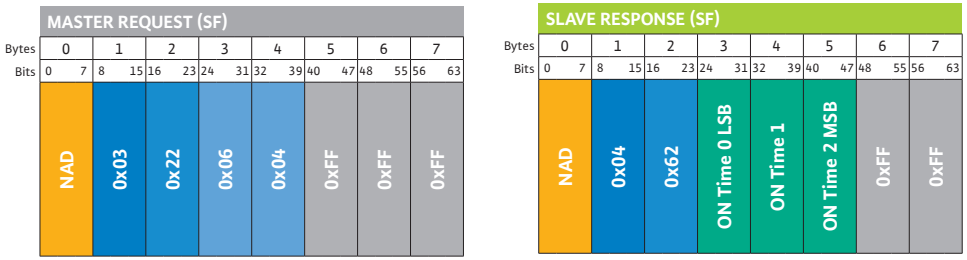
DID 1028 means: energy consumption



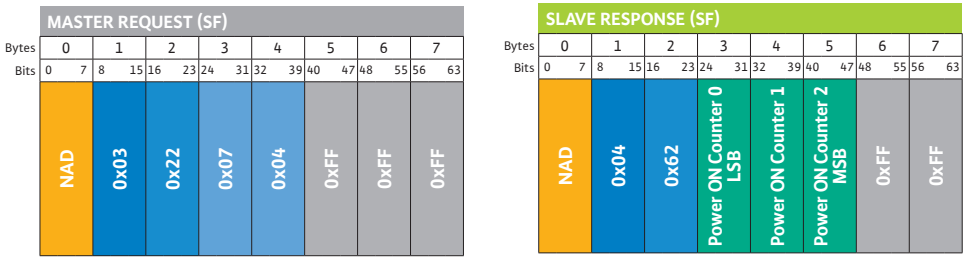
DID 1029 means: operation time



DID 1030 means: accumulated ON Time



DID 1031 means: power on counter



DID 1032 means: fallback settings

MASTER REQUEST (SF)							
Bytes	0	1	2	3	4	5	6	7
Bits	0 7	8 15	16 23	24 31	32 39	40 47	48 55	56 63
	NAD	0x03	0x22	0x08	0x04	0xFF	0xFF	0xFF

SLAVE RESPONSE (SF)							
Bytes	0	1	2	3	4	5	6	7
Bits	0 7	8 15	16 23	24 31	32 39	40 47	48 55	56 63
	NAD	0x06	0x62	Setpoint LSB	Setpoint MSB	Control Mode	Preset ON / Direction / Fallback Time LSB	Fallback Time MSB

DID 1033 means: product serial number string

MASTER REQUEST (SF)							
Bytes	0	1	2	3	4	5	6	7
Bits	0 7	8 15	16 23	24 31	32 39	40 47	48 55	56 63
	NAD	0x03	0x22	0x09	0x04	0xFF	0xFF	0xFF

SLAVE RESPONSE (FF)							
Bytes	0	1	2	3	4	5	6	7
Bits	0 7	8 15	16 23	24 31	32 39	40 47	48 55	56 63
	NAD	0x10	0x11	0x62	Serial String 0 LSB	Serial String 1	Serial String 2	Serial String 3

SLAVE RESPONSE (CF1)							
Bytes	0	1	2	3	4	5	6	7
Bits	0 7	8 15	16 23	24 31	32 39	40 47	48 55	56 63
	NAD	0x21	String 4	String 5	String 6	String 7	String 8	String 9

SLAVE RESPONSE (CF2)							
Bytes	0	1	2	3	4	5	6	7
Bits	0 7	8 15	16 23	24 31	32 39	40 47	48 55	56 63
	NAD	0x22	String 10	String 11	String 12	String 13	String 14	String 15

More details on page 21

DID 1034 means: operation Limitation details

MASTER REQUEST (SF)							
Bytes	0	1	2	3	4	5	6	7
Bits	0 7	8 15	16 23	24 31	32 39	40 47	48 55	56 63
	NAD	0x03	0x22	0x0A	0x04	0xFF	0xFF	0xFF

SLAVE RESPONSE (SF)							
Bytes	0	1	2	3	4	5	6	7
Bits	0 7	8 15	16 23	24 31	32 39	40 47	48 55	56 63
	NAD	0x05	0x62	VLCP List LSB	VLCP List MSB	Vendor specific list LSB	Vendor Specific list MSB	0xFF

DID 1035 means: read Optional feature support

MASTER REQUEST (SF)							
Bytes	0	1	2	3	4	5	6	7
Bits	0 7	8 15	16 23	24 31	32 39	40 47	48 55	56 63
	NAD	0x03	0x22	0x0B	0x04	0xFF	0xFF	0xFF

SLAVE RESPONSE (SF)							
Bytes	0	1	2	3	4	5	6	7
Bits	0 7	8 15	16 23	24 31	32 39	40 47	48 55	56 63
	NAD	0x06	0x62	Control Mode LSB	Control Mode MSB	Rotation direction	Reserved LSB	Reserved MSB

DID 1036 means: read OEM Production information

MASTER REQUEST (SF)							
Bytes	0	1	2	3	4	5	6	7
Bits	0 7	8 15	16 23	24 31	32 39	40 47	48 55	56 63
	NAD	0x03	0x22	0x0C	0x04	0xFF	0xFF	0xFF

SLAVE RESPONSE (FF)							
Bytes	0	1	2	3	4	5	6	7
Bits	0 7	8 15	16 23	24 31	32 39	40 47	48 55	56 63
	NAD	0x10	0x0F	0x62	OEM String 0	OEM String 1	OEM String 2	OEM String 3

SLAVE RESPONSE (CF1)							
Bytes	0	1	2	3	4	5	6	7
Bits	0 7	8 15	16 23	24 31	32 39	40 47	48 55	56 63
	NAD	0x21	OEM String 4	OEM String 5	OEM String 6	OEM String 7	OEM String 8	OEM String 9

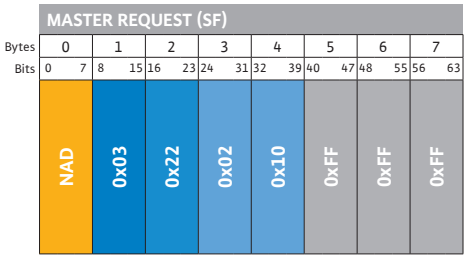
SLAVE RESPONSE (CF2)							
Bytes	0	1	2	3	4	5	6	7
Bits	0 7	8 15	16 23	24 31	32 39	40 47	48 55	56 63
	NAD	0x22	OEM String 10	OEM String 11	OEM String 12	OEM String 13	0xFF	0xFF

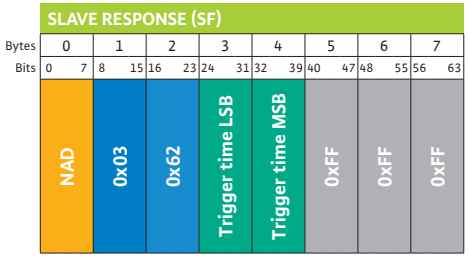
DID 1037 means: read Delta T max and min setpoint

MASTER REQUEST (SF)							
Bytes	0	1	2	3	4	5	6	7
Bits	0 7	8 15	16 23	24 31	32 39	40 47	48 55	56 63
	NAD	0x03	0x22	0x0D	0x04	0xFF	0xFF	0xFF

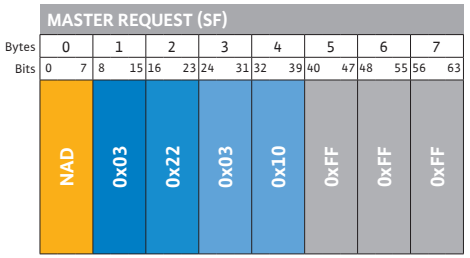
SLAVE RESPONSE (SF)							
Bytes	0	1	2	3	4	5	6	7
Bits	0 7	8 15	16 23	24 31	32 39	40 47	48 55	56 63
	NAD	0x03	0x62	Delta T max	Delta T min	0xFF	0xFF	0xFF

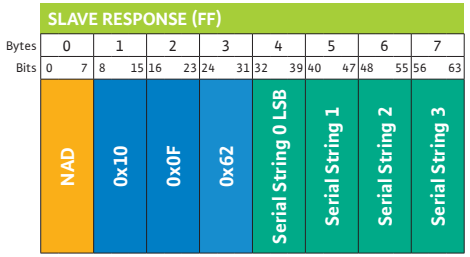
DID 4098 means: trigger time

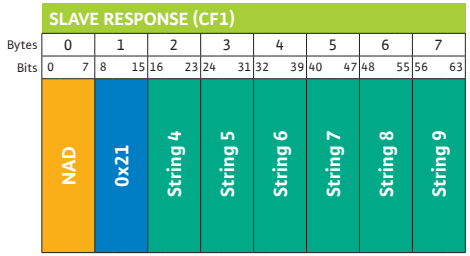


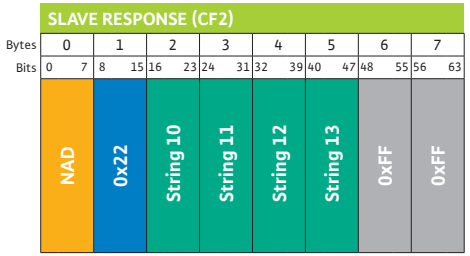


DID 4099 means: customer specific code









More details on page 22

→ Operation Limitation details

The pump has reached a limit if the signal **Operational_Status_GET_PUMP_OperationalLimitatReached** is set to 1 in the unconditional frame **Operational_Status_GET_PUMP**.
In this case, the Operation Limitation details service provides more information about the specificities of the limit reach.

The Operation limitation details is available with the diagnostic service 0x22, DID 1034 described previously.

VLCP list

Bit	Data to read	VDMA status	Wilo status	Note
0	Maximum speed	Optional	✓	*If limit reached = 1*
1	Minimum speed	Optional	✓	*If limit reached = 1*
2	Maximum power	Optional	✓	*If limit reached = 1*
3	Lower medium temperature limit reached	Optional	–	
4	Upper medium temperature limit reached	Optional	–	
5	Upper pump temperature limit reached	Optional	–	
6–15	For future VDMA use	Optional	X	

✓ = All signal values handled – = Signal not handled (✓) = Some signal values handled X = Not usable

Vendor specific part

Bit	Data to read	VDMA status	Wilo status	Note
0	Generator operation	Optional	✓	*If active = 1*
1	Dry run	Optional	✓	*If active = 1*
2	Overload	Optional	✓	*If active = 1*
3	Over temperature module	Optional	✓	*If limit reached = 1*
4–7	Vendor specific	Optional	X	*Wilo Reserved – Not to be used by the customer*
8	Limitation voltage mains	Optional	✓	*If limit reached = 1*
9–15	Vendor specific	Optional	–	

✓ = All signal values handled – = Signal not handled (✓) = Some signal values handled X = Not usable

→ Fallback mode and Bus sleep

In the case of communication failure between the master and the pump, the Wilo pumps handle a “Fallback mode“.
The communication failure is detected according to 2 criterias : Trigger time and Fallback time.

- Trigger time : it is the time after which the pump assumes the LIN communication failure occurs if no LIN frame is on the bus.
- Fallback time : it is the time after trigger time when no LIN frame being on the bus, the pump will go into a specific mode called "Fallback mode".

The trigger time is used to ensure there is no communication on the bus in order to start launching the fallback time.

When delivered, the Wilo standard delivery setting is:

- Pump running, full speed (100%), in speed control mode with a fallback time set to 0 s (whereas the VDMA default value is defined as: Pump Stop, 0%, speed control mode with a fallback time set to 100s).
- This setting can be adjusted later by the customer by LIN communication using the diagnostic service (write request service 0x2E DID 1032).
- Under request, this setting can be modified on Wilo production lines

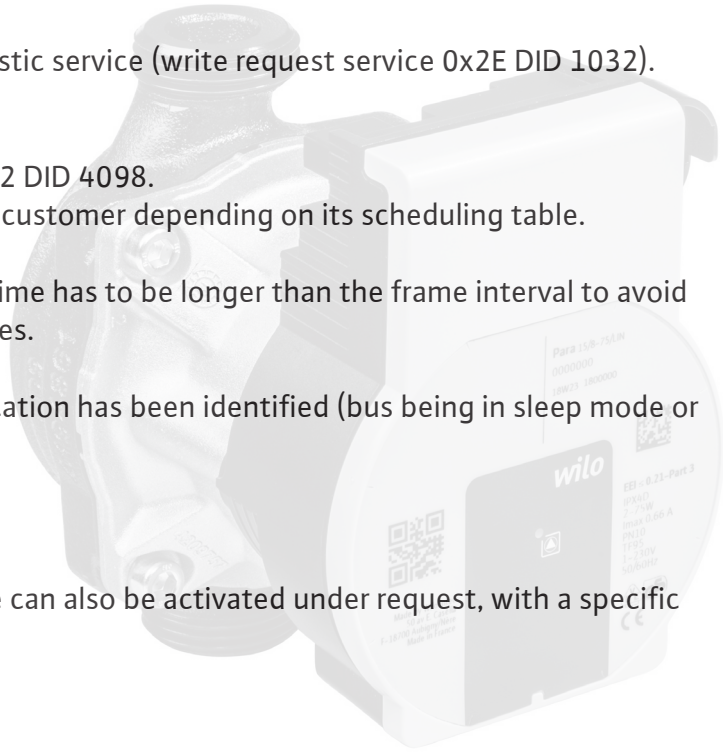
Wilo trigger time is initially defined @500 ms. It can be read out using read request service 0x22 DID 4098.
Wilo trigger time is configurable through LIN Diagnostic command and is then adjusted by the customer depending on its scheduling table.

The trigger time setting shall be linked to the period of the unconditional frames. The trigger time has to be longer than the frame interval to avoid that "normal gaps" in the frame scheduling are considered as communication losses in the slaves.

At the end of “trigger time + fallback time “, the pump will be in fallback mode if no communication has been identified (bus being in sleep mode or not).

This is not connected to the timer for the bus sleep that remains as existing.

In case of no communication, the pump bus will switch to sleep mode after 4s (the sleep mode can also be activated under request, with a specific frame, immediately after the request).



Fallback mode diagram

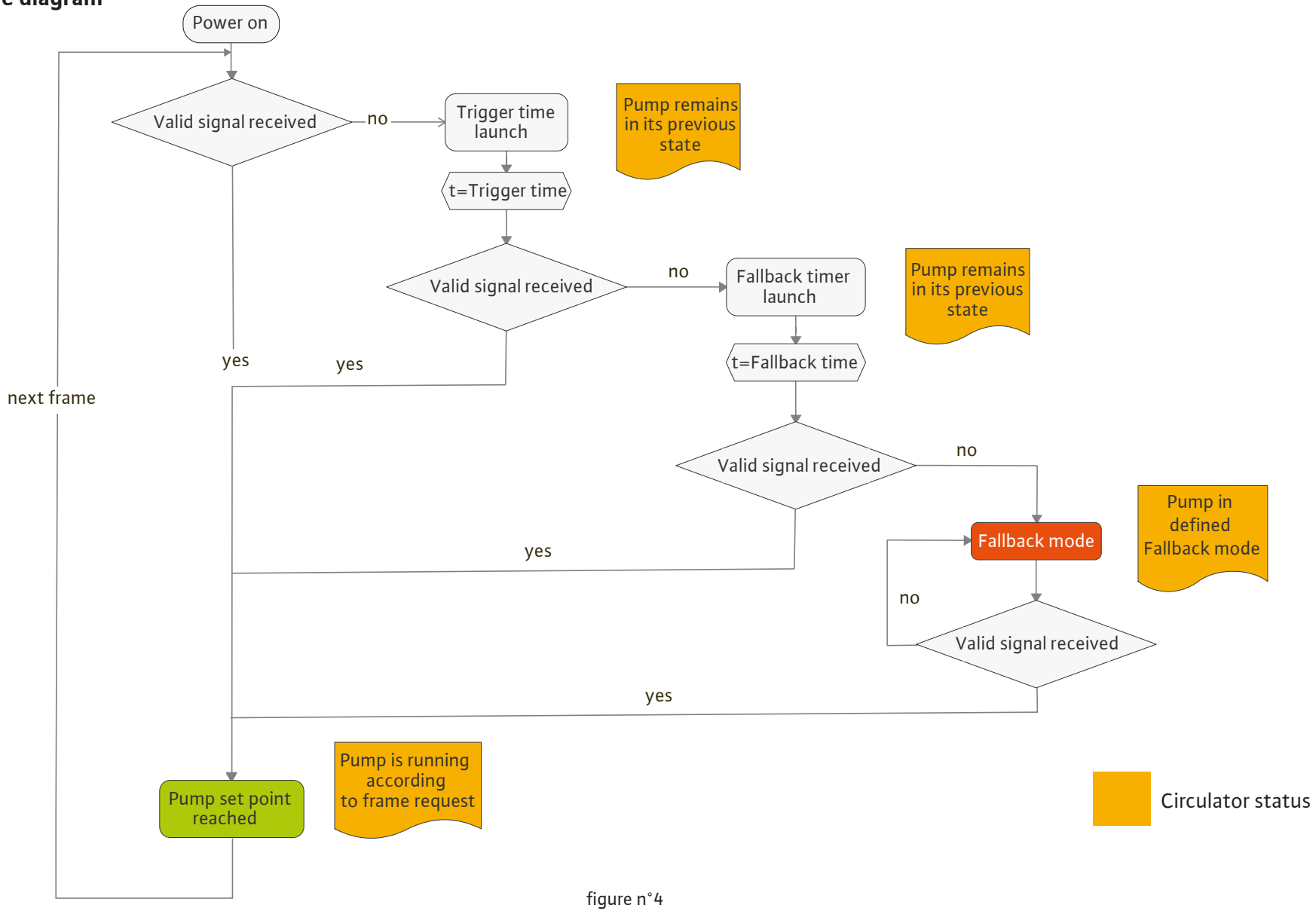


figure n°4

→ Wilo Part traceability is based on the below whole number defining the Pump serial number.

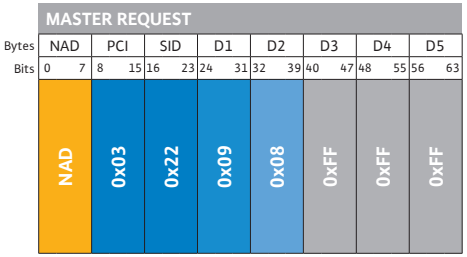
Wilo Pump serial number format:

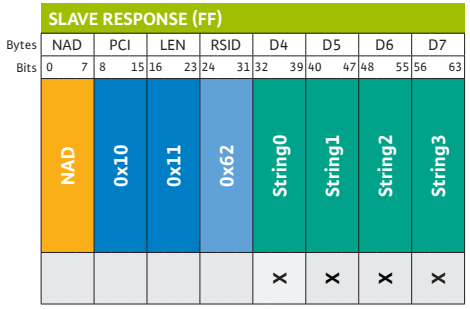
XXXXXXX * AAAAAALL
(*=0x00)

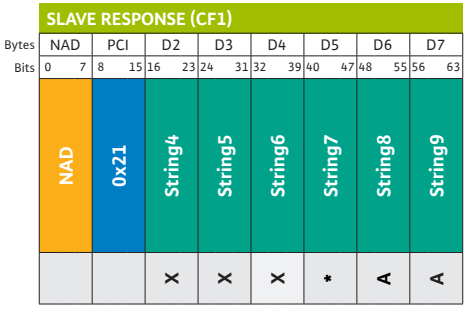
The Wilo part number is written once at the end of the production line, and is never changed during the pump's lifetime.
It is made up of 2 groups:

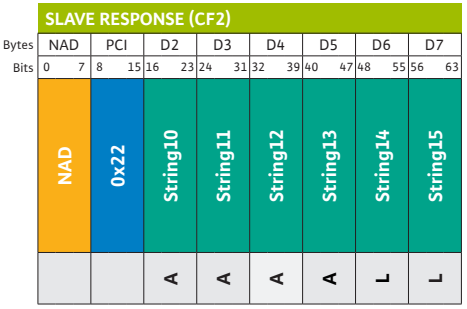
- First group is the product reference (Wilo article number) composed of 7 characters
- Second group is the unique part number (incremental) of 8 characters

Product reference and product unique number are read accessible by LIN communication with the diagnostic service 0x22, DID 1033 according to below tables:









Product date content :

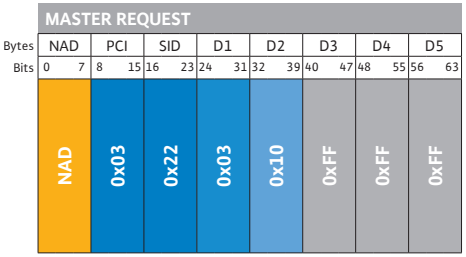
DID1024 is defined according to VDMA definition:

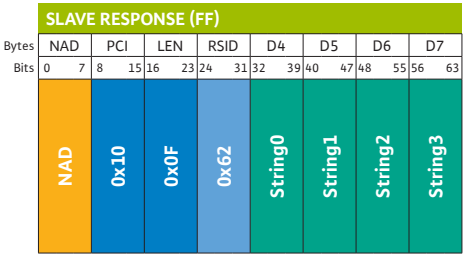
- Year given as a number between 0..65535
- Week of year given as a number between 1..53, FF16 if manufacturing week is not handled
- Day of week given as a value between 1 = Monday .. 7 = Sunday, FF16 if manufacturing day is not handled

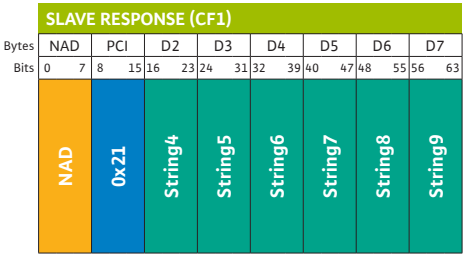
Customer traceability:

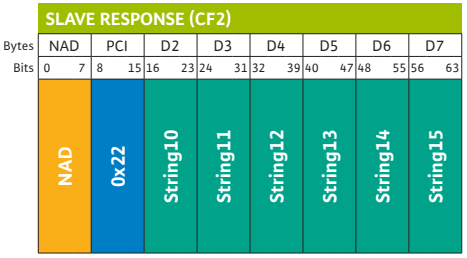
The customer specific code is a reserved memory location for customers who want their code to be accessible only for reading by LIN communication. Its size is of 14 bytes.

The customer specific code is read only by LIN communication with the diagnostic service 0x22, DID 4099 according to below tables









The customer specific code is written once at the end of the Wilo production line, and is never changed during the pump's lifetime

Service for writing data (SID 0x2E)

The service enables data to be written in the pump.
The following data can be writen:

Write requests overview

DID	Data to write	VDMA status	Wilo status	Note
0 .. 1023	Reserved (ISO 14229-1)	Reserved	X	
1024 .. 1031	Reserve for future VLCP use	Optional	–	
1032	Default setpoint, control mode and fallback time for communication failure	Mandatory	(✓)	*According control mode and rotation direction availability*
1033 .. 1035	Reserve for future VLCP use	Optional	–	
1036	Write OEM production information	Mandatory	✓	
1037 ..4095	Reserve for future VLCP use	Optional	–	
4096 ..4097	Vendor specific product/unit information	Optional	–	
4098 .. 8191	Reserve for future VLCP use	Optional	✓	*Wilo specific use : DID4098 "Trigger time"*
8192 .. 65535	Reserved for use by other devices on the VLCP bus	Reserved	X	

✓ = All signal values handled – = Signal not handled (✓) = Some signal values handled X = Not usable

DID 1032 means: write default setpoint, control mode and fallback time for communication failure

MASTER REQUEST (FF)

Bytes	0	1	2	3	4	5	6	7
Bits	0 7	8 15	16 23	24 31	32 39	40 47	48 55	56 63
	NAD	0x10	0x08	0x2E	0x08	0x04	Setpoint LSB	Setpoint MSB

MASTER REQUEST (CF1)

Bytes	0	1	2	3	4	5	6	7
Bits	0 7	8 15	16 23	24 31	32 39	40 47	48 55	56 63
	NAD	0x21	Control Mode	PresetON/direction/ Fallback time LSB	Fallback time MSB	0xFF	0xFF	0xFF

SLAVE RESPONSE (SF)

Bytes	0	1	2	3	4	5	6	7
Bits	0 7	8 15	16 23	24 31	32 39	40 47	48 55	56 63
	NAD	0x05	0x6E	0x08	0x04	0x00	0x00	0xFF

DID 1036 means: write OEM production information

MASTER REQUEST (FF)

Bytes	0	1	2	3	4	5	6	7
Bits	0 7	8 15	16 23	24 31	32 39	40 47	48 55	56 63
	NAD	0x10	0x11	0x2E	0x0C	0x04	OEM String 0 LSB	OEM String 1

MASTER REQUEST (CF1)

Bytes	0	1	2	3	4	5	6	7
Bits	0 7	8 15	16 23	24 31	32 39	40 47	48 55	56 63
	NAD	0x21	OEM String 2	OEM String 3	OEM String 4	OEM String 5	OEM String 6	OEM String 7

MASTER REQUEST (CF2)

Bytes	0	1	2	3	4	5	6	7
Bits	0 7	8 15	16 23	24 31	32 39	40 47	48 55	56 63
	NAD	0x22	OEM String 8	OEM String 9	OEM String 10	OEM String 11	OEM String 12	OEM String 13

SLAVE RESPONSE (SF)

Bytes	0	1	2	3	4	5	6	7
Bits	0 7	8 15	16 23	24 31	32 39	40 47	48 55	56 63
	NAD	0x05	0x6E	0x0C	0x04	0x42	0x4F	0xFF

DID 4098 means: write trigger time

MASTER REQUEST (SF)

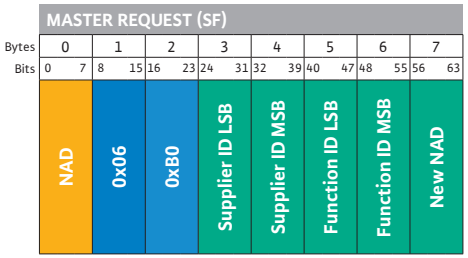
Bytes	0	1	2	3	4	5	6	7
Bits	0 7	8 15	16 23	24 31	32 39	40 47	48 55	56 63
	NAD	0x05	0x2E	0x02	0x10	Fallback trigger time LSB	Fallback trigger time MSB	0xFF

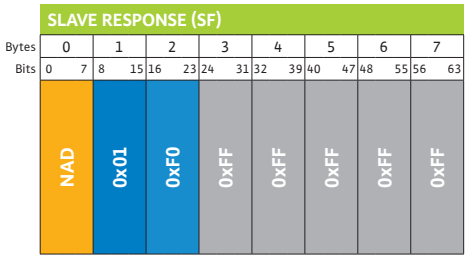
SLAVE RESPONSE (SF)

Bytes	0	1	2	3	4	5	6	7
Bits	0 7	8 15	16 23	24 31	32 39	40 47	48 55	56 63
	NAD	0x05	0x6E	0x02	0x10	Fallback trigger time LSB	Fallback trigger time MSB	0xFF

NAD Assignment (SID 0xB0)

As all VLCP have the same initial **NAD = 0x02**, for instance if more than one pump is used in a system, the NAD can be changed by this service in range of 1–125 (0x7D).
The request from the master to change NAD is shown on the master request frame. If the initial NAD, the supplier ID, and the function ID match, the successful reponse sent by the pump is shown on slave response frame.





	Wilo	WildCard
Supplier ID	0xA9	0x7FFF
Function ID	0x00	0xFFFF
NAD	0x02	0x7F

WildCard values can be used when only 1 slave is connected to the bus

Read by "Identifier" (SID 0xB2)

The service 0xB2, via Identifier bytes, enables data to be read from the pump.
The following data can be read:

Read requests overview

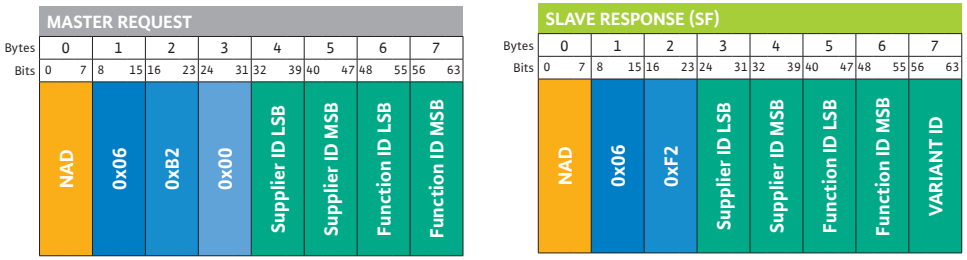
ID	Requested slave data	VDMA status	Wilo status	Note
0	LIN product identification	Mandatory	✓	
1	Serial number	Optional	–	
2–31	Reserved in ISO	Reserved	X	
32	Error/warning Information	Mandatory	✓	*See "LIN Warming / Error Information" (p.33)*
33	Product number (vendor specific numbering)	Mandatory	✓	
34	VDMA profile revision major/minor revision	Mandatory	✓	

✓ = All signal values handled – = Signal not handled (✓) = Some signal values handled X = Not usable

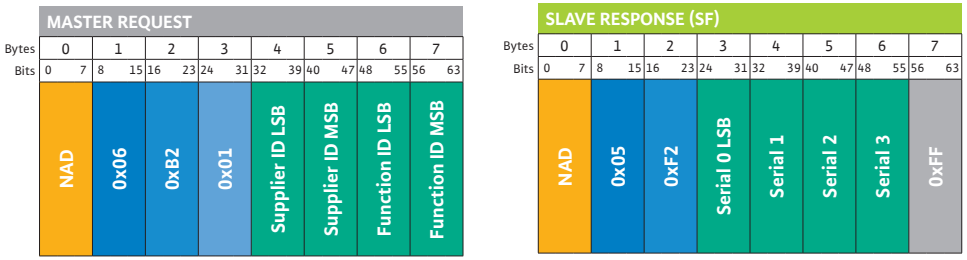
	Wilo	WildCard
Supplier ID	0xA9	0x7FFF
Function ID	0x00	0xFFFF
NAD	0x02	0x7F

WildCard values can be used when only 1 slave is connected to the bus

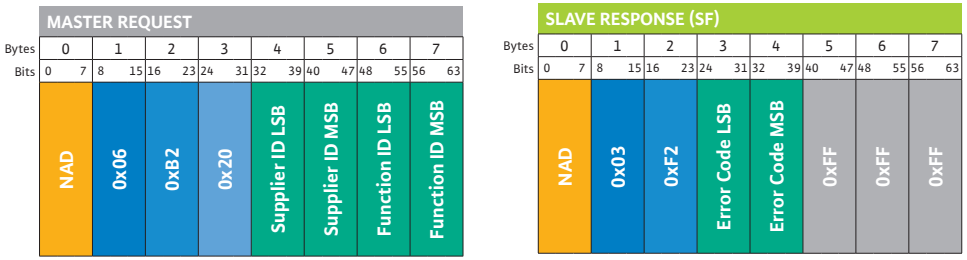
ID 0 means: read LIN product identification



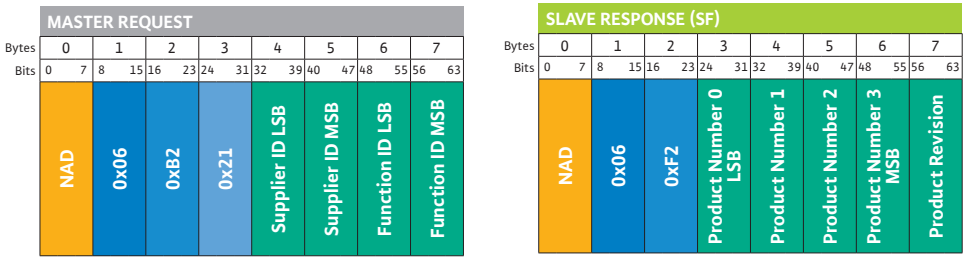
ID 1 means: read serial number



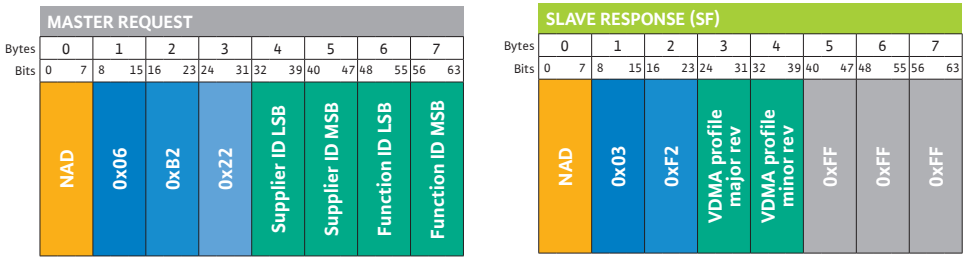
ID 32 means: detailed error code identifier



ID 33 means: product number



ID 34 means: VDMA profile version

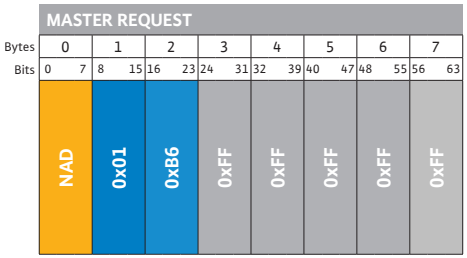


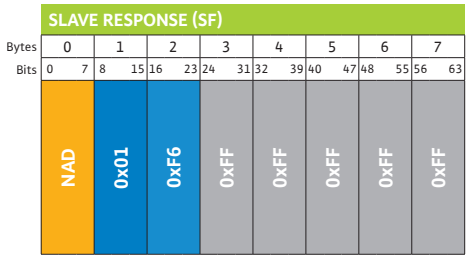
	Wilo	WildCard
Supplier ID	0xA9	0x7FFF
Function ID	0x00	0xFFFF
NAD	0x02	0x7F

WildCard values can be used when only 1 slave is connected to the bus

Save configuration (SID 0xB6)

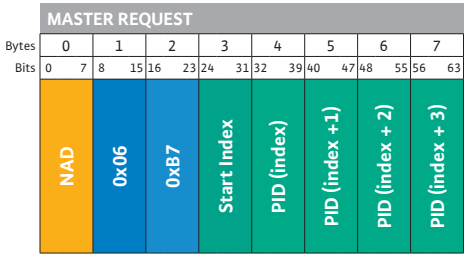
This service saves the actual LIN configuration (current NAD and current PID assignment).

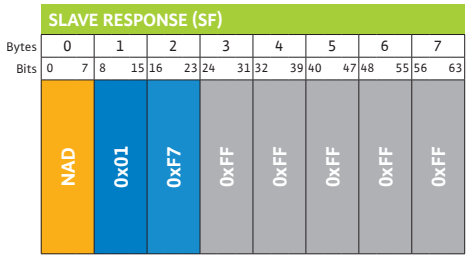




Frame Identifier Range assignment (SID 0xB7)

Assign frame ID range is used to set or disable PIDs up to four frames in the range of 1– 59 (0x3B).

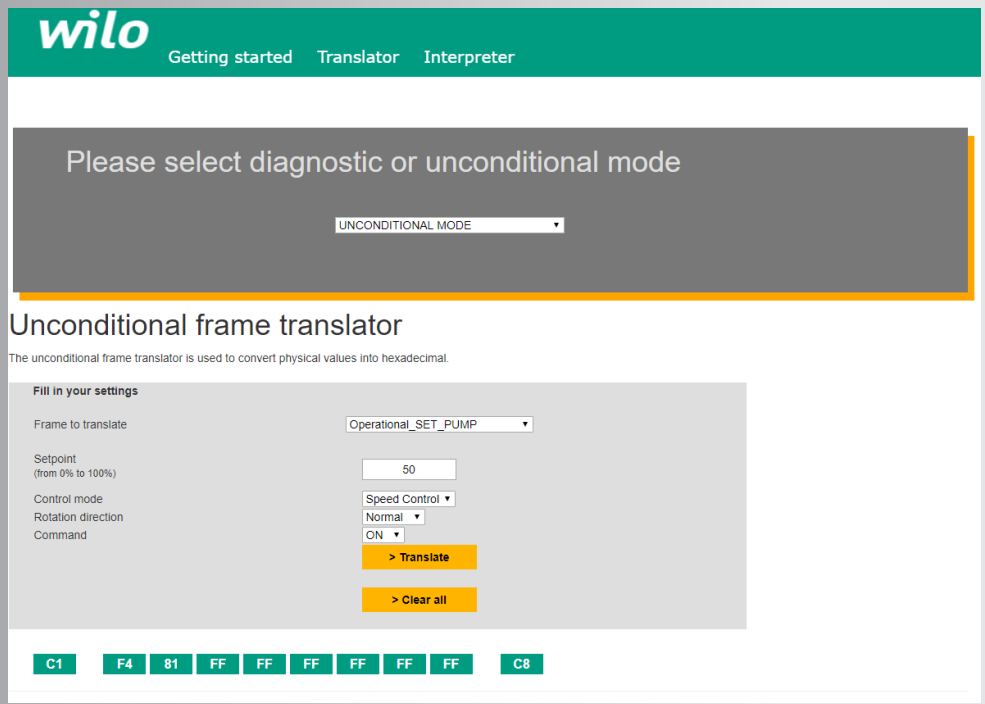


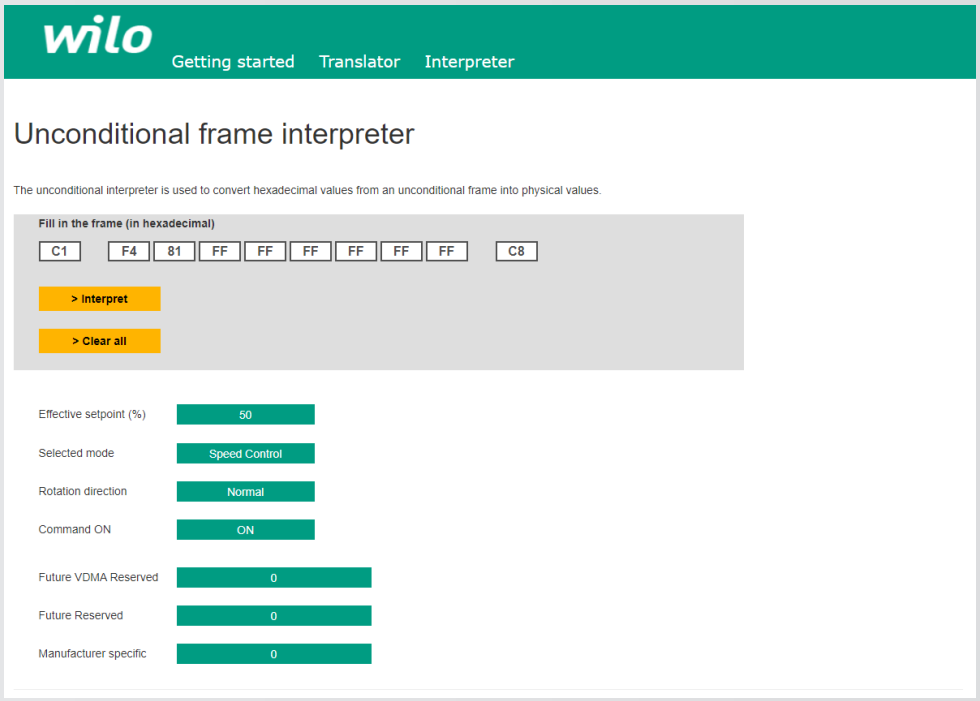


LIN frames content

For all details regarding Frame content, please use **the Wilo LIN Frame Translate application** that can be used on our Wilo website, at the following link:

www.wilo-oem.com





Wilo LIN identification

A Wilo pump is defined in the communication bus as follow:

– Wilo identifier: **Supplier ID =** 0xA9
Function ID = 0x00

– Initial **pump NAD:** 0x02

} Assign numbers from www.can-cia.org

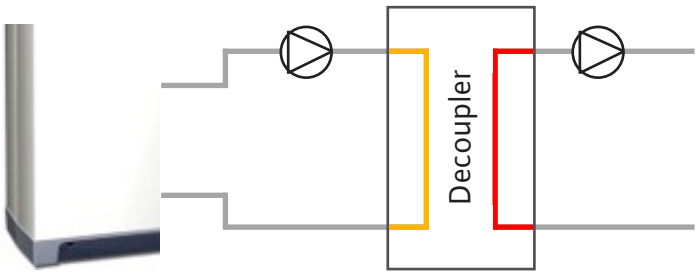
In case of need, the pump NAD can be changed using diagnostic service

The **control modes** that are available are:

– **N-cst mode:** standard
– **Δp-c mode:** LIN Extended only
– **Δp-v mode:** LIN Extended only

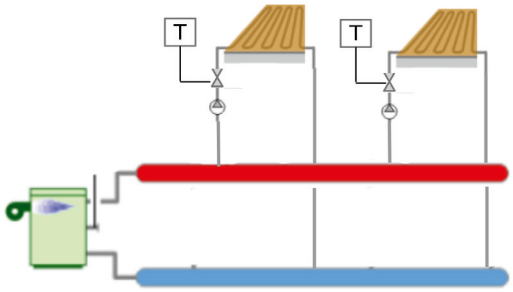
Illustration of control modes

N-cst mode:



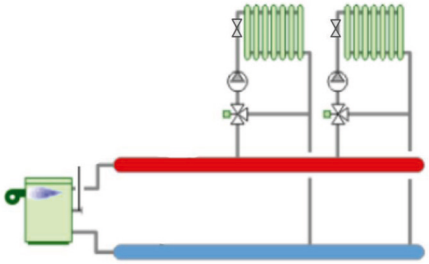
N-cst mode is used for application where the speed could be ajusted according to what the network needs to reach the necessary flow (ie. usually used on primary circuit of a heating system)

Δp-c mode:



Δp-c mode is used for application where the flow could be variable associated with constant pressure losses (ie. usually used on installation equipped with underfloor heating)

Δp-v mode:



Δp-v mode is used for application where the flow could be variable associated with variable pressure losses (ie. usually used on installation equipped with radiators)

figure n°5

LIN Transfer function

For Speed control (N-cst), the transfer function can be used as described on the transfer curve.
For Δp-c mode, transfer curve is defined for all flow values (as the flow is not impacting the head level for this mode).
For Δp-v, the transfer curve is defined considering max flow. Obviously, the real head delivered by the pump will then depend on the pump flow according to the Δp-v regulation (see hydraulic curve).

The below min and max values can be read by diagnostic service: 0x22. *(This is given as an example, the real values must be the ones read from the pump)*

Hydraulic values (for example 7.7 m of Head Max) are valid only for cast iron pump housing. For a composite pump housing, see with the "Customer Technical contact" to have data related to composite pump housing used.

N-cst	Min speed	Max speed	inflection point
	rpm	rpm	%
6 m	700	4300	16,3
7 m	700	4700	14,9
8 m	500	4800	10,4

Δp-c or Δp-v	Min head	Max head	inflection point Δp-c	inflection point Δp-v
	m	m	%	%
6 m	0,5	6,7	7,5	15
7 m	0,5	7,7	6,5	13
8 m	0,5	8,5	5,9	11,8

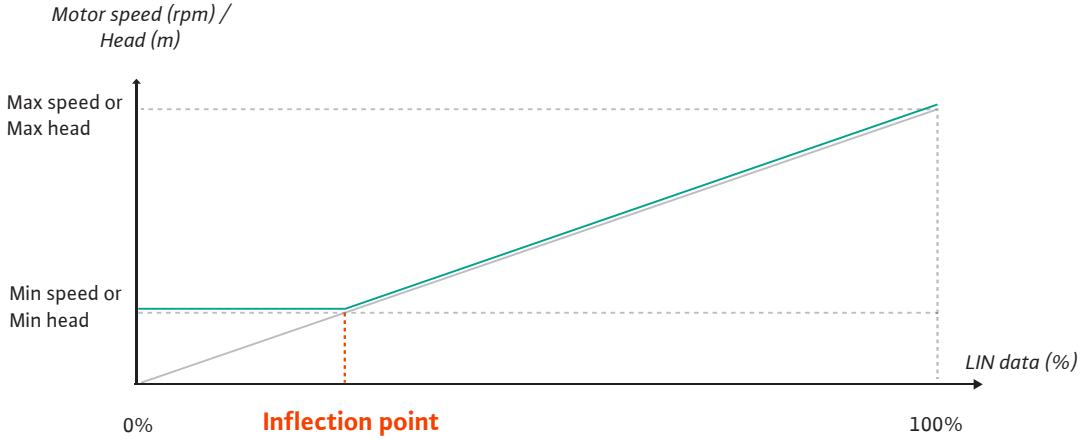


figure n°6

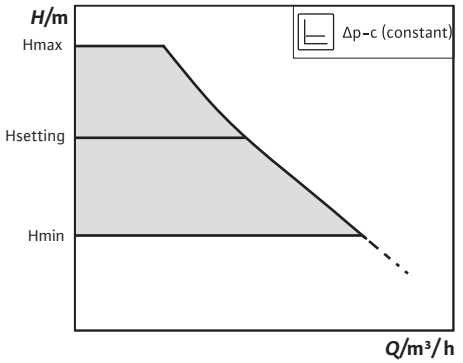


figure n°7

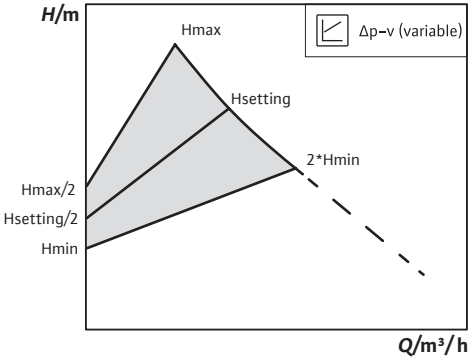


figure n°8

LIN circulator HMI

Wilo pumps are able to provide some visual information to help the end user to understand what is **the pump status (see figure n°7).**

It is defined as follow:

Final error:	*The status LED is **fixed red***	
Error:	*The status LED **blinks red***	
Warning:	*The status LED **blinks green and red alternately for :***	• *generator operation,* • *dry running,* • *overload motor warning*
	*The status LED is **fixed green for :***	• undervoltage warning (> 160 – < 190V) • DC link error
LIN Communication error:	*The status LED **blinks green***	
Normal operation:	*The status LED is **fixed green***	

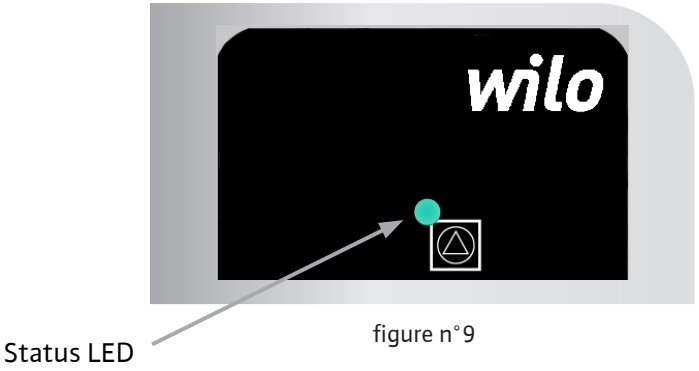


figure n°9

LIN Warning / Error information

According to the VDMA LIN circulator profile, the diagnostic services handle 0xB2 read by Identifier services.
The Identifier 32 enables the definition of a warning / error information. Wilo defined them as follow:

LIN warning / Error information overview

Error code and name		Error type	Short description of warning consequences and/or pump actions
0	Missing motor windings contact or disconnected electronic box	Final error	*Could occur if the plumber disconnect the motor from electronic box or when the motor windings are damaged*
1	Driver fault	Final error	
2	Over current	Error	*Motor current exceeding acceptable limit*
3	Blocked rotor	Error Final error	*The pump will try with a routine to unblock itself.* *The pump is finally blocked after the routine is completed. No more restarting trial until power occurs.* *Action: try to change the fluid or remove the particles blocking the pump*
4	Loss of synchronization	Error	*Temporary situation. Motor will restart by itself*
5	Overload motor	Error	*High friction due to mechanical ageing or particles in the medium* *Action: try to change the fluid or remove the particles blocking the pump*
6	Overvoltage **≥ 263 VAC** The pump could stop and, if stopped, must reliably issue the assigned error code – if pump is stopped, it must be able to start when voltage reaches < 263 VAC	Error	*The pump could stop until the voltage is back to a normal level* *Action: check the power supply stability*
7	Undervoltage Voltage drop (dc link) **≤ 160 VAC** The pump could stop, but must, after a short time, issue the assigned error code **≥ 170 VAC** Pump able to run and start, but possibly with limitations of performance, but not into the function The pump needs to stop status of voltage of ≥ 170 VAC to start rotation	Error	*Fast voltage drop : this occurs when there is a high voltage dip for the DC link voltage detected.* *If, after the voltage drop, the voltage stays under the restart level, the motor stays stopped.* *If the voltage rises above the limit, the motor restarts by itself.* *The relation between drop at the DC link and the main voltage has the following influence factors: kind of high or low impedance power line, tolerances of components and the operation point (main factor)* *Action: check the power supply stability*

LIN warning / Error information overview

Error code and name		Error type	Short description of warning consequences and/or pump actions
8	Over speed	Error	*Motor speed over the acceptable limits*
9	Turbine mode	Error	*Turbine mode: could happen if there is another device generating opposite flow. Action: check the installation/setup*
10	Undervoltage	Error	*Slow voltage drop : In case of error, the motor stops until the voltage is back to a normal level. Stopping the motor is done in a range around 160V that is dependant on component tolerances, operating point gap in between measured voltage and estimated value from the pump*
12	Over temperature motor	Error	*In case of the motor gets too hot, the motor stops After a cool down time, the motor restarts by itself*
14	Over temperature module	Error	*Over temperature: the temperature of the module is too high, pump stops Action: reduce the ambient temperature*
15	Over temperature power bridge / components	Error	*Over temperature on electronic component: the temperature of some electronic components is too high. Action: reduce the ambient temperature*
16	Generator operation	Warning	*Generator operation: could happen if there is another device generating direct flow. Action: check the installation/setup*
17	Dry running	Warning	*Dry running: no fluid in the installation. Action: fill the installation*
18	Overload motor	Warning	*Overload motor: high friction due to mechanical ageing of particles in the medium Action: clean or change the medium*
19	Overtemperature Module	Warning	*The temperature of the module is going too high with reduced performances*
255	No error present		*Pump is running without issue*

NB: There is no priority defined by the number ordering

N.B: In the range 160 VAC < U <190/195V

The pump operates. In case of speed or power limitation due to the power supply, the pump returns a status information by activating the OperationalLimitReached into the Unconditional frame. By accessing DID 1034, the master can have access to the explanation regarding the details of the OperationalLimitReached.

LIN circulator troubleshooting

Wilo pumps are designed to provide the best efficiency all through the product's lifetime.
If, however, you are facing issues, please to check in the below table what the recommended actions are:

LIN circulator troubleshooting overview		
Behavior	**Please check how is the status LED – Root cause**	**Remedy**
The pump is running but application doesn't reach the performances	If LED blinks green/red, the pump is still operating but not at full performance due to abnormal conditions	*Check if the pump temperature is over the allowed limits* *Check if the power supply voltage is inside the limits (170V < U < 253V RMS)* *Check if there is no external flow pushing water at the pump* *Check if there is no over current exceeding the limit*
I plugged in my pump, applied the LIN signal and the pump is not running or the pump was running and is now stopped	If LED is fixed green, the LIN signal is maybe asking the pump to be stopped	*Check on the master side which LIN signal is provided*
	If LED blinks green, the signal connection is not (or no more) working properly	*Check your installation and make sure that the LIN signal is provided to the pump* *Check the signal cable*
	If LED blinks red, the pump is stopped due to external issue. The pump will restart automatically when conditions are ok	*Check if the pump temperature is over the allowed limits* *Check if the power supply voltage is inside the limits (170V < U < 253V RMS)* *Check if there is no external flow pushing water at the pump* *Check if there is no over current exceeding the limit.*
	If LED is fixed red, the pump is stopped due to internal "final" error	*Check on the master side which LIN signal is received from the pump* *Switch OFF the pump, wait 30s before switching ON the pump. Then through the master side try to start the pump.* *If the pump LED is still red after a power reset, replace the pump*

Referenced Documents

VDMA 24226 ed 1.0

The VDMA is a German Engineering Association

Glossary

LIN: Local Interconnect Network

Frame ID: Frame Identifier

ID: IDentifier

DID: Data IDentifier

SID: Service IDentifier

NAD: Node Address for Diagnostic

HMI: Human Machine Interface

OEM: Original Equipment Manufacturer

EMC: ElectroMagnetic Compatibility

Speed control: Constant speed control mode

△p-c: Constant pressure control mode

△p-v: Proportional pressure control mode

rpm: Revolution per minute

LED: Light Emitting Diode

VLCP: VDMA LIN Circulator Profile

RMS: Root Mean Square

LSB: Least Significant Bit

MSB: Most Significant Bit

How can Wilo support you ?

Wilo can provide more support to our customers under request.

Please, contact your local sales contact or use our website:

www.wilo-oem.com

From our website, you can also obtain information about the Wilo LIN communication Evaluation Kit

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