Manual

WAGO-I/O-SYSTEM 750

AS-Interface Master M4 V3.0

750-655

WAGO AS-Interface Master

Version 1.4.0, valid from SW/HW Version XXXX0304

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Every conceivable measure has been taken to ensure the accuracy and completeness of this documentation. However, as errors can never be fully excluded, we always appreciate any information or suggestions for improving the documentation.

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1 Notes about this Documentation

Note

Keep this documentation!
The operating instructions are part of the product and shall be kept for the entire lifetime of the device. They shall be transferred to each subsequent owner or user of the device. Care must also be taken to ensure that any supplement to these instructions are included, if applicable.

1.1 Validity of this Documentation

This documentation is only applicable to the I/O module 750-655 (AS-Interface Master M4 V3.0) of the WAGO-I/O-SYSTEM 750 series.

The I/O module 750-655 shall only be installed and operated according to the instructions in this manual and in the manual for the used fieldbus coupler/controller.

NOTICE

Consider power layout of the WAGO-I/O-SYSTEM 750!
In addition to these operating instructions, you will also need the manual for the used fieldbus coupler/controller, which can be downloaded at www.wago.com. There, you can obtain important information including information on electrical isolation, system power and supply specifications.

1.2 Copyright

1.3 Symbols

DANGER

Personal Injury!
Indicates a high-risk, imminently hazardous situation which, if not avoided, will result in death or serious injury.

DANGER

Personal Injury Caused by Electric Current!
Indicates a high-risk, imminently hazardous situation which, if not avoided, will result in death or serious injury.

WARNING

Personal Injury!
Indicates a moderate-risk, potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

Personal Injury!
Indicates a low-risk, potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

NOTICE

Damage to Property!
Indicates a potentially hazardous situation which, if not avoided, may result in damage to property.

NOTICE

Damage to Property Caused by Electrostatic Discharge (ESD)!
Indicates a potentially hazardous situation which, if not avoided, may result in damage to property.

Note

Important Note!
Indicates a potential malfunction which, if not avoided, however, will not result in damage to property.

Information

Additional Information:
Refers to additional information which is not an integral part of this documentation (e.g., the Internet).

1.4 Number Notation

Table 1: Number notation

Number code	Example	Note
Decimal	100	Normal notation
Hexadecimal	0x64	C notation
Binary	'100' '0110.0100'	In quotation marks, nibble separated with dots (.)

1.5 Font Conventions

Table 2: Font conventions

Font type	Indicates
italic	Names of paths and data files are marked in italic-type. e.g.: *C:\Programme\WAGO-I/O-CHECK*
Menu	Menu items are marked in bold letters. e.g.: **Save**
>	A greater-than sign between two names means the selection of a menu item from a menu. e.g.: **File** > **New**
Input	Designation of input or optional fields are marked in bold letters, e.g.: **Start of measurement range**
“Value”	Input or selective values are marked in inverted commas. e.g.: Enter the value “4 mA” under **Start of measurement range**.
[Button]	Pushbuttons in dialog boxes are marked with bold letters in square brackets. e.g.: **[Input]**
[Key]	Keys are marked with bold letters in square brackets. e.g.: **[F5]**

2 Important Notes

This section includes an overall summary of the most important safety requirements and notes that are mentioned in each individual section. To protect your health and prevent damage to devices as well, it is imperative to read and carefully follow the safety guidelines.

2.1 Legal Bases

2.1.1 Subject to Changes

WAGO Kontakttechnik GmbH & Co. KG reserves the right to provide for any alterations or modifications that serve to increase the efficiency of technical progress. WAGO Kontakttechnik GmbH & Co. KG owns all rights arising from the granting of patents or from the legal protection of utility patents. Third-party products are always mentioned without any reference to patent rights. Thus, the existence of such rights cannot be excluded.

2.1.2 Personnel Qualifications

All sequences implemented on Series 750 devices may only be carried out by electrical specialists with sufficient knowledge in automation. The specialists must be familiar with the current norms and guidelines for the devices and automated environments.

All changes to the coupler or controller should always be carried out by qualified personnel with sufficient skills in PLC programming.

2.1.3 Use of the 750 Series in Compliance with Underlying Provisions

Couplers, controllers and I/O modules found in the modular WAGO-I/O-SYSTEM 750 receive digital and analog signals from sensors and transmit them to the actuators or higher-level control systems. Using programmable controllers, the signals can also be (pre-) processed.

The components have been developed for use in an environment that meets the IP20 protection class criteria. Protection against finger injury and solid impurities up to 12.5 mm diameter is assured; protection against water damage is not ensured. Unless otherwise specified, operation of the components in wet and dusty environments is prohibited.

Operating 750 Series components in home applications without further measures is only permitted if they meet the emission limits (emissions of interference) according to EN 61000-6-3. You will find the relevant information in the section on "WAGO-I/O-SYSTEM 750" → "System Description" → "Technical Data" in the manual for the used fieldbus coupler/controller.

Appropriate housing (per 94/9/EG) is required when operating the WAGO-I/O-SYSTEM 750 in hazardous environments. Please note that a prototype test certificate must be obtained that confirms the correct installation of the system in a housing or switch cabinet.

2.1.4 Technical Condition of Specified Devices

The components to be supplied Ex Works, are equipped with hardware and software configurations, which meet the individual application requirements. WAGO Kontakttechnik GmbH & Co. KG will be exempted from any liability in case of changes in hardware or software as well as to non-compliant usage of components.

Please send your request for modified and new hardware or software configurations directly to WAGO Kontakttechnik GmbH & Co. KG.

2.2 Safety Advice (Precautions)

For installing and operating purposes of the relevant device to your system the following safety precautions shall be observed:

DANGER

Do not work on components while energized!
All power sources to the device shall be switched off prior to performing any installation, repair or maintenance work.

DANGER

Installation only in appropriate housings, cabinets or in electrical operation rooms!
The WAGO-I/O-SYSTEM 750 and its components are an open system. As such, install the system and its components exclusively in appropriate housings, cabinets or in electrical operation rooms. Allow access to such equipment and fixtures to authorized, qualified staff only by means of specific keys or tools.

NOTICE

Replace defective or damaged devices!
Replace defective or damaged device/module (e.g., in the event of deformed contacts), since the long-term functionality of device/module involved can no longer be ensured.

NOTICE

Protect the components against materials having seeping and insulating properties!
The components are not resistant to materials having seeping and insulating properties such as: aerosols, silicones and triglycerides (found in some hand creams). If you cannot exclude that such materials will appear in the component environment, then install the components in an enclosure being resistant to the above-mentioned materials. Clean tools and materials are imperative for handling devices/modules.

NOTICE

Cleaning only with permitted materials!
Clean soiled contacts using oil-free compressed air or with ethyl alcohol and leather cloths.

NOTICE

Do not use any contact spray!
Do not use any contact spray. The spray may impair contact area functionality in connection with contamination.

NOTICE

Do not reverse the polarity of connection lines!
Avoid reverse polarity of data and power supply lines, as this may damage the devices involved.

NOTICE

Avoid electrostatic discharge!
The devices are equipped with electronic components that you may destroy by electrostatic discharge when you touch. Pay attention while handling the devices to good grounding of the environment (persons, job and packing).

3 Device Description

The I/O module 750-655 (AS-Interface Master M4 V3.0) is used to integrate the AS-Interface network into the WAGO-I/O-SYSTEM 750. By this means, AS-Interface slaves or subsystems, together with modules from the WAGO-I/O-SYSTEM 750, can be used in widely differing field bus systems.

The AS-Interface master module 750-655 behaves as a master for the AS-Interface and as a slave for the field bus.

It already complies with the new AS-Interface specification 3.0. This means that:

- Up to 62 AS-Interface slaves can be connected to the master
- The transmission of analog values is integrated within the masters and
- All other functions of the new specification, such as the evaluation of peripheral errors, are also implemented.

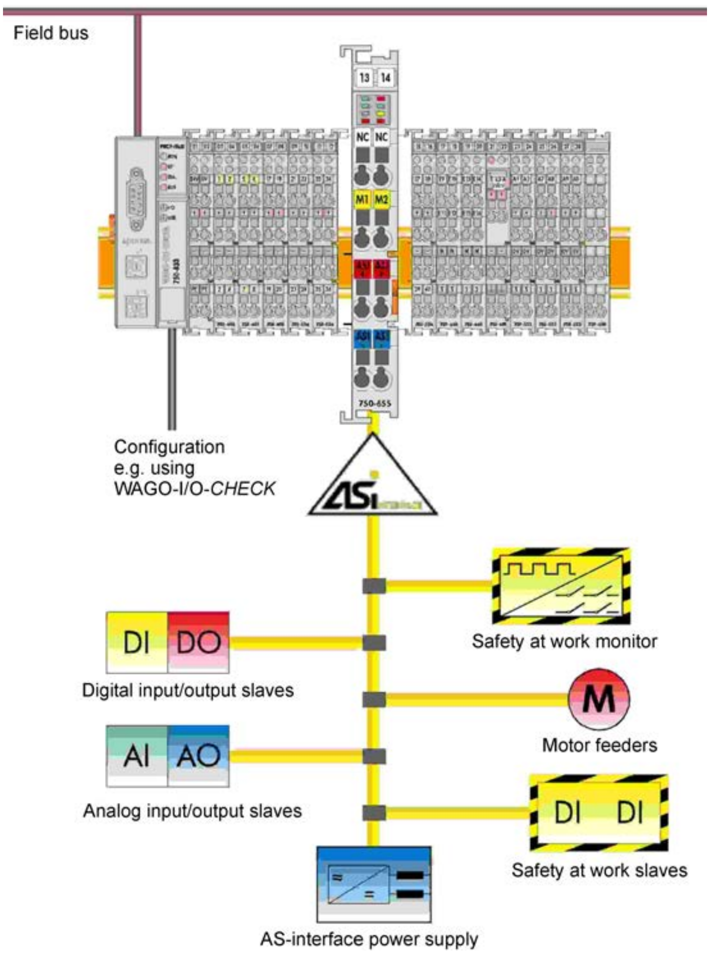


Figure 1: Overview of the AS-Interface network

The AS-Interface functions are made available acyclically and the AS-Interface process data are made available both cyclically and acyclically over the field bus.

In cyclical data exchange, up to 32 bytes of I/O data (resettable) are transmitted for the binary data of the AS-Interface strand.

In addition, analog values, and also all other commands of the new AS-Interface specification, can be transmitted acyclically in a management channel over the field bus.

Diagnostics functions, which go well beyond the AS-Interface specification, enable intermittent configuration errors and sources of interference on the AS-Interface communication to be easily localized. In this way, the downtimes of systems can be minimized in the case of a fault and preventative maintenance measures can be implemented.

Multi-color LEDs indicate the operating status and the trouble-free internal bus communication as well as the status of the signal transmission.
The meaning of the LEDs is described in the “Display Elements” section.

The I/O module receives the 24V voltage supply for the field level from an upstream I/O module or from the fieldbus coupler/controller via the power contacts used as blade contacts. It then provides this potential to subsequent I/O modules via the power contacts used as spring contacts.

The field voltage and the system voltage are electrically isolated from each other.

The 750-655 module can be used with the fieldbus couplers and controllers of the WAGO-I/O-SYSTEM 750 of the specified version or higher listed in the "Compatibility list" table.

Table 3: Compatibility List 750-0655

Fieldbus system	**Fieldbus coupler/-controller**	**Item-No.**	**Hardware Version**	**Software Version**	**Maximum Number of modules**
PROFINET	Fieldbus coupler	750-370	From 02	From 02	*)
PROFIBUS	Fieldbus coupler	750-303	xx	From 08	3
		750-333	12	From 07	8
	ECO Fieldbus coupler	750-343	03	From 06	2
	Programmable Fieldbus controller	750-833	16	10	8
ETHERNET	Fieldbus coupler	750-341	03	06	8
		750-342	04	17	3
		750-352	02	01	16
	Programmable Fieldbus controller	750-841	09	17	16
		750-842	04	12	8
		750-871	03	05	16
		750-873	02	02	16
		750-880	03	01	16
		750-881	03	01	16
		750-882	01	01	16
DeviceNet	Fieldbus coupler	750-306	12	4J	8
	ECO Fieldbus coupler	750-346	02	07	2
	Programmable Fieldbus controller	750-806	04	09	8
CANopen	Fieldbus coupler	750-337	09	10	8
		750-338	02	16	8
	ECO Fieldbus coupler	750-347	01	06	2
		750-348	01	06	2
	Programmable Fieldbus controller	750-837	07	12	8
		750-838	02	12	8
EtherCat	Fieldbus coupler	750-354	01	01	8
Powerlink	Fieldbus coupler	750-350	07	01	8
SERCOS III	Fieldbus coupler	750-351	02	03	8
KNX	Programmable Fieldbus controller	750-849	xx	04	16
BACnet	Programmable Fieldbus controller	750-830	01	01	8
LONWORKS	Fieldbus coupler	750-319	xx	05	3
	Programmable Fieldbus controller	750-819	xx	09	8
Various	I/O-IPC-G2 Linux, CODESYS	758-870/ 000-11x	10	03	16
	I/O-IPC-C6 Linux, CODESYS	758-874/ 000-11x	10	03	16
	I/O-IPC-C10 Linux, CODESYS	758-875/ 000-11x	10	03	16
	I/O-IPC-P14 Linux, CODESYS	758-876/ 000-11x	10	03	16
*) Number of AS-Interface modules depends on max. process image size of 320 Byte for PROFINET					

3.1 View

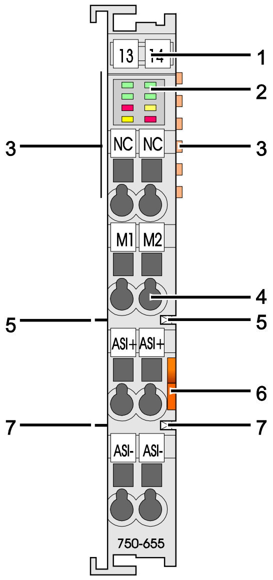


Figure 2: View

Table 4: Caption acc. to figure “View“

No.	Designation	Description	Details see chapter
1	---	Marking possibility with Mini-WSB	---
2	A … H	Status-LEDs	“Device Description” > “Display Elements”
3	---	Data contacts	“Device Description” > “Connections”
4	1 ... 8	CAGE CLAMP®-connections analog inputs AI	“Device Description” > “Connections”
5	---	Power jumper contact +24 V	“Device Description” > “Connections”
6	---	Release clip	“Mounting” > “Insert and remove device”
7	---	Power jumper contact 0 V	“Device Description” > “Connections”

3.2 Connectors

3.2.1 Data Contacts/Internal Bus

Communication between the coupler/controller and the I/O modules as well as the system supply of the I/O modules is carried out via the internal bus. It is comprised of 6 data contacts, which are available as self-cleaning gold spring contacts.

Figure 3: Data contacts

NOTICE

Do not place the I/O modules on the gold spring contacts!
Do not place the I/O modules on the gold spring contacts in order to avoid soiling or scratching!

NOTICE

Ensure that the environment is well grounded!
The modules are equipped with electronic components that may be destroyed by electrostatic discharge. When handling the modules, ensure that the environment (persons, workplace and packing) is well grounded. Avoid touching conductive components, e.g. data contacts.

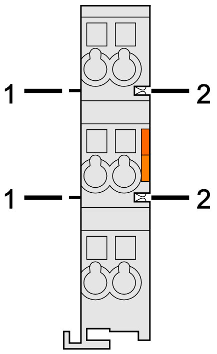
3.2.2 Power Jumper Contacts/Field Supply

⚠ CAUTION

Risk of injury due to sharp-edged male contacts!
The male contacts are sharp-edged. Handle the module carefully to prevent injury.

The I/O module 750-655 has 2 self-cleaning power jumper contacts that supply and transmit power for the field side. The contacts on the left side of the I/O module are designed as male contacts and the contacts on the right side as spring contacts.

Table 5: Power jumper contacts

	Connection	Type	Number	Function
 Figure 4: Power jumper contacts	1	Blade contact	2	Infeed of the field supply voltage (U_V and 0 V)
	2	Spring contact	2	Forwarding of the field supply voltage (U_V and 0 V)

NOTICE

Do not exceed maximum current via power contacts!
The maximum current to flow through the power contacts is 10 A.
Greater currents can damage the power contacts.
When configuring the system, ensure that this current is not exceeded. If exceeded, an additional potential feed module must be used.

Note

Use potential feed module for Ground (earth)!
The I/O module has no power contacts for PE intake and transfer. Use a potential feed module when a PE feed is needed for the subsequent I/O modules.

3.2.3 CAGE CLAMP® Connections

Table 6: Connections

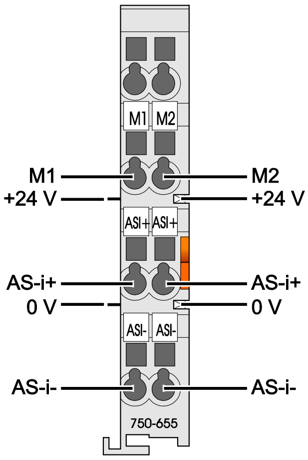


Figure 5: Connections

Connection	Designation	Function
2	M1	Mode-Push Button
3, 7	AS-I+	AS-Interface Network +
4, 8	AS-I-	AS-Interface Network -
6	M2	Mode-Push Button
Power jumper contacts	+24 V	Field supply voltage 24 V
Power jumper contacts	0 V	Field supply voltage 0 V

3.3 Display Elements

Table 7: Display Elements

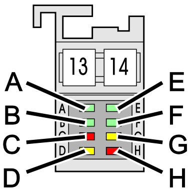


Figure 6: Display Elements

LED	Designation	Status	Function
A	AS-Interface-Power	Off	AS-Interface Supply Fault
		Green	AS-Interface Supply OK
B	Mapping Consistency	Off	AS-Interface incomplete on internal bus (mapping)
		Green	AS-Interface complete on internal bus
C	Internal Bus Timeout	Off	Communication to field bus coupler/controller OK
		Red	Communication to field bus coupler/controller interrupted
D	Overflow	Off	AS-Interface complete on internal bus
		Gelb	AS-Interface incomplete on internal bus (timing)
E	AS-Interface active	Off	AS-Interface not active
		Green	AS-Interface active
F	PRG enable	Off	No automatic programming possible/necessary
		Green	A slave is missing and can be replaced by automatic programming
G	CFG Mode	Off	Protected operating mode
		Yellow	Set-up mode
H	General Fault	Off	No Fault
		Red blinking	Peripheral Fault
		Red	Configuration error (Config Error Bit) or at least one of the status bits 1 or 2

3.4 Operating Elements

The I/O module 750-655 has no operating elements.

The higher-level controller or the WAGO-I/O-CHECK configuration tool is used to make configuration and parameter changes.

3.5 Schematic Diagram

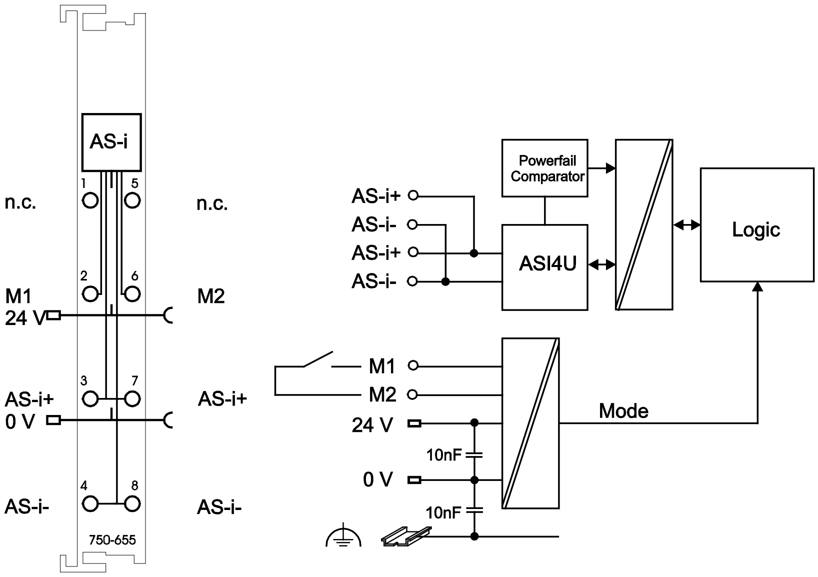


Figure 7: Schematic Diagram

3.6 Technical Data

3.6.1 Dimensions and Weight

Table 8: Technical Data Dimensions and Weight

Width	12 mm
Height (from upper edge of DIN 35 rail)	64 mm
Length	100 mm
Weight	ca. 70 g

3.6.2 Supply

Table 9: Technical Data Supply

Voltage supply	Via system supply internal bus (5 V DC), via power jumper contacts (24 V DC) and via AS-Interface
Current consumption system voltage $_{max.}$ (5 V DC)	55 mA
Current consumption power jumper contacts $_{max.}$ (24 V DC)	3 mA
Supply voltage via power jumper contacts	DC 24 V (-15 % ... +20 %, 20.4 V ... 28.8 V)
Current via power jumper contacts	10 A
Reverse voltage protection for power jumper contacts	No
Supply voltage AS-Interface	26.5 V ... 31.6 V
Current consumption AS-Interface	40 mA
Potential isolation	500 V system / field supply / AS-Interface connection point

3.6.3 Communication

Table 10: Technical Data Communication

AS-Interface specification	3.0
AS-Interface cable length $_{max.}$	100 m, with repeater 300 m
Cycle time AS-Interface	0.3 ms ... 10 ms, depending on number of slaves
Configuration	Via process image, WAGO-I/O-CHECK or AS-Interface mode contacts
Transmission channel	1
Data width	12 ... 48 Bytes max. freely configurable, including 1 byte control/status

3.7 Approvals

Information

More Information about Approvals
Detailed references to the approvals are listed in the document "Overview Approvals **WAGO-I/O-SYSTEM 750**", which you can find on the DVD “AUTOMATION Tools and Docs” (order no. 0888-0412) or via the internet under: www.wago.com → Documentation → WAGO-I/O-SYSTEM 750 → System Description.

The following approvals have been granted to 750-655 I/O modules:

Conformity Marking

$_{C}UL_{US}$ UL508

The following Ex approvals have been granted to 750-655 I/O modules:

TÜV 07 ATEX 554086 X

I M2 Ex d I Mb
II 3 G Ex nA IIC T4 Gc
II 3 D Ex tc IIIC T135°C Dc

Ambient temperature range: $0\ °C \leq T_a \leq +60\ °C$

IECEx TUN 09.0001 X

Ex d I Mb
Ex nA IIC T4 Gc
Ex tc IIIC T135°C Dc

Ambient temperature range: $0\ °C \leq T_a \leq +60\ °C$

$_{C}UL_{US}$ ANSI/ISA 12.12.01
Class I, Div2 ABCD T4

The following ship approvals have been granted to 750-655 I/O modules:

ABS (American Bureau of Shipping)

Federal Maritime and Hydrographic Agency

BV (Bureau Veritas)

DNV (Det Norske Veritas)	Class B
GL (Germanischer Lloyd)	Cat. A, B, C, D (EMC 1)
KR (Korean Register of Shipping)	
LR (Lloyd’s Register)	Env. 1, 2, 3, 4
NKK (Nippon Kaiji Kyokai)	
PRS (Polski Rejestr Statków)	
RINA (Registro Italiano Navale)	

3.8 Standards and Guidelines

750-655 I/O modules meet the following requirements on emission and immunity of interference:

EMC CE-Immunity to interference	acc. to EN 61000-6-2: 2005
EMC CE-Emission of interference	acc. to EN 61000-6-4: 2007
EMC marine applications-Immunity to interference	acc. to Germanischer Lloyd (2003)
EMC marine applications-Emission of interference	acc. to Germanischer Lloyd (2003)

4 Function Description

4.1 Start-up behavior

On start-up, the AS-Interface master module runs through the following phases:

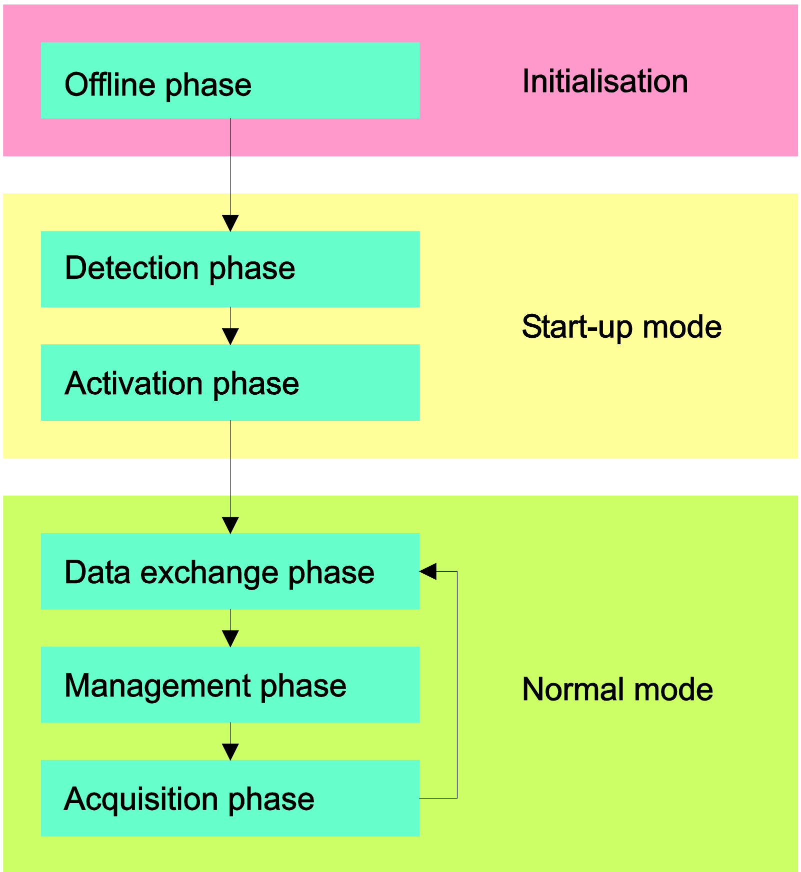


Figure 8: Start-up behavior

4.1.1 Offline phase

The master module is initialized; there is no exchange of data with the slaves.

Note

The offline phase is not exited when the voltage supply is faulty!
The master module will remain in the offline phase if the AS-Interface circuit is not adequately supplied with power (The LED U AS-I does not come on).

After Power-On the master module runs through the offline phase and exits it approx. 1s after the AS-Interface circuit is adequately supplied with power.

In addition the user can set the master module to offline phase via WAGO-I/O-*CHECK*.

4.1.2 Detection phase

Beginning of start-up operation, in which a search is carried out for slaves present on the AS-Interface. The master module remains in the detection phase until at least one slave has been detected.

4.1.3 Activation phase

State at the end of the start-up mode, in which the parameters of all the connected and detected slaves are transmitted. At this point, access is enabled to the data connections in the slaves.

Depending on the operating mode, either all detected and set-up slaves are activated (protected mode of operation) or all detected slaves are activated (set-up mode).

4.1.4 Normal mode

In the normal mode, the master module exchanges data with all active slaves (data exchange phase), transmits management telegrams (telegrams from and to the host, management phase) and searches for and activates newly connected slaves (acquisition phase).

4.2 Slave lists

Information on available or set-up slaves is stored in the master in the form of lists.

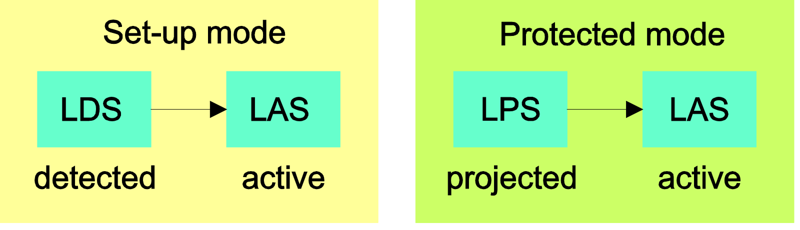


Figure 9: Slave lists

The list of detected slaves (LDS) includes all slaves, which the master detects in the AS-Interface circuit and which have a valid address.

The list of projected slaves (LPS) includes all slaves, which the master expects in the AS-Interface circuit as a result of the set-up.

The list of active slaves (LAS) includes all slaves with which the master exchanges data. In the set-up mode, this list corresponds to the LDS list and, in protected mode, it corresponds to the LPS list.

4.3 Operating modes

4.3.1 Set-up mode

The set-up mode is used for configuring the AS-Interface circuit.

Note

Activation of slaves in set-up mode
In the set-up mode, all detected slaves are activated even when there are differences between the required and actual configuration.

The master module is switched to set-up mode by short-circuiting the mode contacts M1 and M2 for at least five seconds. This switching can also be done via WAGO-I/O-*CHECK*.

The yellow "prj mode" LED illuminates in set-up mode. All detected slaves, with the exception of slave zero, are activated. The master module is in normal mode. Data is exchanged between the master module and all detected slaves regardless of whether the detected slaves have already been set up.

Note

Delivery status
The AS-Interface master module is delivered from the factory in set-up mode.

4.3.2 Protected operating mode

The master module is switched from set-up mode to protected mode by short-circuiting the mode contacts M1 and M2. This switching can also be done via WAGO-I/O-*CHECK*.

Brief short-circuit:

The master module switches from set-up mode to protected mode without setting up the current actual configuration as a required configuration.

Short-circuiting for longer than five seconds:

The master module switches from set-up mode to protected mode. At the same time, the actual configuration is stored in the module as a required configuration.

Note

Slave with address "zero"
If a slave with the address zero is detected on the AS-Interface, it will not be possible to exit the set-up mode.

Note

Activation of slaves in protected operating mode
In protected mode, only those slaves are activated, which have been set up and the required configuration of which matches the actual values.

Note

Data exchange in protected operating mode
In contrast to the set-up mode, in protected mode, data is only exchanged between the master module and the slaves that have been set-up.

4.4 Addressing in set-up mode

AS-Interface systems on the master module can be commissioned with the WAGO-I/O-*CHECK* commissioning tool.

The procedure is described in Chapter “Set up and configuration with WAGO-I/O-*CHECK*”.

Commissioning can also be carried out using an addressing unit.

4.5 Addressing in the case of configuration errors

4.5.1 Automatic addressing (Auto Address Mode)

One of the great advantages of the AS-Interface is the automatic address programming. If a slave fails due to a defect, it can be replaced by a physically identical slave with the address zero. The master module detects this and automatically addresses the new slave with the address of the defective slave.

The following requirements must be satisfied for automatic programming:

- The master module must be in protected mode.
- The enable flag "Auto Address Enable (AAe)" must be set.
- Several slaves may be missing, but their configuration data must be different.
- The new slave must have the same configuration data as the missing one.

When these conditions are satisfied, the master module indicates this with the "prg enable" LED. If a slave is then detected with the address zero, it will automatically be reprogrammed with the address of the missing slave.

The "Auto Address Enable (AAe)" flag for automatic programming can be switched on and off with the WAGO-I/O-*CHECK* commissioning tool.

Note

Automatic address programming for slaves with set "zero" only!
Only slaves with the address zero can be re-addressed by the master module.

Note

Automatic address programming for slaves with the same configuration data!
Automatic address programming is not carried out if the two slaves have different configuration data, i.e. are not physically identical from the AS-Interface side.

4.5.2 Manual addressing

If several slaves have failed, the addresses of the new slaves must be set manually. This can be carried out with the WAGO-I/O-CHECK commissioning tool or an addressing unit.

Note

Failure of slaves with the same configuration data
If several slaves with the same configuration data fail, they can no longer be automatically replaced by the master.

4.5.3 Auto Installation Mode

Auto-installation mode is enabled by power-ON with short-circuited contacts M1 and M2 or via WAGO-I/O-*CHECK*. The master module then switches to project design mode and waits for slaves with address zero.

If such a slave is connected, it is programmed by the master module to the lowest available address. The addresses are scanned in the sequence 1/1A - 1B - 2/2A - 2B - 3/3A, etc.

After readdressing the slave, the master module waits for other slaves with address zero.

The mode is exited when the short-circuiting bridge is removed or when WAGO-I/O-*CHECK* switches the mode off. The master then saves the current configuration and switches to the protected operating mode.

In "auto-installation mode", the LED "AS Interface active" flashes at approx. 2 Hz while waiting for a slave with address "zero" or at approx. 4 Hz while readdressing a slave.

5 Mounting

5.1 Mounting Sequence

All system components can be snapped directly on a carrier rail in accordance with the European standard EN 50022 (DIN 35).

The reliable positioning and connection is made using a tongue and groove system. Due to the automatic locking, the individual components are securely seated on the rail after installation.

Starting with the coupler/controller, the I/O modules are mounted adjacent to each other according to the project design. Errors in the design of the node in terms of the potential groups (connection via the power contacts) are recognized, as the I/O modules with power contacts (male contacts) cannot be linked to I/O modules with fewer power contacts.

⚠ CAUTION

Risk of injury due to sharp-edged male contacts!
The male contacts are sharp-edged. Handle the module carefully to prevent injury.

NOTICE

Connect the I/O modules in the required order!
Never plug I/O modules from the direction of the end terminal. A ground wire power contact, which is inserted into a terminal without contacts, e.g. a 4-channel digital input module, has a decreased air and creepage distance to the neighboring contact in the example DI4.

NOTICE

Assemble the I/O modules in rows only if the grooves are open!
Please take into consideration that some I/O modules have no or only a few power jumper contacts. The design of some modules does not allow them to be physically assembled in rows, as the grooves for the male contacts are closed at the top.

Note

Don't forget the end module!
Always plug an end module 750-600 onto the end of the fieldbus node! You must always use an end module at all fieldbus nodes with the WAGO I/O System 750 fieldbus couplers/controllers to guarantee proper data transfer.

5.2 Inserting and Removing Devices

⚠ DANGER

Use caution when interrupting the PE!
Make sure that people or equipment are not placed at risk when removing an I/O module and the associated PE interruption. To prevent interruptions, provide ring feeding of the ground conductor, see section "Grounding/Ground Conductor" in manual "System Description WAGO-I/O-SYSTEM 750".

NOTICE

Perform work on devices only if the system is de-energized!
Working on devices when the system is energized can damage the devices. Therefore, turn off the power supply before working on the devices.

5.2.1 Inserting I/O Module

1. Position the I/O module so that the tongue and groove joints to the fieldbus coupler/controller or to the previous or possibly subsequent I/O module are engaged.

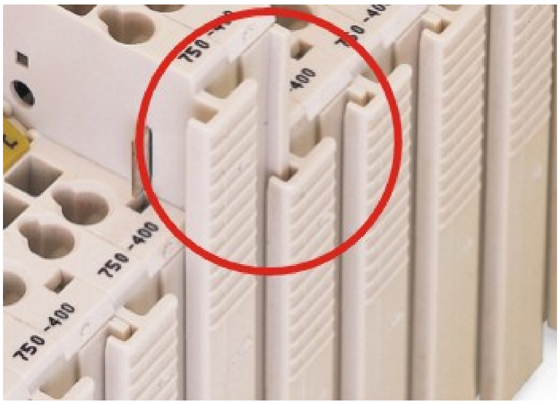


Figure 10: Insert I/O module

2. Press the I/O module into the assembly until the I/O module snaps into the carrier rail.

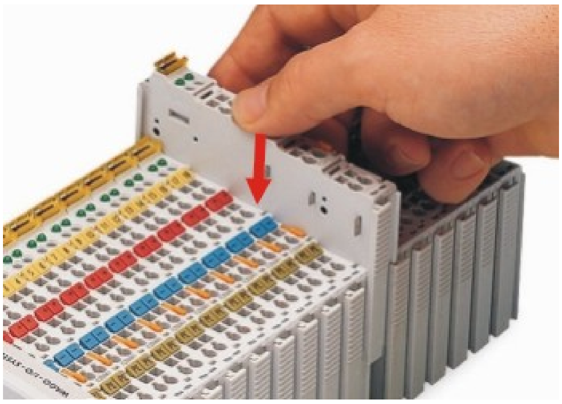


Figure 11: Snap the I/O module into place

With the I/O module snapped in place, the electrical connections for the data contacts and power contacts (if any) to the fieldbus coupler/controller or to the previous or possibly subsequent I/O module are established.

5.2.2 Removing the I/O Module

1. Remove the I/O module from the assembly by pulling the release tab.

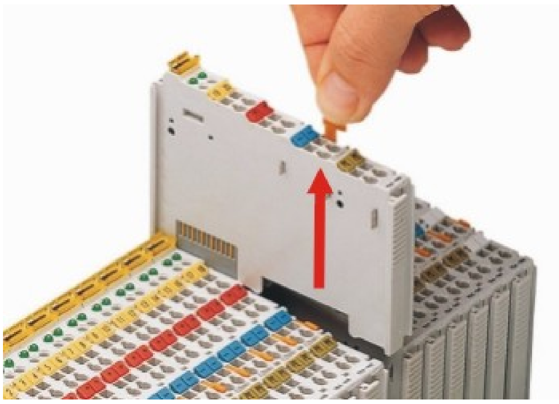


Figure 12: Removing the I/O module

Electrical connections for data or power contacts are disconnected when removing the I/O module.

6 Connect Devices

6.1 Connecting a Conductor to the CAGE CLAMP®

The WAGO CAGE CLAMP® connection is appropriate for solid, stranded and finely stranded conductors.

Note

Only connect one conductor to each CAGE CLAMP® connection!
Only one conductor may be connected to each CAGE CLAMP® connection.
Do not connect more than one conductor at one single connection!

If more than one conductor must be routed to one connection, these must be connected in an up-circuit wiring assembly, for example using WAGO feed-through terminals.

Exception:
If it is unavoidable to jointly connect 2 conductors, then you must use a ferrule to join the wires together. The following ferrules can be used:

Length	8 mm
Nominal cross section $_{max.}$	1 mm^2 for 2 conductors with 0.5 mm^2 each
WAGO Product	216-103 or products with comparable properties.

1. To open the CAGE CLAMP® insert the actuating tool into the opening above the connection.

2. Insert the conductor into the corresponding connection opening.

3. To close the CAGE CLAMP® simply remove the tool - the conductor is then clamped firmly in place.

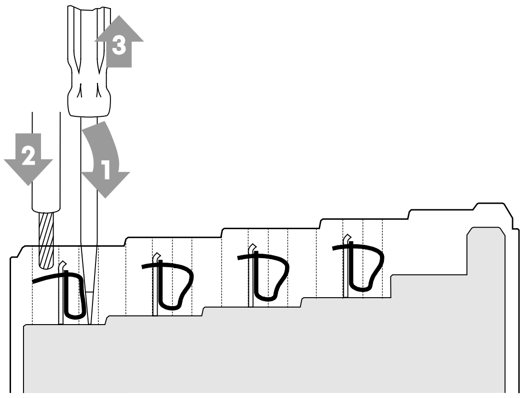


Figure 13: Connecting a conductor to a CAGE CLAMP®

6.2 Connection Example

Note

Note the maximum number of AS interface master modules!
The maximum number of AS interface master modules is specified in the compatibility list in the chapter "Device Description". Maximum 3 AS interface master modules may be arranged directly next to each other!

6.2.1 Grouping of AS interface master modules

An individual AS interface master module can be plugged in anywhere in a fieldbus node. However, if two or three AS interface master modules are installed directly next to each other, these I/O modules must be installed at the end of the node because in this case, no current can be tapped for the power supply via the power jumper contacts of the AS interface master modules. Likewise, the supply for the AS interface circuit cannot come from the CAGE CLAMP® connections of the AS interface module, but most be fed between AS interface master module and the connected slaves or between the connected slaves.

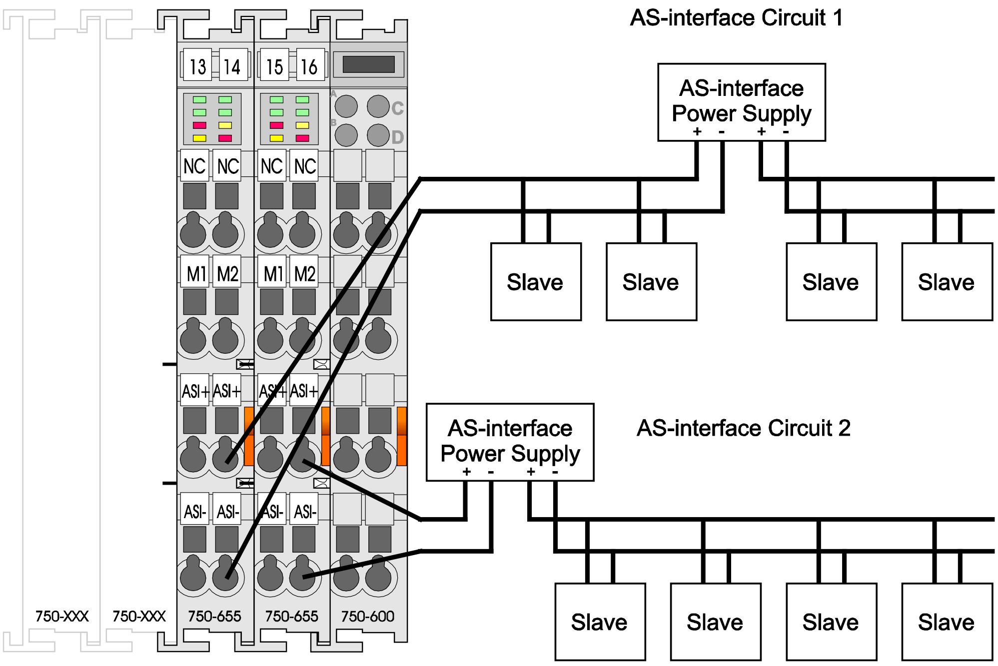


Figure 14: Node structure with 2 AS interface master modules

If more AS interface master modules are operated in one node, every 2 AS interface master modules must be separated by a type 750-621 spacer module. The AS interface master modules can be plugged in anywhere in the fieldbus node.

7 Commissioning

7.1 Setting Parameters via Parameter Channels

7.1.1 Introduction

A common data channel between the application and the I/O module is used to exchange parameter sets acyclically and have them checked by the complex I/O module. In order to access via all available interfaces of a fieldbus coupler or fieldbus controller, the parameter channel is mapped to the existing register model. Currently, the parameter channel can be operated with the following interfaces:

- via the control/status byte during the process data exchange
- via the 2-byte process data interface (SPS interface)
- via the parameter exchange for the corresponding fieldbus systems (e.g. PROFIBUS-DP/DP-V1)
- via the asynchronous serial interface of the fieldbus coupler/controller (e.g., for WAGO-I/O-*CHECK*, WAGO-I/O-*PRO*).

The parameter channel is mapped via registers 56 and 57 of the corresponding table or the corresponding channel. The parameter data is stored word by word in register 56, communication control is done via register 57. The structure for registers 56 and 57 is described in the following sections.

7.1.2 Structure of the Register

7.1.2.1 Parameter Data (Register 56)

Register 56 contains the parameter data to be read or written. Depending on the access type, either the I/O module (read parameters) or the fieldbus coupler/controller (write parameters) will write data to the register.

Table 11: Parameter Data (Register 56)

Bit	**7**	**6**	**6**	**4**	**3**	**2**	**1**	**0**
Parameter	PRM 7	PRM 6	PRM 5	PRM 4	PRM 3	PRM 2	PRM 1	PRM 0
Bit	**15**	**14**	**13**	**12**	**11**	**10**	**9**	**8**
Parameter	PRM 15	PRM 14	PRM 13	PRM 12	PRM 11	PRM 10	PRM 9	PRM 8
PRM0 ... PRM15	Parameter data bit 0 to bit 15							

7.1.2.2 Communication Control (Register 57)

Parameter channel control and diagnostics are done via register 57.

Table 12: Communication Control (Register 57)

Bit	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Request parameter	A7	A6	A5	A4	A3	A2	A1	A0
Response parameter	A7	A6	A5	A4	A3	A2	A1	A0
Bit	**15**	**14**	**13**	**12**	**11**	**10**	**9**	**8**
Request parameter	TGL_MS	PRM_RW	MORE_PRM	RES	RES	RES	RES	RES
Response parameter	TGL_SM	TIME OUT	BUF_OVF	PRM_ERR	PRM_UPD	SR_LEN_UPD	RES	RES
Request parameter	Information is written by the application and read by the I/O module							
Response parameter	Information is written by the I/O module and read by the application							

Table 13: Communication Control Parameters

Parameter	**Value range**	**Meaning**
A0-A7	0...255	Word address of the parameter to be read / to be written.
TGL_MS	FALSE, TRUE	Toggle bit to release new instructions from the application to the module. If TGL_SM and TGL_MS have the same status, no new instruction has been released yet. If the flags have different statuses, a new instruction has been released and is currently being processed.
PRM_RW	FALSE	Parameter data of A7 ... A0 are read
	TRUE	Parameter data are written to A7 ... A0
MORE_PRM	FALSE	End of parameter transmission
	TRUE	More parameter data to follow
TGL_SM	FALSE, TRUE	Toggle bit indicating that a parameter sent by the module has been transferred. If TGL_SM and TGL_MS have different statuses, the corresponding instruction is processed by the module. If both flags have the same status, the instruction for the parameter that was sent or requested is completed.

Table 13: Communication Control Parameters

Parameter	Value range	Meaning
TIMEOUT	FALSE	The transmission of the parameters has been completed within the stipulated time (parameter address 0).
	TRUE	The maximum time for the transmission of the parameters between I/O module and application was exceeded.
BUF_OVF	FALSE	Access to the write or read buffer of the I/O module was permitted.
	TRUE	Parameters outside of the write or read buffer were accessed.
PRM_ERR	FALSE	The parameter/all parameters previously transmitted are valid.
	TRUE	At least one transmitted parameter was defective. The flag can either be set after each parameter that is received or after the transmission of the parameters is completed.
PRM_UPD	FALSE	No change in modules individual parameter data set.
	TRUE	Module's individual parameter data set has been changed. A respective iPar-Server request is to be initiated by the PROFIBUS/PROFINET coupler/controller.
SR_LEN_UPD	FALSE	No change in modules KBUS shift register size.
	TRUE	Modules KBUS shift register size will be changed. The initiation of a KBUS reset sequence is necessary.
RES	FALSE	Reserved for expansions

7.1.3 Parameter Sets

For use of the parameter channel, parameter sets are defined and indexed using parameter addresses (A7 ... A0). Module-specific parameters (parameters 0 through 249) and general system parameters (parameters 250 through 255) are differentiated.

7.1.3.1 General Parameter Data (System Parameter Range)

The following addresses are defined to access the system parameters of the I/O modules:

Table 14: System Parameters

Address	Mode	Parameter	Description
250 ... 253	R/W	RESERVED	Reserved for expansions
254	R/W	TIMEOUT	This parameter contains the maximum permissible time in milliseconds that can elapse for the transfer of the parameter set. If TIMEOUT = 0, the monitoring time is infinite.
255	R	NO_OF_PRMS	Number of words (parameter data) of the I/O module.
	W	SET_DEFAULT_PRMS	The I/O module is reset to the default setting.

7.1.3.2 I/O-module-specific parameter data

The following addresses are defined for access to the specific parameter data of the AS-Interface master module:

Table 15: I/O-module-specific parameter data

Address	Mode	Parameter			Description	
0	R/W	LB	Bit 0 ... 7	ASI_ DATA_ LEN	AS-Interface data length in bytes	
		HB	Bit 8 ... 14	MBX_ LEN	Length of the mailbox to be set in bytes	
			Bit 15	MBX_ MODE*)	FALSE	No superimposition of mailbox and AS-Interface process data
					TRUE	Mailbox can be superimposed on the AS-Interface process data (by setting bit 25 in the control byte)
1	R/W	LB	Bit 0	DS_EN	Internal use	
			Bit 1 ... 7	RES	Reserved for expansion	
		HB	Bit 8 ... 15	RES	Reserved for expansion	
2 ... 249	R/W	RESERVED			Reserved for expansion	

*) see Chapter “Overview process image”

The contents of address 0 are also entered by the module in register 33 with the read-only attribute.

7.1.4 Parameter transmission process

Parameter data are exchanged between application and bus modules by means of the Request-Response process. The application initiates an order with the help of the toggle bit (TGL_MS != TGL_SM). The communications control register (R57) then polls the module until the latter acknowledges the execution of the order (TGL_SM == TGL_MS).

The possible orders to the parameterizing interface of the bus module are listed in the following.

7.1.4.1 Determining the maximum bus module parameter data (system parameters)

Request (Application)

Table 16: Determining the maximum bus module parameter data (Request)

Parameter	Value	Meaning
TGL_MS	!= TGL_SM	Initiate order
PRM_RW	= FALSE	Read access
A0 ... A7	255	Address of parameter data length

Response (I/O module)

Table 17: Determining the maximum bus module parameter data (Response)

Parameter	Value	Meaning
TGL_SM	== TGL_MS	Order executed
A0 ... A7	255	Address of parameter data length mirrored
PRM0 ... PRM15	N	Number of parameters in the address range 0 ... (n-1), $n \in \{N < 250\}$

7.1.4.2 Restoring factory settings (system parameters)

Request (Application)

Table 18: Restoring factory settings (Request)

Parameter	Value	Meaning
TGL_MS	!= TGL_SM	Initiate order
PRM_RW	= TRUE	Write access
A0 ... A7	255	Address of factory settings

Response (I/O module)

Table 19: Restoring factory settings (Response)

Parameter	Value	Meaning
TGL_SM	== TGL_MS	Order executed
A0 ... A7	255	Address of factory settings mirrored

7.1.4.3 Reading/writing parameters (I/O module-specific)

Request (Application)

Table 20: Reading/writing parameters (Request)

Parameter	Value	Meaning
TGL_MS	!= TGL_SM	Initiate order
PRM_RW	= FALSE	Read access
	= TRUE	Write access
MORE_PRM	= FALSE	The transmission of the parameter data is terminated with the currently transmitted parameter.
	= TRUE	Further parameter data are to follow.
A0 ... A7	0 ... (n-1)	Address of parameter data
PRM0 ... PRM15	0 ... 65535	Parameter data for write access

Response (I/O module)

Table 21: Reading/writing parameters (Response)

Parameter	Value	Meaning
TGL_SM	== TGL_MS	Order executed
A0 ... A7	0 ... (n-1)	Address of parameter data mirrored
TIMEOUT	FALSE, TRUE	Monitoring time expired
BUF_OFL	FALSE, TRUE	Access outside the module parameter range
PRM_ERR	FALSE, TRUE	Parameter/parameter set error
PRM0 ... PRM15	0 ... 65535	Parameter data for read access

Errors when exchanging parameter data are reported by the module in the error flags TIMEOUT, BUF_OV and PRM_ERR.

When the last parameter has been transferred to the module (MORE_PRM = FALSE), the entire parameter set is checked by the module and accepted if correct. Otherwise, the module returns a parameterizing error (PRM_ERR = TRUE).

7.1.4.4 Example: Configuring AS-Interface process data and mailbox

Request (Application)

Table 22: Configuring AS-Interface process data and mailbox (Request)

Parameter	Value	Meaning	
TGL_MS	!= TGL_SM	Initiate order	
PRM_RW	= TRUE	Write access	
MORE_PRM	= FALSE	The transmission of the parameter data is terminated with the currently transmitted parameter.	
A0 ... A7	0	Address of parameter data	
PRM0 ... PRM7	ASI_DATA_ LEN	AS-Interface data length in bytes	
PRM8 ... PRM14	MBX_LEN	Mailbox length in bytes	
PRM15	MBX_MODE	FALSE	No superimposition of mailbox and AS-Interface process data
		TRUE	Mailbox can be superimposed on the AS-Interface process data (by setting bit 5 in the control byte).

Response (I/O module)

Table 23: Configuring AS-Interface process data and mailbox (Response)

Parameter	Value	Meaning
TGL_SM	== TGL_MS	Order executed
A0 ... A7	0	Address of parameter data mirrored
TIMEOUT	FALSE, TRUE	Monitoring time expired
BUF_OFL	FALSE, TRUE	Access outside the module parameter range
PRM_ERR	FALSE, TRUE	Parameter/parameter set error

7.1.5 Set up and configuration with WAGO-I/O-*CHECK*

In order to work with the AS-Interface master module 750-655, first set up the communication connection to your node. Then read out the node configuration and select the required module in the navigation screen or node view.

Next set the required process data and mailbox length in the parameter setting dialog.

After this, you can set up the required operating mode for the master in the process data dialog or select a slave for further processing from the list of slave addresses.

Use the diagnostics function in order to correct configuration errors.

7.1.5.1 Setting up the AS-Interface process data and mailbox length

Open the parameter dialog for the selected bus module. To do this, click on the Settings command in the context menu for the module (node view or navigation).

The size of the internal bus process image is specified with the Process Image Length selection box. You can choose values of 12, 20, 24, 32, 40 or 48 bytes.

The size of the mailbox is specified with the Mailbox Length selection box. You can set values of 0, 6, 10, 12 or 18 bytes.

Note

Access to all analog process data and configuration and diagnostic information when mailbox length > 0 byte only!
If a mailbox length of 0 bytes is selected, it will only be possible to display process data for digital slaves in monitor mode. Process data cannot then be displayed or set up in control mode.

The **Overlapped Mailbox** selection box is used to determine whether the mailbox data are overlapped with the AS-Interface process data (selection box activated) or whether the AS-Interface process data are transmitted after the mailbox data (selection box not activated).

The available combinations of options correspond to the configurations that can be set up using the PROFIBUS or CANopen type files.

To display the default values for this module, click on **[DEFAULT]**. The displayed values can then be further modified.

Transfer the set values to the non-volatile memory of the module by clicking **[ACCEPT]** and exit the dialog box by pressing **[CLOSE]**.

7.1.5.2 Setting up the operating mode for the AS-Interface master

Open the process data dialog for the selected bus module. To do this, click on the **Process data and Configuration …** command in the context menu for the module (node view or navigation).

The current state of the AS-Interface master is shown in the Properties area.

The required operating mode for the AS-Interface master is set by means of the control flags.

7.1.5.3 Including a new slave in the AS-Interface network

Open the process data dialog of the selected I/O module. Execute the **process data and configuration command ...** in the context menu of the module (node view or navigation).

After opening the dialog, the connected AS interface slaves are scanned and the results displayed in the slave overview on the left side of the dialog. With the selection box in the header, switch the display between A-/ B- and Safety-at-Work slaves.

Select the required slave by clicking the respective table entry. The configuration, parameter and process data of the selected slave appears on the right side of the dialog.

You can configure the slave here or observer and set the process data of the slave.

If the selected slave involves a Safety-at-Work monitor, the slave properties of the Safety-at-Work monitor appear instead.

7.1.5.3.1 Configuring an AS-Interface slave

You can set up the configuration (IO, ID, ID1, ID2) and the required parameters for the selected slave and also assign a new address.

To set up the required configuration, select the required slave type from the Permanent Configuration line in the Description drop-down list.

Alternatively, you can also save the slave type that has just been read as a permanent configuration by pressing the **[STORE ACTUAL CONFIGURATION]** button. The set values are accepted by means of the **[SET PERMANENT CONFIGURATION]** button. When all slaves have been configured, save the configuration data in the master by pressing the **[SET PERMANENT CONFIGURATION]** button. The parameters are set by setting the bits B0 – B3 in the Permanent Parameter line. Alternatively, here too, you can save the slave type that has just been read as permanent parameters by pressing the **[WRITE ACTUAL]** button. The set values are accepted by means of the **[SET PERMANENT]** button.

When the parameters of all slaves have been set, save the parameter data in the master by pressing the **[STORE PARAMETER]** button. Please refer to the description of the appropriate slaves for the meaning of the parameters.

In order to assign a new address to the selected slave, enter the number of the new address in the New Address field and then press the **[SET]** button. Entering of addresses that are already occupied is rejected with an error message.

7.1.5.3.2 Observing and setting up AS-Interface process data

The current process data for the selected slave are displayed in the data area.

The input data are shown in the **Input** line and the output data can be set in the **Output** line. In doing so, the values are displayed depending on the function type. Digital functions are indicated by the states **ON/OFF.** Analog functions are displayed in hexadecimal format, as the physical measured variables relating to the analog inputs and outputs are not known to the master.

The digital output data are set by clicking on the appropriate bits and the analog output data are set by entering the hexadecimal value for the appropriate channel.

7.1.5.3.3 AS-Interface diagnostics

The flags in the properties area for the master are provided for diagnosing the AS-Interface master.

The status flags are used for information; the operating mode for the AS-Interface master can be set with the control flags in the right-hand column. The list of all the slaves with configuration errors (LCS) and the list of all slaves, which switch the master off line in the case of a fault (LOS), are provided for diagnosing the AS-Interface slaves.

The LCS list shows all slaves with configuration errors. The entries in the list contain the slave address, the number of errors that have occurred since the last read-out, the configuration ID and the slave description.

Errors that occur and their frequency are stored in the master. In this way, even short-term errors can be detected. After it has been read out, the error memory is reset.

To open the LOS list, select the "Offline on Configuration Error" flag. The table displays all slaves with their addresses, the configuration and description. Select those slaves from the LOS list, which are to switch the master into the offline state in the case of a configuration error, by clicking the check boxes next to the slave address. You can mark all slaves with the [ALL] button and reset all marked entries with the [NONE] button.

To update the list, press the [Refresh] button.
To apply the changes and to close the list, press the [OK] button.
To exit the list without applying the changes, press the [Cancel] button.
To apply the changes without closing the list, press the [Apply] button.

After closing the list, the flag checkbox is selected if at least one slave is selected in the list.

8 Process Image

8.1 Overview

The length of the process image of the AS-Interface master module can be set to fixed sizes of 12, 20, 24, 32, 40 or 48 bytes.

It consists of a control/status byte, a mailbox with a size of 0, 6, 10, 12 or 18 bytes and the AS-Interface process data, which can range from 0 to 32 bytes (Mode 1).

Alternatively, the mailbox can be set up to overlap, i.e. the mailbox is temporarily superimposed on the AS-Interface process data with a length of 6, 10, 12 or 18 bytes depending on the total length of the process image that has been configured (Mode 2).

Register communication is used to set up the module via the parameter channel (Mode 3).

Table 24: Process image overview

<table>
<tr><th>Mode 1</th><th>Mode 2.1</th><th>Mode 2.2</th><th>Mode 3</th></tr>
<tr><td>permanently configured mailbox (normal mode)</td><td>overlapping mailbox activated</td><td>overlapping mailbox deactivated</td><td>register communication</td></tr>
<tr><td>Control/Status (1 Byte, Byte 0)</td><td>Control/Status (1 Byte, Byte 0)</td><td>Control/Status (1 Byte, Byte 0)</td><td>Control/Status (1 Byte, Byte 0)</td></tr>
<tr><td>Internal use (1 Byte, Byte 1)</td><td>Internal use (1 Byte, Byte 1)</td><td>Internal use (1 Byte, Byte 1)</td><td>Internal use (1 Byte, Byte 1)</td></tr>
<tr><td>Mailbox (acyclical data, 0 ... 18 bytes long, bytes 2 ... n)</td><td>Mailbox (acyclical data, 6 ... 18 bytes long, bytes 2 ... n)</td><td rowspan="2">Process data (cyclical data, 0 ... 32 bytes long, bytes 2 ... m)</td><td>Register data (2 Byte, bytes 2 ... 3)</td></tr>
<tr><td>Process data (cyclical data, 0 ... 32 bytes long, bytes n+1 ... m)</td><td>Process data (cyclical data, 0 ... 32 bytes long, bytes n+1 ... m) (take validity of data into account!)</td><td>Invalid data (bytes 4 ... m)</td></tr>
</table>

Changing between Mode 1 (permanently configured mailbox) and Mode 2 (overlapping mailbox) as well as the setting up of the mailbox and process image sizes is carried out with the WAGO-I/O-CHECK commissioning tool or by means of the parameter channel via address 0. The values set are mirrored in Register 33.

Mode 3 (register communication) is switched on and off with bit 7 of the control byte. As this mode has a superimposed function, the previously activated Mode 1 or 2 remains active after switching off.

All possible settings relating to the total process image length and mailbox length are listed in the following tables.

In Mode 1, the control/status byte, the mailbox and the cyclical process data are mapped. This is the default setting.

When the difference between the process image length and the mailbox length is less than 34 bytes, only the first part of the AS-Interface process data is transmitted; the data for the slaves with the higher addresses are then omitted.

Table 25: Process image in mode 1

Process image		**Mailbox length (permanently configured)**									
length in Byte	**Offset in Byte**	**0 byte**		**6 byte**		**10 byte**		**12 byte**		**18 byte**	
	0	Control/status byte									
	1	Internal use									
Register data [1]	2	Flags	1/1A								
	3	2/2A	3/3A								
12 byte	4	4/4A	5/5A								
	5	6/6A	7/7A	Mailbox							
	6	8/8A	9/9A								
	7	10/10A	11/11A			Mailbox					
	8	12/12A	13/13A	Flags	1/1A			Mailbox			
	9	14/14A	15/15A	2/2A	3/3A						
	10	16/16A	17/17A	4/4A	5/5A						
	11	18/18A	19/19A	6/6A	7/7A					Mailbox	
20 byte	12	20/20A	21/21A	8/8A	9/9A	Flags	1/1A				
	13	22/22A	23/23A	10/10A	11/11A	2/2A	3/3A				
	14	24/24A	25/25A	12/12A	13/13A	4/4A	5/5A	Flags	1/1A		
	15	26/26A	27/27A	14/14A	15/15A	6/6A	7/7A	2/2A	3/3A		
	16	28/28A	29/29A	16/16A	17/17A	8/8A	9/9A	4/4A	5/5A		
	17	30/30A	31/31A	18/18A	19/19A	10/10A	11/11A	6/6A	7/7A		
	18	Flags	1B	20/20A	21/21A	12/12A	13/13A	8/8A	9/9A		
	19	2B	3B	22/22A	23/23A	14/14A	15/15A	10/10A	11/11A		
24 byte	20	4B	5B	24/24A	25/25A	16/16A	17/17A	12/12A	13/13A	Flags	1/1A
	21	6B	7B	26/26A	27/27A	18/18A	19/19A	14/14A	15/15A	2/2A	3/3A
	22	8B	9B	28/28A	29/29A	20/20A	21/21A	16/16A	17/17A	4/4A	5/5A
	23	10B	11B	30/30A	31/31A	22/22A	23/23A	18/18A	19/19A	6/6A	7/7A
32 byte	24	12B	13B	Flags	1B	24/24A	25/25A	20/20A	21/21A	8/8A	9/9A
	25	14B	15B	2B	3B	26/26A	27/27A	22/22A	23/23A	10/10A	11/11A
	26	16B	17B	4B	5B	28/28A	29/29A	24/24A	25/25A	12/12A	13/13A
	27	18B	19B	6B	7B	30/30A	31/31A	26/26A	27/27A	14/14A	15/15A
	28	20B	21B	8B	9B	Flags	1B	28/28A	29/29A	16/16A	17/17A
	29	22B	23B	10B	11B	2B	3B	30/30A	31/31A	18/18A	19/19A
	30	24B	25B	12B	13B	4B	5B	Flags	1B	20/20A	21/21A
	31	26B	27B	14B	15B	6B	7B	2B	3B	22/22A	23/23A
40 byte	32	28B	29B	16B	17B	8B	9B	4B	5B	24/24A	25/25A
	33	30B	31B	18B	19B	10B	11B	6B	7B	26/26A	27/27A
	34	X [2]	X	20B	21B	12B	13B	8B	9B	28/28A	29/29A
	35	X	X	22B	23B	14B	15B	10B	11B	30/30A	31/31A
	36	X	X	24B	25B	16B	17B	12B	13B	Flags	1B
	37	X	X	26B	27B	18B	19B	14B	15B	2B	3B
	38	X	X	28B	29B	20B	21B	16B	17B	4B	5B
	39	X	X	30B	31B	22B	23B	18B	19B	6B	7B
48 byte	40	X	X	X	X	24B	25B	20B	21B	8B	9B
	41	X	X	X	X	26B	27B	22B	23B	10B	11B
	42	X	X	X	X	28B	29B	24B	25B	12B	13B
	43	X	X	X	X	30B	31B	26B	27B	14B	15B
	44	X	X	X	X	X	X	28B	29B	16B	17B
	45	X	X	X	X	X	X	30B	31B	18B	19B
	46	X	X	X	X	X	X	X	X	20B	21B
	47	X	X	X	X	X	X	X	X	22B	23B

1) Bit 7 in control byte C0 = 1
2) If "Automatically Populate ON" is on in the data frame dialog, analog data from slaves appear after the data of the last slave, in protected operating mode. (See chapter “Analog AS interface data”)

Mode 2 describes the operating mode with suppressible mailbox. If the mailbox flag (bit 5 in the control byte C0) is set, then the mailbox is imposed over the cyclical data range. The covered range is then no longer valid (the range not covered continues to be updated, however, and can therefore be used). If the mailbox flag is not set, then the mailbox is suppressed and the cyclical data range becomes valid. The required setting is acknowledged by mirroring in bit 5 of the status byte S0.

Note

Note the validity of the data ranges!
The application program must take into account the validity of the data ranges.

Table 26: Process image in mode 2

Process image		**Mailbox suppressed** (Bit 5 in control byte C0 = FALSE)		**Mailbox imposed** (Bit 5 in control byte C0 = TRUE)							
Length in bytes	**Offset in byte**	**n byte mailbox**		**6 byte**		**10 byte**		**12 byte**		**18 byte**	
	0	Control/status byte									
	1	Internal use									
Register data [1]	2	Flags	1/1A	Mailbox		Mailbox		Mailbox		Mailbox	
	3	2/2A	3/3A								
12 byte	4	4/4A	5/5A								
	5	6/6A	7/7A								
	6	8/8A	9/9A								
	7	10/10A	11/11A								
	8	12/12A	13/13A	12/12A	13/13A						
	9	14/14A	15/15A	14/14A	15/15A						
	10	16/16A	17/17A	16/16A	17/17A						
	11	18/18A	19/19A	18/18A	19/19A						
20 byte	12	20/20A	21/21A	20/20A	21/21A	20/20A	21/21A				
	13	22/22A	23/23A	22/22A	23/23A	22/22A	23/23A				
	14	24/24A	25/25A	24/24A	25/25A	24/24A	25/25A	24/24A	25/25A		
	15	26/26A	27/27A	26/26A	27/27A	26/26A	27/27A	26/26A	27/27A		
	16	28/28A	29/29A	28/28A	29/29A	28/28A	29/29A	28/28A	29/29A		
	17	30/30A	31/31A	30/30A	31/31A	30/30A	31/31A	30/30A	31/31A		
	18	Flags	1B	Flags	1B	Flags	1B	Flags	1B		
	19	2B	3B	2B	3B	2B	3B	2B	3B		
24 byte	20	4B	5B	4B	5B	4B	5B	4B	5B	4B	5B
	21	6B	7B	6B	7B	6B	7B	6B	7B	6B	7B
	22	8B	9B	8B	9B	8B	9B	8B	9B	8B	9B
	23	10B	11B	10B	11B	10B	11B	10B	11B	10B	11B
32 byte	24	12B	13B	12B	13B	12B	13B	12B	13B	12B	13B
	25	14B	15B	14B	15B	14B	15B	14B	15B	14B	15B
	26	16B	17B	16B	17B	16B	17B	16B	17B	16B	17B
	27	18B	19B	18B	19B	18B	19B	18B	19B	18B	19B
	28	20B	21B	20B	21B	20B	21B	20B	21B	20B	21B
	29	22B	23B	22B	23B	22B	23B	22B	23B	22B	23B
	30	24B	25B	24B	25B	24B	25B	24B	25B	24B	25B
	31	26B	27B	26B	27B	26B	27B	26B	27B	26B	27B
40 byte	32	28B	29B	28B	29B	28B	29B	28B	29B	28B	29B
	33	30B	31B	30B	31B	30B	31B	30B	31B	30B	31B
	…	X [2]	X [2]	X [2]	X [2]	X [2]	X [2]	X [2]	X [2]	X [2]	X [2]
	39	X	X	X	X	X	X	X	X	X	X
48 byte	40	X	X	X	X	X	X	X	X	X	X
	…	X	X	X	X	X	X	X	X	X	X
	47	X	X	X	X	X	X	X	X	X	X

[1] [2] See notes in table “Process image in mode 1”

Mode 3 is reserved for register communication. Bit 7 in the control byte is set to activate register communication. Resetting this bit switches register communication off again. The selected setting is mirrored in bit 7 of the status byte. The register data are superimposed on the PA offset byte 2 and byte 3 over the respective cyclical or acyclical memory range depending on the selected mode.

Note

Note the validity of the mailbox and process data!
In Mode 3, the mailbox and the process data are basically no longer valid.

Process image length and mailbox length:

The process image length and the mailbox length can be freely set within fixed limits with the limitation that the process image length is greater than the mailbox length plus two control/status bytes.

The size of the process image can be set to 12 bytes, 20 bytes, 24 bytes, 32 bytes, 40 bytes or 48 bytes.

The mailbox length can be set to 0 bytes, 6 bytes, 10 bytes, 12 bytes or 18 bytes.

Note

Access to only digital slaves when 0 byte mailbox length!
If a mailbox length of 0 bytes is set, it will only be possible to access the process data of digital slaves.

AS-Interface process data:

The length of the AS-Interface data and thus the number of transferable slaves is given by the combination of the above-mentioned process image and mailbox settings.

AS-Interface process data length = (Process image length - Mailbox length - 2)

The following table shows a summary of the permissible configurations of process image and mailbox:

Table 27: Permissible configurations of process image and mailbox

PA	C/S	Mailbox length									
		0 byte		6 byte		10 byte		12 byte		18 byte	
		PD	SL	PD	SL	PD	SL	PD	SL	PD	SL
12	2	10	19	4	7	0	0	-	-	-	-
20	2	18	34	12	23	8	15	6	11	0	0
24	2	22	42	16	31	12	23	10	19	4	7
32	2	30	58	24	46	20	38	18	34	12	23
40	2	38	62	32	62	28	54	26	50	18	38
48	2	46	62	40	62	36	62	34	62	28	54

PA:	Length of process image that can be set
C/S:	Number of status and control bytes (incl. filler bytes)
PD:	Length of AS-Interface process data
SL:	Number of transferable slaves

The standard setting is a process image length of 24 bytes and a mailbox length of 6 bytes. This results in an AS-Interface process data length of 16 bytes, i.e. 31 slaves can be read out.

8.2 Control- and status byte

Table 28: Control byte C0

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
RegCom	0	MBX	0	0	0	0	0

MBX	0:	Mailbox suppressed
	1:	Mailbox superimposed
RegCom	0:	Process data communication
0	This bit is reserved and may not be changed.	

The superimposition of the mailbox is activated and deactivated with bit 5 in the control byte.

With process data communication, bit 7 in the control byte is always reset.

Table 29: Status byte S0

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
RegCom	Error	MBX	CNF Mode	Mapping consis-tency	AS-Interface power	AS-I	Over-flow

Overflow	0:	AS-Interface data complete on internal bus
	1:	AS-Interface data incomplete on internal bus (timing)
AS-I	0:	AS-Interface active
	1:	AS-Interface not active
AS-Interface-power	0:	AS-Interface supply OK and 24 V supply OK
	1:	AS-Interface supply fault or 24 V supply fault
Mapping consistency	0:	AS-Interface data complete on internal bus
	1:	AS-Interface data incomplete on internal bus (mapping)
CNF Mode	0:	Protected operating mode
	1:	Set-up mode
MBX	0:	Mailbox suppressed
	1:	Mailbox superimposed
Config Error	0:	No fault
	1:	Configuration error or at least one of the status bits 1 or 2
RegCom	0:	Process data communication

The status of the AS-Interface master module is indicated by the bits 0 to 4 and 6 in the status byte.

The superimposition of the mailbox is acknowledged by the bus module with bit 5 in the status byte.

Process data communication is acknowledged by the bus module with bit 7 in the status byte.

8.3 AS-Interface process data

In the data field of the AS-Interface process data, the data for (or from) 2 slaves are transmitted with each byte. In doing so, the data for the slave with the higher address are located in the lower value nibble.

The main EC (Execution Control) flags or control bits are transmitted in place of slave 0, with which the master does not exchange any process data.

Table 30: AS-Interface process data

Byte-Offset	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Flags				Slave 1/1A			
	F3	F2	F1	F0	D3	D2	D1	D0
1	Slave 2/2A				Slave 3/3A			
...	...				...			
14	Slave 28/28A				Slave 29/29A			
15	Slave 30/30A				Slave 31/31A			
16	Reserved				Reserved			
17	Slave 2B				Slave 1B			
...	...				...			
30	Slave 28B				Slave 29B			
31	Slave 30B				Slave 31B			

Depending on the process image length, mailbox length and mailbox mode, it may be that not all AS-Interface process data are transmitted (cf. chapter "Overview process image").

8.3.1 AS-Interface flags

Table 31: AS-Interface flags

Flag	Input data	Output data
F0	ConfigError	Offline
F1	APF	LOS-Master-Bit
F2	PeripheryFault	A rising edge switches the master to the set-up mode
F3	ConfigurationActive	A rising edge switches the master to the protected mode

ConfigError:	0:	ConfigOK
	1:	ConfigError
APF:	0:	AS-Interface Power OK
	1:	AS-Interface Power Fail
PeripheryFault:	0:	PeripheryOK
	1:	PeripheryFault
ConfigurationActive:	0:	Configuration inactive, master in protected mode
	1:	Configuration active, master in set-up mode
Off-Line:	0:	On-Line
	1:	Off-Line
LOS-Master-Bit:	0:	Off-Line with ConfigError deactivated
	1:	Off-Line with ConfigError activated

All bits in the LOS are set with a rising edge of the LOS master bit. All bits in the LOS are reset with a falling edge of the LOS master bit.

8.4 Analog AS interface data

If "Automatically Populate ON" is on in the data frame dialog, analog data from slaves appear in protected operating mode after the data of the last slave, where the number of AI or AO channels is not 0 (see the following table).

Table 32: Combination slaves with digital and/or analog process data

Profile (S-IO.ID.ID2)	Type	AI (Channels)	AO (Channels)	DIO (Nibble)
S-6.0.{2,3,4,A,B,C}[1)]	CTT5	1	1	0
S-6.0.{5,6,7}[2]		0	0	0
S-7.3.{0,4}	CTT1	1	0	0
S-7.3.{1,5}		2	0	0
S-7.3.{2,3[3)],6,7[3)]}		4	0	0
S-7.3.{8,C}		0	1	0
S-7.3.{9,D}		0	2	0
S-7.3.{A,B[3)],E,F}		0	4	0
S-7.4.{0,1[3)],2[3)],3[3)],8[3)],9[3)],A[3)],B[3)]}	CTT1	0	0	1
S-7.4.4		1	0	0
S-7.4.5		2	0	0
S-7.4.{6,7[3)]}		4	0	0
S-7.4.C		0	1	0
S-7.4.D		0	2	0
S-7.4.{E,F}		0	4	0
S-7.5.5[4)]	CTT2	4	4	1
S-7.A.5[4)]		2	2	1
S-7.A.7[5)]	CTT3	0	0	1
S-7.A.8	CTT4	0	1	1
S-7.A.9		0	1	0
S-7.A.A[6)]	CTT3	1	1	0
S-B.A.5[4)]	CTT2	2	2	0
All others		0	0	1

1) First slave of a series of S-6.0 slaves
2) Second or more slaves of a series of S-6.0 slaves: no I/O
3) This profile is not described in the AS-i specification, but is handled as a "constant extension" of the specification.
4) The I/O configuration of CTT2 slaves can only be read in the data exchange (as ID object). The maximum (2 or 4 channels AIO, 0 or 1 Nibble DIO) is assumed here.
5) The I/Os (4 bit) appear as DIO.
6) The I/Os (8 bit) appear as AIO.

At which address slaves with digital data are expected and which slave can transfer how much analog data, is determined from the list of configured slaves and the permanent configuration data (PCD).

The analog values are separated for input and output data direction and arranged continuously depending on how much data can be transferred with the profile of the respective configured slave.

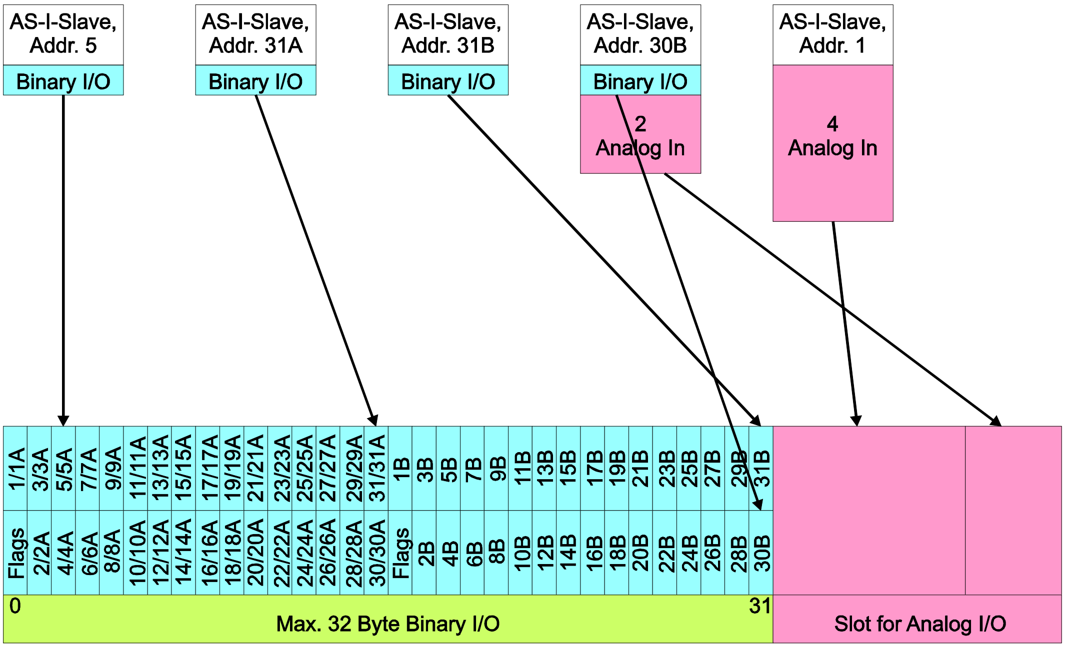


Figure 15: Analog AS interface data

An analog value always starts at an even address.

8.5 Mailbox

As well as the 32 bytes of input and output data, an AS-Interface master manages a large amount of configuration and parameter data. These data are only required for setting up the AS-Interface circuit and for diagnostics and therefore only have to be read or written occasionally.

In addition, the master supports slaves according to profile S-7.3 and S-7.4 and other multiplexing slaves, whereby large amounts of data can also occur.

Access is made to these non-time-critical data via the mailbox.

8.5.1 Structure

Table 33: Mailbox request

<table>
<tr><th>Byte</th><th>Bit 7</th><th>Bit 6</th><th>Bit 5</th><th>Bit 4</th><th>Bit 3</th><th>Bit 2</th><th>Bit 1</th><th>Bit 0</th></tr>
<tr><td>1</td><td colspan="8">Opcode</td></tr>
<tr><td>2</td><td>T</td><td>O</td><td>A/B</td><td colspan="5">-</td></tr>
<tr><td>3</td><td colspan="8">Request parameter byte 1</td></tr>
<tr><td>...</td><td colspan="8">...</td></tr>
<tr><td>36</td><td colspan="8">Request parameter byte 34</td></tr>
</table>

<table>
<tr><td>Opcode:</td><td colspan="3">Command code for the mailbox order</td></tr>
<tr><td>T:</td><td>Toggle-Flag</td><td colspan="2">Mailbox order is started when a change occurs.</td></tr>
<tr><td rowspan="2">O:</td><td rowspan="2">Order-Flag (for mailbox orders with bit information)</td><td>0:</td><td>Bits are stored in parameter bytes in ascending order (default value).</td></tr>
<tr><td>1:</td><td>Bits are stored in parameter bytes in descending order.</td></tr>
<tr><td rowspan="4">A/B</td><td rowspan="2">Slave changeover (for 6-byte mailbox orders with bit information)</td><td>0:</td><td>A-slave data are transmitted before B-slave data.</td></tr>
<tr><td>1:</td><td>B-slave data are transmitted before A-slave data.</td></tr>
<tr><td rowspan="2">Channel changeover (for 6-byte mailbox orders with word -information)</td><td>0:</td><td>Analog values are transmitted in the order Channel 1, Channel 2, Channel 3, Channel 4.</td></tr>
<tr><td>1:</td><td>Analog values are transmitted in the order Channel 3, Channel 4, Channel 1, Channel 2.</td></tr>
</table>

Table 34: Mailbox response

<table>
<tr><th>Byte</th><th>Bit 7</th><th>Bit 6</th><th>Bit 5</th><th>Bit 4</th><th>Bit 3</th><th>Bit 2</th><th>Bit 1</th><th>Bit 0</th></tr>
<tr><td>1</td><td colspan="8">Opcode (mirrored)</td></tr>
<tr><td>2</td><td>T</td><td colspan="7">Result</td></tr>
<tr><td>3</td><td colspan="8">Response parameter byte 1</td></tr>
<tr><td>...</td><td colspan="8">...</td></tr>
<tr><td>34</td><td colspan="8">Response parameter byte 32</td></tr>
</table>

<table>
<tr><td>Opcode:</td><td colspan="2">Mirrored command code for the mailbox order</td></tr>
<tr><td>T:</td><td>Toggle flag</td><td>A mailbox order is acknowledged when a change occurs.</td></tr>
<tr><td>Result:</td><td colspan="2">Status/error in the mailbox order</td></tr>
</table>

In most cases, the mailbox will not have the full length in order to provide space for the AS-Interface process data.

8.5.2 Access procedure

The user first writes the request parameter and then the opcode and toggle flag. As soon as the opcode or toggle flag changes, the master interprets the mailbox range of the module bus output data as a complete mailbox command and executes it. In doing so, the response parameters are stored in the mailbox range of the internal bus input data.

When the command has been processed, the master mirrors the opcode and the toggle flag. From this, the user recognizes that his request has been dealt with and the result is available in the internal bus input data.

The toggle flag is required so that two mailbox commands with the same opcode (but possibly different parameters) can be executed directly after one another.

The execution of a mailbox command is declined if the number of request parameter bytes transmitted (in the output data direction) is too small, i.e. if the mailbox length has been set too low.

8.5.3 Overview of mailbox commands

A detailed overview of the mailbox commands is available in the appendix.

8.5.4 Result values of mailbox commands

Table 35: Result values of mailbox commands

Result	Value	Location	Meaning
OK	0x00	---	Fault-free execution
HI_NG	0x11	HI	General fault (host interface “not good”)
HI_OPCODE	0x12	HI	Invalid value in opcode
HI_LENGTH	0x13	HI	Length of mailbox in I/O data range or length of the DP V1 request is too small
HI_ACCESS	0x14	HI	No access right
EC_NG	0x21	EC	General fault (AS-I execution control “not good”)
EC_SND	0x22	EC	“Slave (source addr) not detected”
EC_SD0	0x23	EC	“Slave 0 detected”
EC_SD2	0x24	EC	“Slave (target addr) not decteced”
EC_DE	0x25	EC	“Delete error”
EC_SE	0x26	EC	“Set error”
EC_AT	0x27	EC	“Address temporary”
EC_ET	0x28	EC	“Extended ID1 temporary”
EC_RE	0x29	EC	“Read (extended ID1) error”
HI : Host Interface of the module			
EC : Execution Control (part specific to AS-Interface)			

8.5.5 Example of mailbox use

The command for reading-in the four 16-bit channels of an AS-Interface input slave, which is set up according to slave profile 7.3, is shown by way of an example (RD_7X_IN).

When editing the process image:

Mailbox size: 6 bytes

Selection of channels 1 and 2 (A/B flag = 0):

Table 36: Request: RD_7X_IN

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	0x50 (RD_7X_IN)							
2	0	0	0	0				
3	0x1D (slave address 29)							
4	0x00							
…	…							
6	0x00							

Table 37: Response: RD_7X_IN

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	0x00							
…	…							
6	0x00							

The mailbox call is not answered with the current analog values because the toggle flag has not been set.

Setting the toggle flag:

Table 38: Request: Setting the toggle flag

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	0x50							
2	1	0	0	0				
3	0x1D (slave address 29)							
4	0x00							
…	…							
6	0x00							

Table 39: Response: Setting the toggle flag

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	0x50							
2	1	0						
3	Analog channel 1 high byte, hex							
4	Analog channel 1 low byte, hex							
5	Analog channel 2 high byte, hex							
6	Analog channel 2 low byte, hex							

The values for channels 1 and 2 are in the response.

Selection of channels 3 and 4 (A/B flag = 1):

Table 40: Request: Selection of channels 3 and 4 (A/B flag = 1):

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	0x50							
2	1	0	1	0				
3	0x1D (slave address 29)							
4	0x00							
…	…							
6	0x00							

Table 41: Response: Selection of channels 3 and 4 (A/B flag = 1):

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	0x00							
…	…							
6	0x00							

The mailbox call is not answered with the current analog values because the toggle flag has not been reset.

Resetting the toggle flag:

Table 42: Request: Resetting the toggle flag:

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	0x50							
2	0	0	1	0				
3	0x1D (slave address 29)							
4	0x00							
…	…							
6	0x00							

Table 43: Response: Resetting the toggle flag:

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	0x50							
2	0x00 (toggle flag = 0, no error)							
3	Analog channel 3 high byte, hex							
4	Analog channel 3 low byte, hex							
5	Analog channel 4 high byte, hex							
6	Analog channel 4 low byte, hex							

The values for channels 3 and 4 are in the response.

9 Diagnostics

9.1 Extended diagnostics of the AS-Interface master

The extended diagnostics can be used to localize intermittent configuration errors as well as assessing the quality of the data transmission on the AS-Interface bus.

9.1.1 List of AS-Interface slaves, which have initiated configuration errors (LCS)

In order to diagnose the causes, which are responsible for short-term configuration errors on the AS-Interface network, along with the list of projected slaves (LPS), the list of detected slaves (LDS) and the list of active slaves (LAS), AS-Interface masters with extended diagnostics functionality also manage an additional list of slaves, which have initiated a configuration error (LCS, List of Corrupted Slaves). In this list appear all slaves, which have caused at least one short-term configuration error since the last time the list was read or since the master was switched on. Furthermore, short-term voltage dips on the AS-Interface network are also displayed in the LCS in place of slave 0.

Note

Delete the LCS when reading!
The LCS is deleted again each time a read process is carried out.

9.1.2 Protocol analysis: Counter for transmission errors for data telegrams

Masters with extended diagnostics provide a counter for each slave for telegram repeats, which is incremented for every transmission error in the case of data telegrams. By this means, the quality of the transmission can be assessed even when only individual telegrams are faulty and the slave would therefore never initiate a configuration error.

Note

Reset the counter when reading!
The status of the counters is read out via the appropriate host interface and reset with each read access. The highest valid instantaneous status of the counter is 254. A count of 255 indicates a counter overflow.

9.1.3 Offline phase in the case of configuration errors

Masters with extended diagnostics provide the option of placing themselves in the offline state in the case of a configuration error, hence placing the AS-Interface network in a safe operating state. It is thus possible to respond more quickly to configuration errors and the host is relieved of this task. If problems occur on the AS-Interface, the masters can automatically switch the AS-Interface network into a safe state.

There are two ways of parameterizing the master for this function:

- Every configuration error that occurs on the AS-Interface switches the master from normal operation in protected mode into the offline phase.
- A list of slave addresses is defined, which can cause the offline phase to be initiated when configuration errors occur (List of Offline Slaves LOS). Here, the user himself can decide how the master is to respond to a configuration error on the AS-Interface. Hence, with critical slaves, the master can be switched directly into the offline phase while, with less critical slaves, the error message "configuration error" is sent to the host, but the AS-Interface network is not switched offline.

10 Use in Hazardous Environments

The **WAGO-I/O-SYSTEM 750** (electrical equipment) is designed for use in Zone 2 hazardous areas.

The following sections include both the general identification of components (devices) and the installation regulations to be observed. The individual subsections of the "Installation Regulations" section must be taken into account if the I/O module has the required approval or is subject to the range of application of the ATEX directive.

10.1 Marking Configuration Examples

10.1.1 Marking for Europe according to ATEX and IEC-Ex

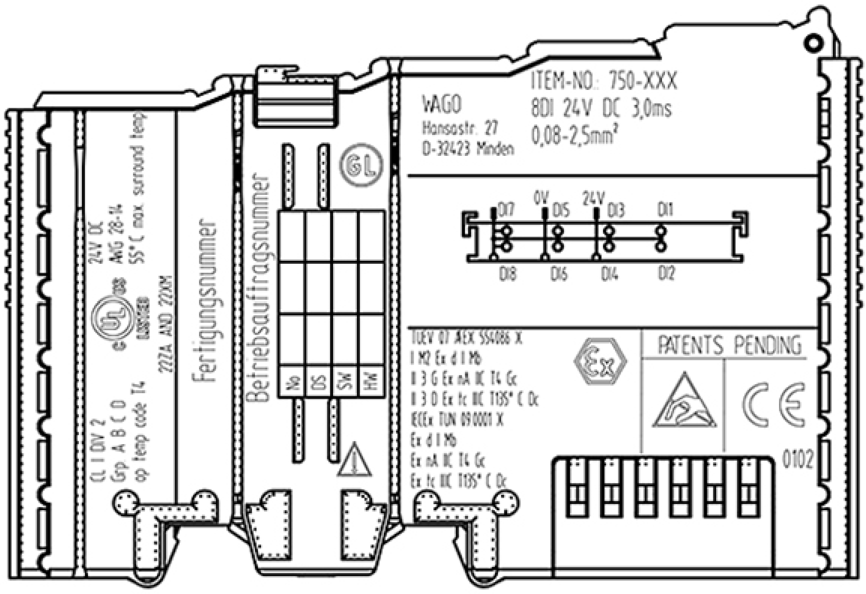


Figure 16: Side marking example for approved I/O modules according to ATEX and IECEx

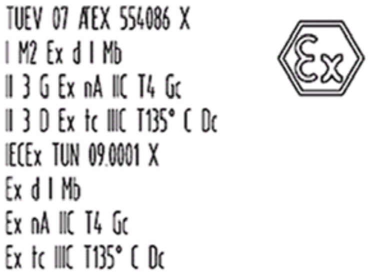


Figure 17: Printing Text detail – Marking example for approved I/O modules according to ATEX and IECEx.

Table 44: Description of marking example for approved I/O modules according to ATEX and IECEx

Printing on Text	Description
TÜV 07 ATEX 554086 X IECEx TUN 09.0001 X	Approving authority and certificate numbers
Dust	
II	Equipment group: All except mining
3D	Category 3 (Zone 22)
Ex	Explosion protection mark
tc Dc	Type of protection and equipment protection level (EPL):protection by enclosure
IIIC	Explosion group of dust
T 135°C	Max. surface temperature of the enclosure (without a dust layer)
Mining	
I	Equipment group: Mining
M2	Category: High level of protection
Ex	Explosion protection mark
d Mb	Type of protection and equipment protection level (EPL): Flameproof enclosure
I	Explosion group for electrical equipment for mines susceptible to firedamp
Gases	
II	Equipment group: All except mining
3G	Category 3 (Zone 2)
Ex	Explosion protection mark
nA Gc	Type of protection and equipment protection level (EPL): Non-sparking equipment
nC Gc	Type of protection and equipment protection level (EPL): Sparking apparatus with protected contacts. A device which is so constructed that the external atmosphere cannot gain access to the interior
IIC	Explosion group of gas and vapours
T4	Temperature class: Max. surface temperature 135°C

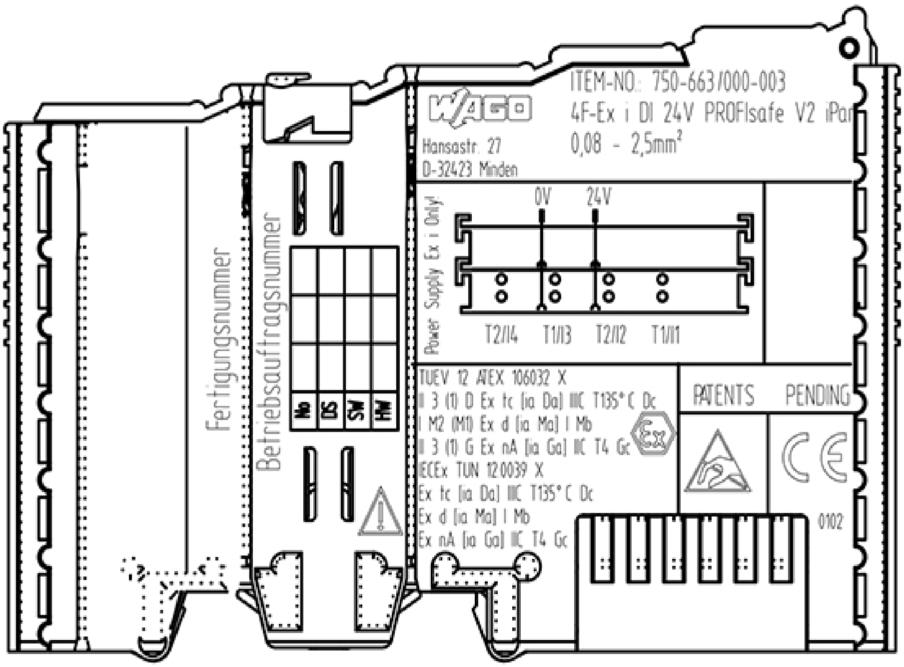


Figure 18: Side marking example for approved Ex i I/O modules according to ATEX and IECEx.

TUEV 12 ATEX 106032 X
II 3 (1) D Ex tc [ia Da] IIIC T135°C Dc
I M2 (M1) Ex d [ia Ma] I Mb
II 3 (1) G Ex nA [ia Ga] IIC T4 Gc
IECEx TUN 12.0039 X
Ex tc [ia Da] IIIC T135°C Dc
Ex d [ia Ma] I Mb
Ex nA [ia Ga] IIC T4 Gc

Figure 19: Text detail – Marking example for approved Ex i I/O modules according to ATEX and IECEx.

Table 45: Description of marking example for approved Ex i I/O modules according to ATEX and IECEx

Inscription text	Description
TÜV 07 ATEX 554086 X IECEx TUN 09.0001X TÜV 12 ATEX 106032 X IECEx TUN 12.0039 X	Approving authority and certificate numbers
Dust	
II	Equipment group: All except mining
3(1)D	Category 3 (Zone 22) equipment containing a safety device for a category 1 (Zone 20) equipment
3(2)D	Category 3 (Zone 22) equipment containing a safety device for a category 2 (Zone 21) equipment
Ex	Explosion protection mark
tc Dc	Type of protection and equipment protection level (EPL): protection by enclosure
[ia Da]	Type of protection and equipment protection level (EPL): associated apparatus with intrinsic safety circuits for use in Zone 20
[ib Db]	Type of protection and equipment protection level (EPL): associated apparatus with intrinsic safety circuits for use in Zone 21
IIIC	Explosion group of dust
T 135°C	Max. surface temperature of the enclosure (without a dust layer)
Mining	
I	Equipment Group: Mining
M2 (M1)	Category: High level of protection with electrical circuits which present a very high level of protection
Ex d Mb	Explosion protection mark with Type of protection and equipment protection level (EPL): Flameproof enclosure
[ia Ma]	Type of protection and equipment protection level (EPL): associated apparatus with intrinsic safety electrical circuits
I	Explosion group for electrical equipment for mines susceptible to firedamp

Table 45: Description of marking example for approved Ex i I/O modules according to ATEX and IECEx

Gases	
II	Equipment group: All except mining
3(1)G	Category 3 (Zone 2) equipment containing a safety device for a category 1 (Zone 0) equipment
3(2)G	Category 3 (Zone 2) equipment containing a safety device for a category 2 (Zone 1) equipment
Ex	Explosion protection mark
nA Gc	Type of protection and equipment protection level (EPL): Non-sparking equipment
[ia Ga]	Type of protection and equipment protection level (EPL): associated apparatus with intrinsic safety circuits for use in Zone 0
[ia Gb]	Type of protection and equipment protection level (EPL): associated apparatus with intrinsic safety circuits for use in Zone 1
IIC	Explosion group of gas and vapours
T4	Temperature class: Max. surface temperature 135°C

10.1.2 Marking for America according to NEC 500

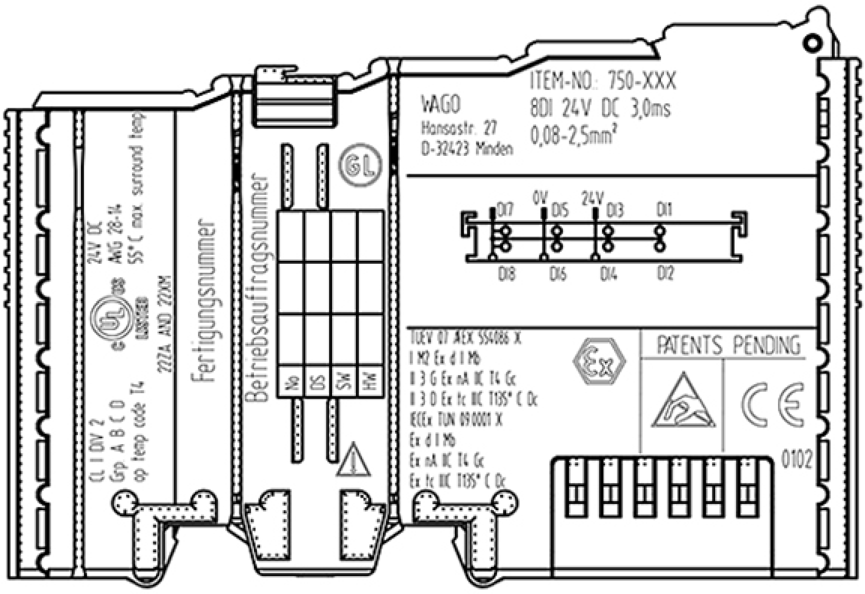


Figure 20: Side marking example for I/O modules according to NEC 500

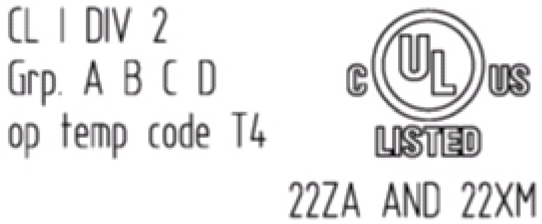


Figure 21: Text detail – Marking example for approved I/O modules according to NEC 500

Table 46: Description of marking example for approved I/O modules according to NEC 500

Printing on Text	Description
CL I	Explosion protection group (condition of use category)
DIV 2	Area of application
Grp. ABCD	Explosion group (gas group)
Op temp code T4	Temperature class

10.2 Installation Regulations

For the installation and operation of electrical equipment in hazardous areas, the valid national and international rules and regulations which are applicable at the installation location must be carefully followed.

10.2.1 Special conditions for safe use (ATEX Certificate TÜV 07 ATEX 554086 X)

1. For use as Gc- or Dc-apparatus (in zone 2 or 22) the Field bus Independent I/O Modules WAGO-I/O-SYSTEM 750-*** shall be erected in an enclosure that fulfils the requirements of the applicable standards (see the marking) EN 60079-0, EN 60079-11, EN 60079-15 and EN 60079-31.
   For use as group I electrical apparatus M2 the apparatus shall be erected in an enclosure that ensures a sufficient protection according to EN 60079-0 and EN 60079-1 and the degree of protection IP64.
   The compliance of these requirements and the correct installation into an enclosure or a control cabinet of the devices shall be certified by an ExNB.
2. Measures have to be taken outside of the device that the rating voltage is not being exceeded of more than 40 % because of transient disturbances.
3. Dip-switches, binary-switches and potentiometers, connected to the module may only be actuated when explosive atmosphere can be excluded.
4. The connecting and disconnecting of the non-intrinsically safe circuits is only permitted during installation, for maintenance or for repair purposes. The temporal coincidence of explosion hazardous atmosphere and installation, maintenance resp. repair purposes shall be excluded.
   This is although and in particular valid for the interfaces “Memory-Card”, “USB”, “Fieldbus connection”, “Configuration and programming interface”, “antenna socket”, “D-Sub”, “DVI-port” and the “Ethernet interface”. These interfaces are not energy limited or intrinsically safe circuits. An operating of those circuits is in the behalf of the operator.
5. For the types 750-606, 750-625/000-001, 750-487/003-000, 750-484, 750-633 the following shall be considered: The Interface circuits shall be limited to overvoltage category I/II/III (non mains/mains circuits) as defined in EN 60664-1.
6. For replaceable fuses the following shall be considered: Do not remove or replace the fuse when the apparatus is energized.
7. The following warnings shall be placed nearby the unit:
   WARNING – DO NOT REMOVE OR REPLACE FUSE WHEN ENERGIZED
   WARNING – DO NOT SEPARATE WHEN ENERGIZED
   WARNING – SEPARATE ONLY IN A NON-HAZARDOUS AREA

10.2.2 Special conditions for safe use (ATEX Certificate TÜV 12 ATEX 106032 X)

1. For use as Gc- or Dc-apparatus (in zone 2 or 22) the Field bus Independent I/O Modules WAGO-I/O-SYSTEM 750-*** Ex i shall be erected in an enclosure that fulfils the requirements of the applicable standards (see the marking) EN 60079-0, EN 60079-11, EN 60079-15 and EN 60079-31.
   For use as group I electrical apparatus M2 the apparatus shall be erected in an enclosure that ensures a sufficient protection according to EN 60079-0 and EN 60079-1 and the degree of protection IP64.
   The compliance of these requirements and the correct installation into an enclosure or a control cabinet of the devices shall be certified by an ExNB.
2. Measures have to be taken outside of the device that the rating voltage is not being exceeded of more than 40 % because of transient disturbances.
3. The connecting and disconnecting of the non-intrinsically safe circuits is only permitted during installation, for maintenance or for repair purposes. The temporal coincidence of explosion hazardous atmosphere and installation, maintenance resp. repair purposes shall be excluded.
4. For the type 750-633/000-003 the following shall be considered: The Interface circuits shall be limited to overvoltage category I/II/III (non mains/mains circuits) as defined in EN 60664-1.

10.2.3 Special conditions for safe use (IEC-Ex Certificate TUN 09.0001 X)

1. For use as Gc- or Dc-apparatus (in zone 2 or 22) the Field bus Independent I/O Modules WAGO-I/O-SYSTEM 750-*** shall be erected in an enclosure that fulfils the requirements of the applicable standards (see the marking) IEC 60079-0, IEC 60079-11, IEC 60079-15 and IEC 60079-31. For use as group I electrical apparatus M2 the apparatus shall be erected in an enclosure that ensures a sufficient protection according to IEC 60079-0 and IEC 60079-1 and the degree of protection IP64.
   The compliance of these requirements and the correct installation into an enclosure or a control cabinet of the devices shall be certified by an ExCB.
2. Measures have to be taken outside of the device that the rating voltage is not being exceeded of more than 40 % because of transient disturbances.
3. DIP-switches, binary-switches and potentiometers, connected to the module may only be actuated when explosive atmosphere can be excluded.
4. The connecting and disconnecting of the non-intrinsically safe circuits is only permitted during installation, for maintenance or for repair purposes. The temporal coincidence of explosion hazardous atmosphere and installation, maintenance resp. repair purposes shall be excluded.
   This is although and in particular valid for the interfaces “Memory-Card”, “USB”, “Fieldbus connection”, “Configuration and programming interface”, “antenna socket”, “D-Sub”, “DVI-port” and the “Ethernet interface”. These interfaces are not energy limited or intrinsically safe circuits. An operating of those circuits is in the behalf of the operator.
5. For the types 750-606, 750-625/000-001, 750-487/003-000, 750-484, 750-633 the following shall be considered: The Interface circuits shall be limited to overvoltage category I/II/III (non mains/mains circuits) as defined in IEC 60664-1.
6. For replaceable fuses the following shall be considered: Do not remove or replace the fuse when the apparatus is energized.
7. The following warnings shall be placed nearby the unit:
   WARNING – DO NOT REMOVE OR REPLACE FUSE WHEN ENERGIZED
   WARNING – DO NOT SEPARATE WHEN ENERGIZED
   WARNING – SEPARATE ONLY IN A NON-HAZARDOUS AREA

10.2.4 Special conditions for safe use (IEC-Ex Certificate IECEx TUN 12.0039 X)

1. For use as Gc- or Dc-apparatus (in zone 2 or 22) the Field bus independent I/O Modules WAGO-I/O-SYSTEM 750-*** Ex i shall be erected in an enclosure that fulfils the requirements of the applicable standards (see the marking) IEC 60079-0, IEC 60079-11, IEC 60079-15, IEC 60079-31.
   For use as group I electrical apparatus M2 the apparatus shall be erected in an enclosure that ensures a sufficient protection according to IEC 60079-0 and IEC 60079-1 and the degree of protection IP64.
   The compliance of these requirements and the correct installation into an enclosure or a control cabinet of the devices shall be certified by an ExCB.
2. Measures have to be taken outside of the device that the rating voltage is not being exceeded of more than 40 % because of transient disturbances.
3. The connecting and disconnecting of the non-intrinsically safe circuits is only permitted during installation, for maintenance or for repair purposes. The temporal coincidence of explosion hazardous atmosphere and installation, maintenance resp. repair purposes shall be excluded.
4. For the type 750-633/000-003 the following shall be considered: The Interface circuits shall be limited to overvoltage category I/II/III (non mains/mains circuits) as defined in IEC 60664-1.

10.2.5 ANSI/ISA 12.12.01

A. This equipment is suitable for use in Class I, Division 2, Groups A, B, C, D or non-hazardous locations only.

B. This equipment is to be fitted within tool-secured enclosures only.

C. WARNING Explosion hazard - substitution of components may impair suitability for Class I, Div. 2.

D. "WARNING – Do not disconnect equipment unless power has been switched off or the area is known to be non-hazardous" has to be placed near each operator accessible connector and fuse holder.

E. When a fuse is provided, the following information shall be provided: "A switch suitable for the location where the equipment is installed shall be provided to remove the power from the fuse."

F. For devices with Ether CAT/Ethernet connectors "Only for use in LAN, not for connection to telecommunication circuits".

G. WARNING - Use Module 750-642 only with antenna module 758-910.

H. For Couplers/Controllers and Economy bus modules only: "The configuration interface Service connector is for temporary connection only. Do not connect or disconnect unless the area is known to be non-hazardous. Connection or disconnection in an explosive atmosphere could result in an explosion."

I. Modules containing fuses only: "WARNING - Devices containing fuses must not be fitted into circuits subject to over loads, e.g. motor circuits"

K. Modules containing SD card reader sockets only: "WARNING - Do not connect or disconnect SD-Card while circuit is live unless the area is known to be free of ignitable concentrations of flammable gases or vapors."

Information

Additional Information
Proof of certification is available on request. Also take note of the information given on the module technical information sheet. The Instruction Manual, containing these special conditions for safe use, must be readily available to the user.

11 Appendix

11.1 Overview of mailbox commands

Table 47: Overview of mailbox commands

Opcode	Value	Meaning	Req Len	Res Len	Executable with mailbox				Page
					6	10	12	18	
IDLE	0x00	No order	2	2	●	●	●	●	87
Configuration									
GET_LDS_A/B	0x46	Get_List_of_Detected_Slaves	2	10	A/B	●	●	●	101
READ_CDI	0x28	Read_Actual_Configuration	3	4	●	●	●	●	96
STORE_CDI	0x07	Store_Actual_Configuration	2	2	●	●	●	●	95
SET_PCD	0x25	Set_Permanent_Configuration	5	2	●	●	●	●	93
GET_PCD	0x26	Get_Permanent_Configuration	3	4	●	●	●	●	94
GET_LPS_A/B	0x44	Get_List_of_Projected_Slaves	2	10	A/B	●	●	●	99
SET_LPS_A/B	0x6B	Set_List_of_Projected_Slaves	10	2	A/B	●	●	●	97
GET_LAS_A/B	0x45	Get_List_of_Activated_Slaves	2	10	A/B	●	●	●	100
Parameter									
GET_PP	0x01	Get_Permanent_Parameter	3	3	●	●	●	●	89
SET_PP	0x43	Set_Permanent_Parameter	4	2	●	●	●	●	88
READ_PI	0x03	Read_Parameter_from_Image	3	3	●	●	●	●	91
WRITE_P	0x02	Write_Parameter	4	3	●	●	●	●	90
STORE_PI	0x04	Store_Actual_Parameter_Image	2	2	●	●	●	●	92
GET_DELTA_A/B*)	0x57	Get list of config. diff.	2	10	A/B	●	●	●	118
SLAVE_ADDR	0x0D	Change_Slave_Address	4	2	●	●	●	●	107
Diagnostics									
GET_FLAGS	0x47	Get_Flags	2	5	●	●	●	●	102
GET_LPF_A/B	0x3E	Get_List_of_Peripheral_Failure	2	10	A/B	●	●	●	110
GET_LCS_A/B*)	0x6C	Get_List_of_Corrupted_Slaves	2	10	A/B	●	●	●	123
GET_TEC_X*)	0x66	Get transm.err.counters X-Slaves	4	≥5	●	●	●	●	129
Operation Modes									
SET_OP_MODE	0x0C	Set_Operation_Mode	3	2	●	●	●	●	104
SET_OFFLINE	0x0A	Set_Off-Line_Mode	3	2	●	●	●	●	105
SET_DATA_EX	0x48	Set_Data_Exchange_Active	3	2	●	●	●	●	106
SET_AAE	0x0B	Set_Auto_Adress_Enable	3	2	●	●	●	●	108
GET_LOS_A/B*)	0x61	GET_LOS	2	10	A/B	●	●	●	125
SET_LOS_A/B*)	0x6D	SET_LOS	10	2	A/B	●	●	●	127
Special Functions									
WRITE_XID1	0x3F	Write_Extended_ID-Code_1	3	2	●	●	●	●	111
EXEC_CMD	0x49	Execute_Command	4	3	●	●	●	●	109
FP_PARAM*)	0x7D	„Functional Profile“ Param.	≥3	≥2	●	●	●	●	131
FP_DATA*)	0x7E	„Functional Profile“ Data	≥3	≥2	●	●	●	●	132
WRITE_ACYC_ TRANS	0x4E	Write_Acyclic_Transfer	≥7	=2	●	●	●	●	133
READ_ACYC_ TRANS	0x4F	Read_Acyclic_Transfer	=5	≥2	●	●	●	●	135
Digital Slaves									
RD_SLV_DATA*)	0x5E	Read_Slave_Data	3	6	●	●	●	●	112
WR_SLV_DATA*)	0x5F	Write_Slave_Data	4	2	●	●	●	●	113

Table 47: Overview of mailbox commands

Opcode	Value	Meaning	Req Len	Res Len	Executable with mailbox				Page
					6	10	12	18	
16 Bit Slaves									
RD_7X_IN_A/B	0x50	Read 1 7.3-slave in.data	3	10	A/B	●	●	●	114
WR_16BIT_OUT_S	0x6F	WR_16BIT_OUT_S	6	2	●	●	●	●	116
WR_7X_OUT	0x51	Write 1 7.3-slave out.data	11	2	-	-	●	●	115
RD_7X_OUT_A/B	0x52	Read 1 7.3-slave out.data	3	10	A/B	●	●	●	117
Extended 16 Bit Slaves									
WR_74_PARAM	0x5A	Write S-7.4-slave parameter	≥6	2	●	●	●	●	119
RD_74_PARAM	0x5B	Read S-7.4-slave parameter	4	≥3	●	●	●	●	120
RD_74_ID	0x5C	Read S-7.4-slave ID string	4	≥3	●	●	●	●	121
RD_74_DIAG	0x5D	Read S-7.4-slave diagnosis string	4	≥3	●	●	●	●	122
Housekeeping									
BUTTONS*)	0x75	Disable Pushbuttons	3	2	●	●	●	●	130

*)	Command in addition to AS-Interface specification
●	Command is executable
-	Command is not executable
A/B	Command is executable with changeover between A/B slaves or channels

11.2 Overview of mailbox commands sorted by function

Table 48: Overview of mailbox commands sorted by function

Opcode	Value	Meaning	Req Len	Res Len	Executable with mailbox				Page
					6	10	12	18	
FP_DATA*)	0x7E	„Functional Profile“ Data	≥3	≥2	●	●	●	●	132
FP_PARAM*)	0x7D	„Functional Profile“ Param.	≥3	≥2	●	●	●	●	131
SLAVE_ADDR	0x0D	Change_Slave_Address	4	2	●	●	●	●	107
BUTTONS*)	0x75	Disable Pushbuttons	3	2	●	●	●	●	130
EXEC_CMD	0x49	Execute_Command	4	3	●	●	●	●	109
GET_DELTA_A/B*)	0x57	Get list of config. diff.	2	10	A/B	●	●	●	118
GET_TEC_X*)	0x66	Get transm.err.counters X-Slaves	4	≥5	●	●	●	●	129
GET_FLAGS	0x47	Get_Flags	2	5	●	●	●	●	102
GET_LAS_A/B	0x45	Get_List_of_Activated_Slaves	2	10	A/B	●	●	●	100
GET_LCS_A/B*)	0x6C	Get_List_of_Corrupted_Slaves	2	10	A/B	●	●	●	123
GET_LDS_A/B	0x46	Get_List_of_Detected_Slaves	2	10	A/B	●	●	●	101
GET_LPF_A/B	0x3E	Get_List_of_Peripheral_Failure	2	10	A/B	●	●	●	110
GET_LPS_A/B	0x44	Get_List_of_Projected_Slaves	2	10	A/B	●	●	●	99
GET_LOS_A/B*)	0x61	GET_LOS	2	10	A/B	●	●	●	125
GET_PCD	0x26	Get_Permanent_Configuration	3	4	●	●	●	●	94
GET_PP	0x01	Get_Permanent_Parameter	3	3	●	●	●	●	89
IDLE	0x00	No order	2	2	●	●	●	●	87
RD_7X_IN_A/B	0x50	Read 1 7.3-slave in.data	3	10	A/B	●	●	●	114
RD_7X_OUT_A/B	0x52	Read 1 7.3-slave out.data	3	10	A/B	●	●	●	117
RD_74_DIAG	0x5D	Read S-7.4-slave diagnosis string	4	≥3	●	●	●	●	122
RD_74_ID	0x5C	Read S-7.4-slave ID string	4	≥3	●	●	●	●	121
RD_74_PARAM	0x5B	Read S-7.4-slave parameter	4	≥3	●	●	●	●	120
READ_CDI	0x28	Read_Actual_Configuration	3	4	●	●	●	●	96
READ_ACYC_ TRANS	0x4F	Read_Acyclic_Transfer	=5	≥2	●	●	●	●	135
READ_PI	0x03	Read_Parameter_from_Image	3	3	●	●	●	●	91
RD_SLV_DATA*)	0x5E	Read_Slave_Data	3	6	●	●	●	●	112
SET_AAE	0x0B	Set_Auto_Adress_Enable	3	2	●	●	●	●	108
SET_DATA_EX	0x48	Set_Data_Exchange_Active	3	2	●	●	●	●	106
SET_LPS_A/B	0x6B	Set_List_of_Projected_Slaves	10	2	A/B	●	●	●	97
SET_LOS_A/B*)	0x6D	SET_LOS	10	2	A/B	●	●	●	127
SET_OFFLINE	0x0A	Set_Off-Line_Mode	3	2	●	●	●	●	105
SET_OP_MODE	0x0C	Set_Operation_Mode	3	2	●	●	●	●	104
SET_PCD	0x25	Set_Permanent_Configuration	5	2	●	●	●	●	93
SET_PP	0x43	Set_Permanent_Parameter	4	2	●	●	●	●	88
STORE_CDI	0x07	Store_Actual_Configuration	2	2	●	●	●	●	95
STORE_PI	0x04	Store_Actual_Parameter_Image	2	2	●	●	●	●	92
WR_16BIT_OUT_S	0x6F	WR_16BIT_OUT_S	6	2	●	●	●	●	116
WR_7X_OUT	0x51	Write 1 7.3-slave out.data	11	2	-	-	●	●	115
WR_74_PARAM	0x5A	Write S-7.4-slave parameter	≥6	2	●	●	●	●	119
WRITE_ACYC_ TRANS	0x4E	Write_Acyclic_Transfer	≥7	=2	●	●	●	●	135

Table 48: Overview of mailbox commands sorted by function

Opcode	**Value**	**Meaning**	**Req Len**	**Res Len**	**Executable with mailbox**				**Page**
					6	**10**	**12**	**18**	
WRITE_XID1	0x3F	Write_Extended_ID-Code_1	3	2	●	●	●	●	111
WRITE_P	0x02	Write_Parameter	4	3	●	●	●	●	90
WR_SLV_DATA*)	0x5F	Write_Slave_Data	4	2	●	●	●	●	113
*)	Command in addition to AS-Interface specification								
●	Command is executable								
-	Command is not executable								
A/B	Command is executable with changeover between A/B slaves or channels								

11.3 Overview of mailbox commands sorted by opcode

Table 49: Overview of mailbox commands sorted by opcode

Opcode	Value	Meaning	Req Len	Res Len	Executable with mailbox				Page
					6	10	12	18	
BUTTONS*)	0x75	Disable Pushbuttons	3	2	●	●	●	●	130
EXEC_CMD	0x49	Execute_Command	4	3	●	●	●	●	109
FP_DATA*)	0x7E	„Functional Profile“ Data	≥3	≥2	●	●	●	●	132
FP_PARAM*)	0x7D	„Functional Profile“ Param.	≥3	≥2	●	●	●	●	131
GET_DELTA_A/B*)	0x57	Get list of config. diff.	2	10	A/B	●	●	●	118
GET_FLAGS	0x47	Get_Flags	2	5	●	●	●	●	102
GET_LAS_A/B	0x45	Get_List_of_Activated_Slaves	2	10	A/B	●	●	●	100
GET_LCS_A/B*)	0x6C	Get_List_of_Corrupted_Slaves	2	10	A/B	●	●	●	123
GET_LDS_A/B	0x46	Get_List_of_Detected_Slaves	2	10	A/B	●	●	●	101
GET_LOS_A/B*)	0x61	GET_LOS	2	10	A/B	●	●	●	125
GET_LPF_A/B	0x3E	Get_List_of_Peripheral_Failure	2	10	A/B	●	●	●	110
GET_LPS_A/B	0x44	Get_List_of_Projected_Slaves	2	10	A/B	●	●	●	99
GET_PCD	0x26	Get_Permanent_Configuration	3	4	●	●	●	●	94
GET_PP	0x01	Get_Permanent_Parameter	3	3	●	●	●	●	89
GET_TEC_X*)	0x66	Get transm.err.counters X-Slaves	4	≥5	●	●	●	●	129
IDLE	0x00	No order	2	2	●	●	●	●	87
RD_74_DIAG	0x5D	Read S-7.4-slave diagnosis string	4	≥3	●	●	●	●	122
RD_74_ID	0x5C	Read S-7.4-slave ID string	4	≥3	●	●	●	●	121
RD_74_PARAM	0x5B	Read S-7.4-slave parameter	4	≥3	●	●	●	●	120
READ_ACYC_ TRANS	0x4F	Read_Acyclic_Transfer	=5	≥2	●	●	●	●	135
RD_7X_IN_A/B	0x50	Read 1 7.3-slave in.data	3	10	A/B	●	●	●	114
RD_7X_OUT_A/B	0x52	Read 1 7.3-slave out.data	3	10	A/B	●	●	●	117
RD_SLV_DATA*)	0x5E	Read_Slave_Data	3	6	●	●	●	●	112
READ_CDI	0x28	Read_Actual_Configuration	3	4	●	●	●	●	96
READ_PI	0x03	Read_Parameter_from_Image	3	3	●	●	●	●	91
SET_AAE	0x0B	Set_Auto_Adress_Enable	3	2	●	●	●	●	108
SET_DATA_EX	0x48	Set_Data_Exchange_Active	3	2	●	●	●	●	106
SET_LOS_A/B*)	0x6D	SET_LOS	10	2	A/B	●	●	●	127
SET_LPS_A/B	0x6B	Set_List_of_Projected_Slaves	10	2	A/B	●	●	●	97
SET_OFFLINE	0x0A	Set_Off-Line_Mode	3	2	●	●	●	●	105
SET_OP_MODE	0x0C	Set_Operation_Mode	3	2	●	●	●	●	104
SET_PCD	0x25	Set_Permanent_Configuration	5	2	●	●	●	●	93
SET_PP	0x43	Set_Permanent_Parameter	4	2	●	●	●	●	88
SLAVE_ADDR	0x0D	Change_Slave_Address	4	2	●	●	●	●	107
STORE_CDI	0x07	Store_Actual_Configuration	2	2	●	●	●	●	95
STORE_PI	0x04	Store_Actual_Parameter_Image	2	2	●	●	●	●	92
WR_16BIT_OUT_S	0x6F	WR_16BIT_OUT_S	6	2	●	●	●	●	116
WR_74_PARAM	0x5A	Write S-7.4-slave parameter	≥6	2	●	●	●	●	119
WRITE_ACYC_ TRANS	0x4E	Write_Acyclic_Transfer	≥7	=2	●	●	●	●	133
WR_7X_OUT	0x51	Write 1 7.3-slave out.data	11	2	-	-	●	●	115

Table 49: Overview of mailbox commands sorted by opcode

Opcode	**Value**	**Meaning**	**Req Len**	**Res Len**	**Executable with mailbox**				**Page**
					6	**10**	**12**	**18**	
WR_SLV_DATA*)	0x5F	Write_Slave_Data	4	2	●	●	●	●	113
WRITE_P	0x02	Write_Parameter	4	3	●	●	●	●	90
WRITE_XID1	0x3F	Write_Extended_ID-Code_1	3	2	●	●	●	●	111

*)	Command in addition to AS-Interface specification
●	Command is executable
-	Command is not executable
A/B	Command is executable with changeover between A/B slaves or channels

11.4 Overview of mailbox commands sorted by value

Table 50: Overview of mailbox commands sorted by value

Opcode	Value	Meaning	Req Len	Res Len	Executable with mailbox				Page
					6	10	12	18	
IDLE	0x00	No order	2	2	●	●	●	●	87
GET_PP	0x01	Get_Permanent_Parameter	3	3	●	●	●	●	89
WRITE_P	0x02	Write_Parameter	4	3	●	●	●	●	90
READ_PI	0x03	Read_Parameter_from_Image	3	3	●	●	●	●	91
STORE_PI	0x04	Store_Actual_Parameter_Image	2	2	●	●	●	●	92
STORE_CDI	0x07	Store_Actual_Configuration	2	2	●	●	●	●	95
SET_OFFLINE	0x0A	Set_Off-Line_Mode	3	2	●	●	●	●	105
SET_AAE	0x0B	Set_Auto_Adress_Enable	3	2	●	●	●	●	108
SET_OP_MODE	0x0C	Set_Operation_Mode	3	2	●	●	●	●	104
SLAVE_ADDR	0x0D	Change_Slave_Address	4	2	●	●	●	●	107
SET_PCD	0x25	Set_Permanent_Configuration	5	2	●	●	●	●	93
GET_PCD	0x26	Get_Permanent_Configuration	3	4	●	●	●	●	94
READ_CDI	0x28	Read_Actual_Configuration	3	4	●	●	●	●	96
GET_LPF_A/B	0x3E	Get_List_of_Peripheral_Failure	2	10	A/B	●	●	●	110
WRITE_XID1	0x3F	Write_Extended_ID-Code_1	3	2	●	●	●	●	111
SET_PP	0x43	Set_Permanent_Parameter	4	2	●	●	●	●	88
GET_LPS_A/B	0x44	Get_List_of_Projected_Slaves	2	10	A/B	●	●	●	99
GET_LAS_A/B	0x45	Get_List_of_Activated_Slaves	2	10	A/B	●	●	●	100
GET_LDS_A/B	0x46	Get_List_of_Detected_Slaves	2	10	A/B	●	●	●	101
GET_FLAGS	0x47	Get_Flags	2	5	●	●	●	●	102
SET_DATA_EX	0x48	Set_Data_Exchange_Active	3	2	●	●	●	●	106
EXEC_CMD	0x49	Execute_Command	4	3	●	●	●	●	109
WRITE_ACYC_ TRANS	0x4E	Write_Acyclic_Transfer	≥7	=2	●	●	●	●	133
READ_ACYC_ TRANS	0x4F	Read_Acyclic_Transfer	=5	≥2	●	●	●	●	135
RD_7X_IN_A/B	0x50	Read 1 7.3-slave in.data	3	10	A/B	●	●	●	114
WR_7X_OUT	0x51	Write 1 7.3-slave out.data	11	2	-	-	●	●	115
RD_7X_OUT_A/B	0x52	Read 1 7.3-slave out.data	3	10	A/B	●	●	●	117
GET_DELTA_A/B*)	0x57	Get list of config. diff.	2	10	A/B	●	●	●	118
WR_74_PARAM	0x5A	Write S-7.4-slave parameter	≥6	2	●	●	●	●	119
RD_74_PARAM	0x5B	Read S-7.4-slave parameter	4	≥3	●	●	●	●	120
RD_74_ID	0x5C	Read S-7.4-slave ID string	4	≥3	●	●	●	●	121
RD_74_DIAG	0x5D	Read S-7.4-slave diagnosis string	4	≥3	●	●	●	●	122
RD_SLV_DATA*)	0x5E	Read_Slave_Data	3	6	●	●	●	●	112
WR_SLV_DATA*)	0x5F	Write_Slave_Data	4	2	●	●	●	●	113
GET_LOS_A/B*)	0x61	GET_LOS	2	10	A/B	●	●	●	125
GET_TEC_X*)	0x66	Get transm.err.counters X-Slaves	4	≥5	●	●	●	●	129
SET_LPS_A/B	0x6B	Set_List_of_Projected_Slaves	10	2	A/B	●	●	●	97
GET_LCS_A/B*)	0x6C	Get_List_of_Corrupted_Slaves	2	10	A/B	●	●	●	123
SET_LOS_A/B*)	0x6D	SET_LOS	10	2	A/B	●	●	●	127
WR_16BIT_OUT_S	0x6F	WR_16BIT_OUT_S	6	2	●	●	●	●	116

Table 50: Overview of mailbox commands sorted by value

Opcode	**Value**	**Meaning**	**Req Len**	**Res Len**	**Executable with mailbox**				**Page**
					6	**10**	**12**	**18**	
BUTTONS*)	0x75	Disable Pushbuttons	3	2	●	●	●	●	130
FP_PARAM*)	0x7D	„Functional Profile“ Param.	≥3	≥2	●	●	●	●	131
FP_DATA*)	0x7E	„Functional Profile“ Data	≥3	≥2	●	●	●	●	132

*)	Command in addition to AS-Interface specification
●	Command is executable
-	Command is not executable
A/B	Command is executable with changeover between A/B slaves or channels

11.5 Mailbox command - Reference

11.5.1 Mailbox commands

11.5.1.1 No order (IDLE, 0x00)

If the value for "opcode" is 0, no order is executed.

Table 51: Mailbox request (IDLE, 0x00)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x00**							
2	T	-	-	-				

Table 52: Mailbox response (IDLE, 0x00)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x00** (mirrored)							
2	T	Result						

11.5.1.2 Set permanent parameter (SET_PP, 0x43)

A parameter value for the specified AS-Interface slave is set up with this command. The AS-Interface slave parameter is stored in the non-volatile memory of the AS-Interface master.

The AS-Interface slave parameter that has been set up is not sent to the AS-Interface slave until the AS-Interface master is switched on. The WRITE_P command must be used to temporarily change the AS-Interface slave parameter.

Table 53: Mailbox request (SET_PP, 0x43)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x43**							
2	T	-	-					
3	-		B	Slave address				
4	-				PP			

B	Area switchover	0:	Standard AS-Interface slave or AS-Interface slave with extended addressing mode in address range A
		1:	AS-Interface slave with extended addressing mode in address range B

Table 54: Mailbox response (SET_PP, 0x43)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x43**							
2	T	Result						

11.5.1.3 Get permanent parameter (GET_PP, 0x01)

The parameter value for the specified slave is read from the non-volatile memory with this command.

Table 55: Mailbox request (GET_PP, 0x01)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x01**							
2	T	-	-					
3	-		B	Slave address				

B	Area switchover	0:	Standard AS-Interface slave or AS-Interface slave with extended addressing mode in address range A
		1:	AS-Interface slave with extended addressing mode in address range B

Table 56: Mailbox response (GET_PP, 0x01)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x01**							
2	T	Result						
3	-				PP			

11.5.1.4 Write parameter (WRITE_P, 0x02)

A parameter value is entered at the appropriate point in the parameter list and transferred to the specified AS-Interface slave with this command.

This parameter is stored in the non-volatile memory of the AS-Interface master.

The command SET_PP must be used for setting a parameter.

After the AS-Interface slave has received the parameter value, it returns the data for the current parameter value as a "slave response". This value can be different from the parameter value transmitted.

Table 57: Mailbox request (WRITE_P, 0x02)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x02**							
2	T	-	-					
3	-		B	Slave address				
4	-				Parameter			

B	Area switchover	0:	Standard AS-Interface slave or AS-Interface slave with extended addressing mode in address range A
		1:	AS-Interface slave with extended addressing mode in address range B

Table 58: Mailbox response (WRITE_P, 0x02)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x02**							
2	T	Result						
3	-				Slave response			

11.5.1.5 Read parameter from image (READ_PI, 0x03)

This command returns the current parameter value from the parameter list for the appropriate slave. This value must not be confused with the slave response from the command WRITE_P, as the parameter is read from the list in the master.

Table 59: Mailbox request (READ_PI, 0x03)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x03**							
2	T	-	-					
3	-		B	Slave address				

B	Area switchover	0:	Standard AS-Interface slave or AS-Interface slave with extended addressing mode in address range A
		1:	AS-Interface slave with extended addressing mode in address range B

Table 60: Mailbox response (READ_PI, 0x03)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x03**							
2	T	Result						
3	-				PI			

11.5.1.6 Store actual parameter image (STORE_PI, 0x04)

This command overwrites the set parameter values with the current actual parameter values in the non-volatile memory. The current parameters of all AS-Interface slaves are set up in this way.

Table 61: Mailbox request (STORE_PI, 0x04)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x04**							
2	T	-	-					

Table 62: Mailbox response (STORE_PI, 0x04)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x04**							
2	T	Result						

11.5.1.7 Set permanent configuration (SET_PCD, 0x25)

The following configuration data are set up for the specified AS-Interface slave with this command:

- I/O configuration
- ID code
- Extended ID code 1
- Extended ID code 2

The configuration data are stored in the non-volatile memory of the AS-Interface master. Based on this configuration data (and the LPS, see SET_LPS), the AS-Interface master can determine whether there is a configuration error by comparing with the configuration data of the slaves actually connected to the AS-Interface.

The execution of this command is associated with a change into the offline phase and the subsequent restart of the AS-Interface master in order to return to normal mode. This command is only executed in set-up mode.

If the specified AS-Interface slave does not support extended ID codes, the value F_{hex} must be specified for xID1 and xID2.

Table 63: Mailbox request (SET_PCD, 0x25)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x25**							
2	T	-	-					
3	-		B	Slave address				
4	xID2				xID1			
5	ID				I0			

B	Area switchover	0:	Standard AS-Interface slave or AS-Interface slave with extended addressing mode in address range A
		1:	AS-Interface slave with extended addressing mode in address range B

Table 64: Mailbox response (SET_PCD, 0x25)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x25**							
2	T	Result						

11.5.1.8 Get permanent configuration (GET_PCD, 0x26)

This command returns the configuration data that has been set up for the specified AS-Interface slave:

- I/O configuration
- ID code
- Extended ID code 1
- Extended ID code 2

Table 65: Mailbox request (GET_PCD, 0x26)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x26**							
2	T	-	-					
3	-		B	Slave address				
…								

B	Area switchover		
		0:	Standard AS-Interface slave or AS-Interface slave with extended addressing mode in address range A
		1:	AS-Interface slave with extended addressing mode in address range B

Table 66: Mailbox response (GET_PCD, 0x26)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x26**							
2	T	Result						
3	xID2				xID1			
4	ID				I0			

11.5.1.9 Store actual configuration (STORE_CDI, 0x07)

The "ACTUAL" configuration data (I/O configuration, ID code, extended ID1 code and extended ID2 code) of all AS-Interface slaves detected on the AS-Interface are stored in the non-volatile memory as (REQUIRED) configuration data with this call. The list of activated slaves (*LAS*) is similarly incorporated into the list of set-up AS-Interface slaves *(LPS).*

When this command is executed, the AS-Interface switches the master into the offline phase and then returns to normal mode (restart AS-Interface master).

This command is only executed in set-up mode.

Table 67: Mailbox request (STORE_CDI, 0x07)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x07**							
2	T	-	-					

Table 68: Mailbox response (STORE_CDI, 0x07)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x07**							
2	T	Result						

11.5.1.10 Read actual configuration (READ_CDI, 0x28)

The following configuration data for an addressed AS-Interface slave determined by the AS-Interface master on the AS-Interface are read with this call:

- I/O configuration
- ID code
- Extended ID1 code
- Extended ID2 code

The configuration data are defined by the manufacturer of the AS-Interface slave.

Table 69: Mailbox request (READ_CDI, 0x28)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x28**							
2	T	-	-					
3	-		B	Slave address				

B	Area switchover	0:	Standard AS-Interface slave or AS-Interface slave with extended addressing mode in address range A
		1:	AS-Interface slave with extended addressing mode in address range B

Table 70: Mailbox response (READ_CDI, 0x28)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x28**							
2	T	Result						
3	xID2				xID1			
4	ID				I0			

11.5.1.11 Set list of projected slaves (SET_LPS_A/B, 0x6B)

The list of set-up AS-Interface slaves is transferred to the non-volatile memory of the master with this call.

When this command is executed, the AS-Interface switches the master into the offline phase and then returns to normal mode (restart AS-Interface master).

This command is only executed in set-up mode.

Using the A and B slave switching, this command can also be used for a 6-byte mailbox. If the A/B flag is not set, the data for t he A slaves are transmitted first and then the data for the B slaves. If the flag is set, the data for the B slaves are transmitted first and then the data for the A slaves.

Note

Call this command two times!
In order to transmit the data for all slaves with a 6-byte mailbox, the command must be called once with A/B = 0 and once with A/B = 1.

Table 71: Mailbox request (SET_LPS_A/B, 0x6B for A/B = 0)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x6B**							
2	T	0	0	-				
3	7A	6A	5A	4A	3A	2A	1A	-
...	...							
6	31A	30A	29A	28A	27A	26A	25A	24A
7	7B	6B	5B	4B	3B	2B	1B	-
...	...							
10	31B	30B	29B	28B	27B	26B	25B	24B

Table 72: Mailbox request (SET_LPS_A/B, 0x6B for A/B = 1)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x6B**							
2	T	0	1	-				
3	7B	6B	5B	4B	3B	2B	1B	-
...	...							
6	31B	30B	29B	28B	27B	26B	25B	24B
7	7A	6A	5A	4A	3A	2A	1A	-
...	...							
10	31A	30A	29A	28A	27A	26A	25A	24A

Table 73: Mailbox response (SET_LPS_A/B, 0x6B)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x6B**							
2	T	Result						

11.5.1.12 Get list of projected slaves (GET_LPS_A/B, 0x44)

The list of set-up AS-Interface slaves is read from the AS-Interface master module with this call.

Using the A and B slave switching, this command can also be used for a 6-byte mailbox. If the A/B flag is not set, the data for the A slaves are transmitted first and then the data for the B slaves. If the flag is set, the data for the B slaves are transmitted first and then the data for the A slaves.

Note

Call this command two times!
In order to transmit the data for all slaves with a 6-byte mailbox, the command must be called once with A/B = 0 and once with A/B = 1.

Table 74: Mailbox request (GET_LPS_A/B, 0x44)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x44**							
2	T	O	A/B	-				

Table 75: Mailbox response (GET_LPS_A/B, 0x44 for A/B = 0)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x44**							
2	T	Result						
3	7A	6A	5A	4A	3A	2A	1A	0A
...	...							
6	31A	30A	29A	28A	27A	26A	25A	24A
7	7B	6B	5B	4B	3B	2B	1B	0
...	...							
10	31B	30B	29B	28B	27B	26B	25B	24B

Table 76: Mailbox response (GET_LPS_A/B, 0x44 for A/B = 1)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x44**							
2	T	Result						
3	7B	6B	5B	4B	3B	2B	1B	0
...	...							
6	31B	30B	29B	28B	27B	26B	25B	24B
7	7A	6A	5A	4A	3A	2A	1A	0
...	...							
10	31A	30A	29A	28A	27A	26A	25A	24A

11.5.1.13 Get list of activated slaves (GET_LAS_A/B, 0x45)

The list of activated AS-Interface slaves LAS is read from the AS-Interface master module with this call.

Using the A and B slave switching, this command can also be used for a 6-byte mailbox. If the A/B flag is not set, the data for the A slaves are transmitted first and then the data for the B slaves. If the flag is set, the data for the B slaves are transmitted first and then the data for the A slaves.

Note

Call this command two times!
In order to transmit the data for all slaves with a 6-byte mailbox, the command must be called once with A/B = 0 and once with A/B = 1.

Table 77: Mailbox request (GET_LAS_A/B, 0x45)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x45**							
2	T	0	A/B	-				

Table 78: Mailbox response (GET_LAS_A/B, 0x45 for A/B = 0)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x45**							
2	T	Result						
3	7A	6A	5A	4A	3A	2A	1A	0
...	...							
6	31A	30A	29A	28A	27A	26A	25A	24A
7	7B	6B	5B	4B	3B	2B	1B	0
...	...							
10	31B	30B	29B	28B	27B	26B	25B	24B

Table 79: Mailbox response (GET_LAS_A/B, 0x45 for A/B = 1)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x45**							
2	T	Result						
3	7B	6B	5B	4B	3B	2B	1B	0
...	...							
6	31B	30B	29B	28B	27B	26B	25B	24B
7	7A	6A	5A	4A	3A	2A	1A	0
...	...							
10	31A	30A	29A	28A	27A	26A	25A	24A

11.5.1.14 Get list of detected slaves (GET_LDS_A/B, 0x46)

The list of detected AS-Interface slaves LDS is read from the AS-Interface master module with this call.

Using the A and B slave switching, this command can also be used for a 6-byte mailbox. If the A/B flag is not set, the data for the A slaves are transmitted first and then the data for the B slaves. If the flag is set, the data for the B slaves are transmitted first and then the data for the A slaves.

Note

Call this command two times!
In order to transmit the data for all slaves with a 6-byte mailbox, the command must be called once with A/B = 0 and once with A/B = 1.

Table 80: Mailbox request (GET_LDS_A/B, 0x46)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x46**							
2	T	0	A/B	-				

Table 81: Mailbox response (GET_LDS_A/B, 0x46 for A/B = 0)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x46**							
2	T	Result						
3	7A	6A	5A	4A	3A	2A	1A	0
...	...							
6	31A	30A	29A	28A	27A	26A	25A	24A
7	7B	6B	5B	4B	3B	2B	1B	0
...	...							
10	31B	30B	29B	28B	27B	26B	25B	24B

Table 82: Mailbox response (GET_LDS_A/B, 0x46 for A/B = 1)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x46**							
2	T	Result						
3	7B	6B	5B	4B	3B	2B	1B	0
...	...							
6	31B	30B	29B	28B	27B	26B	25B	24B
7	7A	6A	5A	4A	3A	2A	1A	0
...	...							
10	31A	30A	29A	28A	27A	26A	25A	24A

11.5.1.15 Get flags (GET_FLAGS, 0x47)

The flags according to the AS-Interface slave specification are read from the AS-Interface master module with this call.

Table 83: Mailbox request (GET_FLAGS, 0x47)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x47**							
2	T	-	-					

Table 84: Mailbox response (GET_FLAGS, 0x47)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x47**							
2	T	Response						
3	-							Pok
4	OR	APF	NA	CA	AAv	AAs	SO	Cok
5	-					AAe	OL	DX

Pok	Periphery OK:	The flag is set if no AS-Interface slave signals a peripheral fault.
S0	LDS.0:	The flag is set if an AS-Interface slave with operating address 0 is present.
AAs	Auto_Address_Assign:	The flag is set if automatic addressing is possible (i.e. AUTO_ADDR_ENABLE = 1 and no "incorrect" AS-Interface slave is connected to the AS-Interface).
AAv	Auto_Address_Available:	The flag is set if automatic addressing can be carried out (i.e. one and only one AS-Interface slave has currently failed).
CA	Configuration_Active:	The flag is set in set-up mode and reset in protected mode.
NA	Normal_Operation_Active:	The flag is set when the AS-Interface master is in normal mode.
APF	APF:	The flag is set if the voltage on the AS-Interface cable is too low.
OR	Offline_Ready:	The flag is set when the AS-Interface master is the offline phase.
Cok	Config_Ok:	The flag is set when the required configuration (the set configuration) and the actual configuration correspond.
AAe	Auto_Address_Enable:	The flag indicates whether automatic addressing has been inhibited (bit = 0) or enabled (bit = 1) by the user.
OL	Offline:	The flag is set when the offline operating state is to be assumed or has already been assumed.
DX	Data_Exchange_Active:	If the "DataExchangeActive" flag is set, data exchange with the AS-Interface slaves is enabled in the data exchange phase. If the bit is not set, data exchange with the slaves is inhibited. In this case, Read-ID telegrams are sent instead of data telegrams. The bit is set by the AS-Interface master on entering the offline phase.

11.5.1.16 Set operation mode (SET_OP_MODE, 0x0C)

This call can be used to select between set-up mode and protected mode.

The AS-Interface master should only be operated in set-up mode during commissioning (when setting up). By default, it is operated in protected mode.

In protected mode, only those AS-Interface slaves are activated, which have been marked in the LPS and the required and actual configurations of which correspond, i.e. when the I/O configuration and the ID code of the detected AS-Interface slave are identical with the set-up values.

All detected AS-Interface slaves (apart from AS-Interface slave "0") are activated in set-up mode. This also applies to AS-Interface slaves where there are differences in the required and actual configurations.

The "OPERATING MODE" bit is stored in non-volatile memory, i.e. it is retained even on start-up/restarting.

When changing from set-up mode to protected mode, the AS-Interface master restarts (transition to offline phase and subsequent switching to online mode).

Note

No changing to protected mode if address in the LDS is 0 !
If an AS-Interface slave with the operating address 0 is entered in the LDS, it is not possible for the AS-Interface master module to switch from set-up mode to protected mode.

Table 85: Mailbox request (SET_OP_MODE, 0x0C)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x0C**							
2	T	-	-					
3	OP							
OP	Operating mode		0:	Protected mode				
			1:	Set-up mode				

Table 86: Mailbox response (SET_OP_MODE, 0x0C)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x0C**							
2	T	Result						

11.5.1.17 Set offline mode (SET_OFFLINE, 0x0A)

This call switches between online and offline mode.

Online mode represents the normal mode of operation of the AS-Interface master. In this case, the following orders are processed cyclically:

- In the so-called data exchange phase, the output data fields for all AS-Interface slaves of the LAS are transferred to the slave outputs. If the transfer is free from errors, the addressed AS-Interface slaves pass the values of the slave inputs to the master.
- This is followed by the acquisition phase, in which a search is carried out for existing AS-Interface slaves and newly added AS-Interface slaves are incorporated into the LDS or LAS.
- Orders, which have been passed through by the user, such as the writing of parameters for example, are executed in the management phase.

In offline mode, the AS-Interface master module only processes orders from the user. (Orders, which instigate an immediate addressing of an AS-Interface slave, are rejected with an error). There is no cyclical exchange of data with the AS-Interface slave.

The AS-Interface circuit is in a safe state when offline.

The bit OFFLINE = TRUE is not permanently stored, i.e. the AS-Interface master module will be in online mode once more on start-up/following a restart.

Table 87: Mailbox request (SET_OFFLINE, 0x0A)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x0A**							
2	T	-	-					
3	OL							
OL	Off-Line	0:	The master is leaving the offline phase.					
		not equal to 0:	The master is changing to the offline phase.					

Table 88: Mailbox response (SET_OFFLINE, 0x0A)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x0A**							
2	T	Result						

11.5.1.18 Set data exchange active (SET_DATA_EX, 0x48)

The exchange of data between AS-Interface master and AS-Interface slaves is enabled with this call.

Table 89: Mailbox request (SET_DATA_EX, 0x48)

<table>
<tr><th>Byte</th><th>Bit 7</th><th>Bit 6</th><th>Bit 5</th><th>Bit 4</th><th>Bit 3</th><th>Bit 2</th><th>Bit 1</th><th>Bit 0</th></tr>
<tr><td>1</td><td colspan="8">0x48</td></tr>
<tr><td>2</td><td>T</td><td>-</td><td colspan="6">-</td></tr>
<tr><td>3</td><td colspan="8">DEA</td></tr>
<tr><td rowspan="2">DEA</td><td rowspan="2" colspan="3">Data_Exchange_Active</td><td>0:</td><td colspan="4">Data exchange not enabled</td></tr>
<tr><td>1:</td><td colspan="4">Data exchange enabled</td></tr>
</table>

Table 90: Mailbox response (SET_DATA_EX, 0x48)

<table>
<tr><th>Byte</th><th>Bit 7</th><th>Bit 6</th><th>Bit 5</th><th>Bit 4</th><th>Bit 3</th><th>Bit 2</th><th>Bit 1</th><th>Bit 0</th></tr>
<tr><td>1</td><td colspan="8">0x48</td></tr>
<tr><td>2</td><td>T</td><td colspan="7">Result</td></tr>
</table>

11.5.1.19 Change slave address (SLAVE_ADDR, 0x0D)

The address of an AS-Interface slave can be changed with this call.

This call is mainly used to add a new AS-Interface slave with the default address "0" to the AS-Interface. In this case, a change of address is carried out from "Old AS-Interface slave address" = 0 to "New AS-Interface slave address".

The change only takes place when the following conditions are fulfilled:

1. An AS-Interface slave with "Old AS-Interface slave address" is present.
2. If the old AS-Interface slave address is not equal to 0, then an AS-Interface slave with the address "0" must not be connected at the same time.
3. The "New AS-Interface slave address" must be valid.
4. An AS-Interface slave with "New AS-Interface slave address" must not be present.

Note

AS-Interface slave is not reset if address changes!
When changing the AS-Interface slave address, the AS-Interface slave is not reset, i.e. the output data for the AS-Interface slave are retained until new data arrive on the new address.

Table 91: Mailbox request (SLAVE_ADDR, 0x0D)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x0D**							
2	T	-	-					
3	-		B	Source address				
4	-		B	Target address				

B:	Area switchover	0:	Standard AS-Interface slave or AS-Interface slave with extended addressing mode in address range A
		1:	AS-Interface slave with extended addressing mode in address range B

Table 92: Mailbox response (SLAVE_ADDR, 0x0D)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x0D**							
2	T	Result						

11.5.1.20 Set auto address enable (SET_AAE, 0x0B)

The "Automatic addressing" function can be enabled or inhibited with this call.

The AUTO_ADDR_ENABLE bit is stored in non-volatile memory, i.e. it is retained even on start-up/restarting of the AS-Interface master.

Table 93: Mailbox request (SET_AAE, 0x0B)

<table>
<tr><th>Byte</th><th>Bit 7</th><th>Bit 6</th><th>Bit 5</th><th>Bit 4</th><th>Bit 3</th><th>Bit 2</th><th>Bit 1</th><th>Bit 0</th></tr>
<tr><td>1</td><td colspan="8">0x0B</td></tr>
<tr><td>2</td><td>T</td><td>-</td><td colspan="6">-</td></tr>
<tr><td>3</td><td colspan="8">AAE</td></tr>
<tr><td rowspan="2">AAE</td><td rowspan="2" colspan="3">Auto_Address_Enable</td><td>0:</td><td colspan="4">Automatic addressing not enabled</td></tr>
<tr><td>1:</td><td colspan="4">Automatic addressing enabled</td></tr>
</table>

Table 94: Mailbox response (SET_AAE, 0x0B)

<table>
<tr><th>Byte</th><th>Bit 7</th><th>Bit 6</th><th>Bit 5</th><th>Bit 4</th><th>Bit 3</th><th>Bit 2</th><th>Bit 1</th><th>Bit 0</th></tr>
<tr><td>1</td><td colspan="8">0x0B</td></tr>
<tr><td>2</td><td>T</td><td colspan="7">Result</td></tr>
</table>

11.5.1.21 Execute command (EXEC_CMD, 0x49)

Table 95: Mailbox request (EXEC_CMD, 0x49)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x49**							
2	T	-						
3	Slave address							
4	Command							

Table 96: Mailbox response (EXEC_CMD, 0x49)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x49**							
2	T	Result						
3	Response data							

11.5.1.22 Get list of peripheral failure (GET_LPF_A/B, 0x3E)

The list of peripheral failure *(LPF)* signaled by the AS-Interface slaves is read from the AS-Interface master with this call. The LPF is cyclically updated by the AS-Interface master. It can be seen from the description of the AS-Interface slave if and when an AS-Interface slave signals a failure from the connected peripheral (e.g. wire break).

Using the A and B slave switching, this command can also be used for a 6-byte mailbox. If the A/B flag is not set, the data for the A slaves are transmitted first and then the data for the B slaves. If the flag is set, the data for the B slaves are transmitted first and then the data for the A slaves.

Note

Call this command two times!
In order to transmit the data for all slaves with a 6-byte mailbox, the command must be called once with A/B = 0 and once with A/B = 1.

Table 97: Mailbox request (GET_LPF_A/B, 0x3E)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x3E**							
2	T	0	A/B	-				

Table 98: Mailbox response (GET_LPF_A/B, 0x3E for A/B = 0)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x3E**							
2	T	Result						
3	7A	6A	5A	4A	3A	2A	1A	0
...	...							
6	31A	30A	29A	28A	27A	26A	25A	24A
7	7B	6B	5B	4B	3B	2B	1B	0
...	...							
10	31B	30B	29B	28B	27B	26B	25B	24B

Table 99: Mailbox response (GET_LPF_A/B, 0x3E for A/B = 1)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x3E**							
2	T	Result						
3	7B	6B	5B	4B	3B	2B	1B	0
...	...							
6	31B	30B	29B	28B	27B	26B	25B	24B
7	7A	6A	5A	4A	3A	2A	1A	0
...	...							
10	31A	30A	29A	28A	27A	26A	25A	24A

11.5.1.23 Write extended ID-code 1 (WRITE_XID1, 0x3F)

The extended ID1 code of an AS-Interface slave with the address "0" can be written directly via the AS-Interface cable with this call. The call is intended for diagnostic purposes and is not required in normal operation of the master.

The AS-Interface master passes on the extended ID1 code to the AS-Interface slave without plausibility checking.

Table 100: Mailbox request (WRITE_XID1, 0x3F)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x3F**							
2	T	-	-					
3	-				xID1			

Table 101: Mailbox response (WRITE_XID1, 0x3F)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x3F**							
2	T	Result						

11.5.1.24 Read slave data (RD_SLV_DATA, 0x5E)

The input and output data as well as the parameter and configuration data of a slave are read out with this function.

Table 102: Mailbox request (RD_SLV_DATA, 0x5E)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x5E**							
2	T	-	-					
3	-		B	Slave address				

B	Area switchover	0:	Standard AS-Interface slave or AS-Interface slave with extended addressing mode in address range A
		1:	AS-Interface slave with extended addressing mode in address range B

Table 103: Mailbox response (RD_SLV_DATA, 0x5E)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x5E**							
2	T	Result						
3	ODI				IDI			
4	PP				PI			
5	CDI.ID2				CDI.ID1			
6	CDI.ID				CDI.I0			

ODI	Output data
IDI	Input data
PP	Permanent parameters
PI	Current parameters
CDI.*	Current configuration

11.5.1.25 Write slave data (WR_SLV_DATA, 0x5F)

The output data of a slave are written with this function.

Table 104: Mailbox request (WR_SLV_DATA, 0x5F)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x5F**							
2	T	-	-					
3	-		B	Slave address				
4	-				ODI			

B	Area switchover	0:	Standard AS-Interface slave or AS-Interface slave with extended addressing mode in address range A
		1:	AS-Interface slave with extended addressing mode in address range B
ODI	Output data		

Table 105: Mailbox response (WR_SLV_DATA, 0x5F)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x5F**							
2	T	Result						

11.5.1.26 Read 1 7.3-slave in data (RD_7X_IN_A/B, 0x50)

The four 16-bit channels of an AS-Interface input slave, which is set up according to slave profile 7.3, can be read in with this command.

Using the channel switching, this command can also be used for a 6-byte mailbox. If the A/B flag is not set, the data are transmitted in the order Channel 1, Channel 2, Channel 3, Channel 4; if the flag is set, the order is Channel 3, Channel 4, Channel 1, Channel 2.

Note

Call this command two times!
In order to transmit the data for all channels with a 6-byte mailbox, the command must be called once with A/B = 0 and once with A/B = 1.

Table 106: Mailbox request (RD_7X_IN_A/B, 0x50)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x50**							
2	T	-	A/B	-				
3	-		0	Slave address				

Table 107: Mailbox response (RD_7X_IN_A/B, 0x50 for A/B = 0)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x50**							
2	T	Result						
3	Channel 1, high byte							
...	...							
6	Channel 2, low byte							
7	Channel 3, high byte							
...	...							
10	Channel 4, low byte							

Table 108: Mailbox response (RD_7X_IN_A/B, 0x50 for A/B = 1)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x50**							
2	T	Result						
3	Channel 3, high byte							
...	...							
6	Channel 4, low byte							
7	Channel 1, high byte							
...	...							
10	Channel 2, low byte							

11.5.1.27 Write 1 7.3-slave out data (WR_7X_OUT, 0x51)

The four 16-bit channels of an AS-Interface output slave, which is set up according to slave profile 7.3, can be written with this command.

Table 109: Mailbox request (WR_7X_OUT, 0x51)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x51**							
2	T	-						
3	-		0	Slave address				
4	Channel 1, high byte							
...	…							
11	Channel 4, low byte							

Table 110: Mailbox response (WR_7X_OUT, 0x51)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x51**							
2	T	Result						

11.5.1.28 Write a 16-bit channel (WR_16BIT_OUT_S, 0x6F)

One 16-bit channel of an AS-Interface output slave, which is set up according to slave profile 7.3, can be written with this command.

This command can also be used with a 6-byte mailbox.

Table 111: Mailbox request (WR_16BIT_OUT_S, 0x6F)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x6F**							
2	T	-	-					
3	-		0	Slave address				
4	-						Channel No. n	
5	Channel No. n, high byte							
6	Channel No. n, low byte							

Table 112: Mailbox response (WR_16BIT_OUT_S, 0x6F)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x6F**							
2	T	Result						

11.5.1.29 Read 1 7.3-slave out.data (RD_7X_OUT_A/B, 0x52)

The four 16-bit channels of an AS-Interface output slave, which is set up according to slave profile 7.3, can be read from the AS-Interface master with this command.

Using the channel switching, this command can also be used for a 6-byte mailbox. If the A/B flag is not set, the data are transmitted in the order Channel 1, Channel 2, Channel 3, Channel 4; if the flag is set, the order is Channel 3, Channel 4, Channel 1, Channel 2.

Note

Call this command two times!
In order to transmit the data for all channels with a 6-byte mailbox, the command must be called once with A/B = 0 and once with A/B = 1.

Table 113: Mailbox request (RD_7X_OUT_A/B, 0x52)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x52**							
2	T	-	A/B	-				
3	-		0	Slave address				

Table 114: Mailbox response (RD_7X_OUT_A/B, 0x52 for A/B = 0)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x52**							
2	T	Result						
3	Channel 1, high byte							
...	...							
6	Channel 2, low byte							
7	Channel 3, high byte							
...	...							
10	Channel 4, low byte							

Table 115: Mailbox response (RD_7X_OUT_A/B, 0x52 for A/B = 1)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x52**							
2	T	Result						
3	Channel 3, high byte							
...	...							
6	Channel 4, low byte							
7	Channel 1, high byte							
...	...							
10	Channel 2, low byte							

11.5.1.30 Get list of configuration errors (GET_DELTA_A/B, 0x57)

The delta list includes the list of slave addresses with configuration errors.

Using the A and B slave switching, this command can also be used for a 6-byte mailbox. If the A/B flag is not set, the data for the A slaves are transmitted first and then the data for the B slaves. If the flag is set, the data for the B slaves are transmitted first and then the data for the A slaves.

Note

Call this command two times!
In order to transmit the data for all slaves with a 6-byte mailbox, the command must be called once with A/B = 0 and once with A/B = 1.

Table 116: Mailbox request (GET_DELTA_A/B, 0x57)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x57**							
2	T	O	A/B	-				

Table 117: Mailbox response (GET_DELTA_A/B, 0x57 for A/B = 0)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x57**							
2	T	Result						
3	7A	6A	5A	4A	3A	2A	1A	0
...	...							
6	31A	30A	29A	28A	27A	26A	25A	24A
7	7B	6B	5B	4B	3B	2B	1B	0
...	...							
10	31B	30B	29B	28B	27B	26B	25B	24B

Table 118: Mailbox response (GET_DELTA_A/B, 0x57 for A/B = 1)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x57**							
2	T	Result						
3	7B	6B	5B	4B	3B	2B	1B	0
...	...							
6	31B	30B	29B	28B	27B	26B	25B	24B
7	7A	6A	5A	4A	3A	2A	1A	0
...	...							
10	31A	30A	29A	28A	27A	26A	25A	24A

11.5.1.31 Write S-7.4-slave parameter (WR_74_PARAM, 0x5A)

The parameter string of a slave according to profile S-7.4 is written with this function. As the string can be longer than the mailbox, it is first written in sections to a buffer and only then transmitted to the slave.

n is the length of the partial string, which is to be written to the buffer from index i.

When i = 0, the string is transmitted to the slave.

Table 119: Mailbox request (WR_74_PARAM, 0x5A)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x5A**							
2	T	-	-					
3	Slave address							
4	i							
5	n							
6	Buffer byte i							
...	...							
n+5	Buffer byte i+n-1							

Table 120: Mailbox response (WR_74_PARAM, 0x5A)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x5A**							
2	T	Result						

11.5.1.32 Read S-7.4-slave parameter (RD_74_PARAM, 0x5B)

The parameter string of a slave according to profile S-7.4 is read with this function. As the string can be longer than the mailbox, it is first stored in a buffer, the contents of which can be read in sections from index i.

The first byte in the buffer defines the length of the string that has been read.

When i = 0, the string is read from the slave, otherwise the function responds from the store, as a result of which the data can be read consistently.

Table 121: Mailbox request (RD_74_PARAM, 0x5B)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x5B**							
2	T	-	-					
3	Slave address							
4	i							

Table 122: Mailbox response (RD_74_PARAM, 0x5B)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x5B**							
2	T	Result						
3	Buffer byte i							
...	...							
n+2	Buffer byte i+n-1							

11.5.1.33 Read S-7.4-slave ID string (RD_74_ID, 0x5C)

The ID string of a slave according to profile S-7.4 is read with this function. As the string can be longer than the mailbox, it is stored in a buffer, the contents of which can be read in sections from index i.

The first byte in the buffer defines the length of the string that has been read.

When i = 0, the string is read from the slave, otherwise the function responds from the store, as a result of which the data can be read consistently.

Table 123: Mailbox request (RD_74_ID, 0x5C)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x5C**							
2	T	-	-					
3	Slave address							
4	i							

Table 124: Mailbox response (RD_74_ID, 0x5C)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x5C**							
2	T	Result						
	Buffer byte i							
...	...							
n+2	Buffer byte i+n-1							

11.5.1.34 Read S-7.4-slave diagnosis string (RD_74_DIAG, 0x5D)

The diagnosis string of a slave according to profile S-7.4 is read with this function. As the string can be longer than the mailbox, it is stored in a buffer, the contents of which can be read in sections from index i.

The first byte in the buffer defines the length of the string that has been read.

When i = 0, the string is read from the slave, otherwise the function responds from the store, as a result of which the data can be read consistently.

Table 125: Mailbox request (RD_74_DIAG, 0x5D)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x5D**							
2	T	-	-					
3	Slave address							
4	i							

Table 126: Mailbox response (RD_74_DIAG, 0x5D)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x5D**							
2	T	Result						
	Buffer byte i							
...								
n+2	Buffer byte i+n-1							

11.5.1.35 Get list of corrupted slaves (GET_LCS_A/B, 0x6C)

This call is used to read out the list of AS-Interface slaves, which have caused at least one configuration error since the last time the master was switched on or since the last time this list was read out (LCS). The APF flag is shown in place of slave 0, which indicates a short-term voltage dip on the AS-Interface.

Using the A and B slave switching, this command can also be used for a 6-byte mailbox. If the A/B flag is not set, first the data for the A slaves and then the data for the B slaves are written to a buffer and reset in the master. The data for the A slaves are then transmitted first from the buffer followed by the data for the B slaves. If the flag is set, first the data for the B slaves and then the data for the A slaves are transmitted from the buffer.

⚠ WARNING

With mailboxes larger than 6 bytes, the command may only be called with A/B = 0, as with A/B = 1 only the data from the buffer are transmitted.

Note

Call this command two times!
In order to transmit the data for all slaves with a 6-byte mailbox, the command must be called once with A/B = 0 and once with A/B = 1.

Table 127: Mailbox request (GET_LCS_A/B, 0x6C)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x6C**							
2	T	0	A/B	-				

Table 128: Mailbox response (GET_LCS_A/B, 0x6C at A/B = 0)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x6C**							
2	T	Result						
3	7A	6A	5A	4A	3A	2A	1A	APF
...	...							
6	31A	30A	29A	28A	27A	26A	25A	24A
7	7B	6B	5B	4B	3B	2B	1B	0
...	...							
10	31B	30B	29B	28B	27B	26B	25B	24B

Table 129: Mailbox response (GET_LCS_A/B, 0x6C at A/B = 1)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x6C**							
2	T	Result						
3	7B	6B	5B	4B	3B	2B	1B	0
...	...							
7	31B	30B	29B	28B	27B	26B	25B	24B
3	7A	6A	5A	4A	3A	2A	1A	0
...	...							
10	31A	30A	29A	28A	27A	26A	25A	24A

11.5.1.36 Get list of offline slaves (GET_LOS_A/B, 0x61)

This command is used to read out a list of slave addresses, which can cause the offline phase to be initiated when configuration errors occur (List of Offline Slaves *LOS*).

Here, the user himself can decide how the AS-Interface master is to respond to a configuration error on the AS-Interface. Hence, with critical slaves, the master can be switched directly into the offline phase while, with less critical slaves, the error message "configuration error" is sent to the host, but the AS-Interface is not switched offline.

Using the A and B slave switching, this command can also be used for a 6-byte mailbox. If the A/B flag is not set, the data for the A slaves are transmitted first and then the data for the B slaves. If the flag is set, the data for the B slaves are transmitted first and then the data for the A slaves.

Note

Call this command two times!
In order to transmit the data for all slaves with a 6-byte mailbox, the command must be called once with A/B = 0 and once with A/B = 1.

Table 130: Mailbox request (GET_LOS_A/B, 0x61)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x61**							
2	T	O	A/B	-				

Table 131: Mailbox response (GET_LOS_A/B, 0x61 for A/B = 0)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x61**							
2	T	Result						
3	7A	6A	5A	4A	3A	2A	1A	0
...	...							
6	31A	30A	29A	28A	27A	26A	25A	24A
7	7B	6B	5B	4B	3B	2B	1B	0
...	...							
10	31B	30B	29B	28B	27B	26B	25B	24B

Table 132: Mailbox request (GET_LOS_A/B, 0x61 for A/B = 1)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x61**							
2	T	Result						
3	7B	6B	5B	4B	3B	2B	1B	0
...	...							
6	31B	30B	29B	28B	27B	26B	25B	24B
7	7A	6A	5A	4A	3A	2A	1A	0
...	...							
10	31A	30A	29A	28A	27A	26A	25A	24A

11.5.1.37 Set list of offline slaves (SET_LOS_A/B, 0x6D)

A list of slave addresses is defined, which cause the offline phase to be initiated when configuration errors occur (List of Offline Slaves *LOS*).

Here, the user himself can decide how the AS-Interface master is to respond to a configuration error on the AS-Interface. Hence, with critical slaves, the master can be switched directly into the offline phase while, with less critical slaves, the error message "configuration error" is sent to the host, but the AS-Interface is not switched offline.

Using the A and B slave switching, this command can also be used for a 6-byte mailbox. If the A/B flag is not set, the data for the A slaves are transmitted first and then the data for the B slaves. If the flag is set, the data for the B slaves are transmitted first and then the data for the A slaves.

Note

Call this command two times!
In order to transmit the data for all slaves with a 6-byte mailbox, the command must be called once with A/B = 0 and once with A/B = 1.

Table 133: Mailbox request (SET_LOS_A/B, 0x6D for A/B = 0)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x6D**							
2	T	0	0	-				
3	7A	6A	5A	4A	3A	2A	1A	-
...	...							
6	31A	30A	29A	28A	27A	26A	25A	24A
7	7B	6B	5B	4B	3B	2B	1B	-
...	...							
10	31B	30B	29B	28B	27B	26B	25B	24B

Table 134: Mailbox request (SET_LOS_A/B, 0x6D for A/B = 1)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x6D**							
2	T	0	1	-				
3	7B	6B	5B	4B	3B	2B	1B	-
...	...							
6	31B	30B	29B	28B	27B	26B	25B	24B
7	7A	6A	5A	4A	3A	2A	1A	-
...	...							
10	31A	30A	29A	28A	27A	26A	25A	24A

Table 135: Mailbox response (SET_LOS_A/B, 0x6D)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x6D**							
2	T	Result						

11.5.1.38 Get transm.err.counters (GET_TEC_X, 0x66)

This command is used to read out the status of the n error counters starting from a particular slave address. Cf. chapter “Protocol analysis: Counter for transmission errors for data telegrams” in “Diagnostics”.

The error counters are restarted each time the status of the counters is read out.

The status of the counters is read out via the appropriate host interface and reset with each read access. The highest valid instantaneous status of the counter is 254. A count of 255 indicates a counter overflow.

Table 136: Mailbox request (GET_TEC_X, 0x66)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x66**							
2	T	-	-					
3	1. Slave address							
4	Number of counters							

Table 137: Mailbox response (GET_TEC_X, 0x66)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x66**							
2	T	Result						
3	Counter 1							
...	...							
n	Counter n - 2							

11.5.1.39 Disable pushbuttons (BUTTONS, 0x75)

The control of the unit via contacts M1 and M2 can be inhibited with this call.

Table 138: Mailbox request (BUTTONS, 0x75)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x75**							
2	T	-	-					
3	BD							

BD	Buttons disabled	0:	Control of the unit via contacts M1 and M2 enabled
		1:	Control of the unit via contacts M1 and M2 disabled

Table 139: Mailbox response (BUTTONS, 0x75)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x75**							
2	T	Result						

11.5.1.40 “Functional profiles” parameters (FP_PARAM, 0x7D)

This command is used for setting the parameters of "functional profiles".

The content of the request and response bytes depends on the function (see Chapter 11.5.2 "Functional Profiles").

Table 140: Mailbox request (FP_PARAM, 0x7D)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x7D**							
2	T	-	-					
3	Function							
4	Request byte 1							
...	...							
n	Request byte n-3							

Table 141: Mailbox response (FP_PARAM, 0x7D)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x7D**							
2	T	Result						
3	Response byte 1							
...	...							
n	Response byte n-2							

11.5.1.41 “Functional profiles” data (FP_DATA, 0x7E)

This command is used for exchanging data with "functional profiles".

The content of the request and response bytes depends on the function (see Chapter 11.5.2 "Functional Profiles").

Table 142: Mailbox request (FP_DATA, 0x7E)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x7E**							
2	T	-	-					
3	Function							
4	Request byte 1							
...	...							
n	Request byte n-3							

Table 143: Mailbox response (FP_DATA, 0x7E)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x7E**							
2	T	Result						
3	Response byte 1							
...	...							
n	Response byte n-2							

11.5.1.42 Write acyclic transfer (WRITE_ACYC_TRANS, 0x4E)

This function starts various types of acyclic transfer (S-7.4, S-7.5 and Safety Monitor). The transfer occurs in the background. The results must be read out with READ_ACYC_TRANS. The function is intended as a substitute for the functions (RD_74_75_PARAM, WR_74_75_PARAM, RD_74_75_ID, RD_74_DIAG and "Safety at Work" monitor diagnostics) because it works in the background and does not stop the AS interface master during the transfer.

As the data to be transferred can be longer than the command interface, it is first written to a buffer in sections before the transfer is begun.

"n" is the length of the substring to be written to the buffer from Index (i). If i = 0, the transfer is started.

An overview of the commands and supported monitor types is available in the chapter "Acyclic commands".

Table 144: Mailbox request (WRITE_ACYC_TRANS, 0x4E with A/B = 0)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x4E**							
2	T	0	0	-				
3	Slave address							
4	Buffer index (i) high							
5	Buffer index (i) low							
6	Command1							
7	Number (n)							
8	Data 0							
9	Data 1							
10	Data 2							
11	Data 3							
…	…							
n + 7	Data n-1							

Table 145: Mailbox request (WRITE_ACYC_TRANS, 0x4E with A/B = 1)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x4E**							
2	T	0	1	-				
3	Number (n)							
4	Data 0							
5	Data 1							
6	Data 2							
7	Slave address							
8	Buffer index (i) high							
9	Buffer index (i) low							
10	Command1							
11	Data 3							
…	…							
n + 7	Data n-1							

Table 146: Mailbox response (WRITE_ACYC_TRANS, 0x4E)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x4E**							
2	T	Result						

11.5.1.43 Read acyclic transfer (READ_ACYC_TRANS, 0x4F)

This function is used to read the response of a transfer command started with WRITE_ACYC_TRANS.

Table 147: Mailbox request (READ_ACYC_TRANS, 0x4F)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x4F**							
2	T	-	-					
3	Slave address							
4	Buffer index (i) high							
5	Buffer index (i) low							

Table 148: Mailbox response (READ_ACYC_TRANS, 0x4F)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x4F**							
2	T	Result						
3	Data i							
...	…							
m	Data i+(m-2)							

The response data has the same format as the commands RD_74_75_PARAM, RD_74_75_ID and "Safety at Work" monitor diagnostics.

The structure of the response buffer is available in the chapter "Acyclic commands".

11.5.2 Functional Profiles

11.5.2.1 Overview

Table 149: Overview functional profiles

Function	Designation	Req Len	Res Len	Executable with mailbox				Page
				6	10	12	18	
0x00	„Safety at Work" - list 1	3	8	-	●	●	●	137
0x02	„Safety at Work" - monitor diagnostics	3	≥3	●	●	●	●	139
0x03	Integrated AS-Interface sensors: Warnings	3	10	-	●	●	●	141
0x04	Integrated AS-Interface sensors: Availability	3	6	●	●	●	●	142
0x0D	„Safety at Work" - list 6	3	6	●	●	●	●	143
0x0F	Substituting the input data for safety slaves	4/3	2/3	●	●	●	●	144
0x10	List of safety slaves	3	6	●	●	●	●	145
●	Function is executable							
–	Function is not executable							

11.5.2.2 "Safety at Work" list 1

Function: 0x00

With a 16-byte mailbox this function is not executable. Use function 0x0D.

The “Safety at Work” list 1 is a list of the safety-related input slaves ("AS-Interface Safety at Work"), in which the safety function has tripped.

Safety-related input slaves have the profile S-7.B or S-0.B. (IO = 0 or 7, ID = B, see Chapter 11.5.1 "Mailbox commands": "Read actual configuration data").

The "Safety at Work" list 1 is a bit list, which contains one bit for each possible slave address (1 - 31). This list appears in bytes 5 to 8 of the response to the mailbox command. In addition, in bytes 3 and 4, the response contains the EC flags of the master (see Chapter 11.5.1 "Mailbox commands": "Read flags").

The bits of the "Safety at Work" list 1 are set when the slave safety function has tripped (e.g. Emergency Stop button pressed). In the case of safety slaves with two contacts, the corresponding bit is only set when both contacts have tripped.

Otherwise the bits have the value 0. The bits have the value 0 even in the case of "normal" (not safety-related) slaves.

As the safety monitor also trips when a safety slave is missing or if the AS-Interface circuit has been switched off (offline active), the EC flags are transferred at the same time. It is, however, sufficient to monitor the collective fault message Cok (configuration error). The list of "safety-related input slaves" can be used as long as there is no configuration error.

Safety-related slaves, which have been set up but are not present, and slaves, which are present but transmit an incorrect code sequence, are not entered in this list.

Table 150: Mailbox request (Function: 0x00)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x7E**							
2	T	0	-					
3	0x00							

Table 151: Mailbox response (Function: 0x00)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x7E**							
2	T	Result						
3	-							Pok
4	OR	APF	NA	CA	AAv	AAS	SO	Cok
5	7	6	5	4	3	2	1	-
...	...							
8	31	30	29	28	27	26	25	24

Cok	Config_Ok
S0	LDS.0 (Slave with address 0 detected)
AAs	Auto_Address_Assign
AAv	Auto_Address_Available
CA	Configuration_Active
NA	Normal_Operation_Active
APF	AS-Interface_Power_Fault
OR	Offline_Ready
Pok	Periphery_Ok

Example:

Response: 7E 00 01 25 10 04 00 00

Peripherals OK (no peripheral errors) (Pok),
Configuration OK (Cok),
Auto Address Assign (AAs)
Normal Operation Active (NA)
2 safety slaves with activated safety function,
AS-Interface addresses 4 and 10

11.5.2.3 "Safety at Work" monitor diagnostics

Function: 0x02

As the "Safety at Work" monitor can produce more than 32 bytes of diagnostics data, this must be read with several mailbox calls. In doing so, the second request byte specifies the start index in the diagnostics data field.

When the start index = 0, new data are fetched from the monitor, otherwise the function responds from the store, as a result of which the data can be read consistently.

Table 152: Mailbox request (Function: 0x02)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x7E**							
2	T	-	-					
3	0x02							
4	Slave address							
5	Index							

Table 153: Mailbox response (Function: 0x02)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x7E**							
2	T	Result						
3	Diagnostics byte #Index+0							
4	Diagnostics byte #Index+1							
...	...							
n	Diagnostics byte #Index+n-3							

The diagnostics data field of the safety monitor is made up as follows:

Table 154: Mailbox request (Function: 0x02)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0x00							
1	Monitor status							
2	Status, circuit 1							
3	Status, circuit 2							
4	Number, circuit 1							
5	Number, circuit 2							
6	Index of device 32, Circuit 1							
7	Color of device, Circuit 1							
8	Index of device 33, Circuit 1							
9	Color of device, Circuit 1							
...	...							
68	Index of device 63, Circuit 1							
69	Color of device, Circuit 1							
70	Index of device 32, Circuit 2							
71	Color of device, Circuit 2							
...	...							
132	Index of device 63, Circuit 2							
133	Color of device, Circuit 2							

11.5.2.4 Integrated AS-Interface sensors: Warnings

Function: 0x03

This list includes the integrated AS-Interface sensors according to profile S-1.1 (without extended addressing) or S-3.A.1 (with extended addressing), in which the input data bit D1 ("Warning") is reset.

Only CDI and IDI are evaluated to create the list. Integrated AS-Interface sensors, which have been set up, but are not present, are therefore not entered here.

Table 155: Mailbox request (Function: 0x03)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x7E**							
2	T	0	-					
3	0x03							

Table 156: Mailbox response (Function: 0x03)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x7E**							
2	T	Result						
3	7A	6A	5A	4A	3A	2A	1A	0
...	...							
10	31B	30B	29B	28B	27B	26B	25B	24B

11.5.2.5 Integrated AS-Interface sensors: Availability

Function: 0x04

This function creates a list of the integrated AS-Interface sensors according to profile S-1.1, in which the input data bit D2 ("Availability") is reset.

Only CDI and IDI are evaluated to create the list. Integrated AS-Interface sensors, which have been set up, but are not present, are therefore not entered here.

Table 157: Mailbox request (Function: 0x04)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x7E**							
2	T	0	-					
3	0x04							

Table 158: Mailbox response (Function: 0x04)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x7E**							
2	T	Result						
3	7	6	5	4	3	2	1	0
...	...							
6	31	30	29	28	27	26	25	24

11.5.2.6 "Safety at Work" list 6

Function: 0x0D

This function is adapted to the 6-byte mailbox and creates a list of the safety-related input slaves ("AS-Interface Safety at Work"), in which the safety function has tripped.

Safety-related input slaves have the profile S-7.B or S-0.B. (IO = 0 or 7, ID = B, see Chapter 11.5.1 "Mailbox commands": "Read actual configuration data").

The "Safety at Work" list 6 is a bit list, which contains one bit for each possible slave address (1 - 31). This list appears in bytes 3 to 6 of the response to the mailbox command.

The bits of the "Safety at Work" list 6 are set when the slave safety function has tripped (e.g. Emergency Stop button pressed). In the case of safety slaves with two contacts, the corresponding bit is only set when both contacts have tripped. Otherwise the bits have the value 0. The bits have the value 0 even in the case of "normal" (not safety-related) slaves.

The safety monitor also trips when a safety slave is missing or if the AS-Interface circuit has been switched off (offline active). It is, however, sufficient to monitor the collective fault message Cok (configuration error). The list of "safety-related input slaves" can be used as long as there is no configuration error.

Safety-related slaves, which have been set up but are not present, and slaves, which are present but transmit an incorrect code sequence, are not entered in this list.

Table 159: Mailbox request (Function: 0x0D)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x7E**							
2	T	0	-					
3	0x0D							

Table 160: Mailbox response (Function: 0x0D)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x7E**							
2	T	Result						
3	7	6	5	4	3	2	1	0
...	...							
6	31	30	29	28	27	26	25	24

Example: Response: 7E 00 10 04 00 00

2 safety slaves with activated safety function, AS-Interface addresses 4 and 10.

11.5.2.7 Substituting input data for safety slaves

Function: 0x0F

This function can be used to replace input data for safety slaves with interpretation values. If this function is enabled, the input data of the safety slaves has the following meaning:

Bit 0, 1: 00=Channel 1 has triggered, 11=Channel 1 has not triggered.
Bit 2, 3: 00=Channel 2 has triggered, 11=Channel 2 has not triggered.

Set:

Table 161: Mailbox request (Function: 0x0F, set)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x7D**							
2	T	-	-					
3	0x0F							
4	Safety slaves (0=no substitute values, 1=substitute values for safety slaves)							

Table 162: Mailbox response (Function: 0x0F, set)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x7D**							
2	T	Result						

Read:

Table 163: Mailbox request (Function: 0x0F, read)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x7E**							
2	T	-	-					
3	0x0F							

Table 164: Mailbox response (Function: 0x0F, Read)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x7E**							
2	T	Result						
3	Safety slaves (0=no substitute values, 1=substitute values for safety slaves)							

11.5.2.8 List of safety slaves

Function: 0x10

This function is used to read on which addresses the safety slaves are.

Table 165: Mailbox request (Function: 0x10)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x7D**							
2	T	0	-					
3	0x10							

Table 166: Mailbox response (Function: 0x10)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0x7D**							
2	T	Result						
3	7	6	5	4	3	2	1	0
...	...							
6	31	30	29	28	27	26	25	24

11.5.3 Acyclic Commands

11.5.3.1 Overview

The following acyclic commands can be executed:

Table 167: Overview of acyclic commands

Command	Description							Page
1	Read "S-7.4 ID String"							148
2	Read "S-7.4 Diag String"							148
3	Read "S-7.4 Param String"							149
4	Write "S-7.4 Param String"							149
5	"S-7.5 Transfer"							150
6	Read "Cyclical S-7.5 16-bit configuration of the slaves"							151
7	Read safety monitor diagnostics (sorted by release circuit)	●	●	●	-	-	-	152
8	Read safety monitor diagnostics (unsorted)	●	●	●	-	-	-	154
9	Reserved/not defined	-	-	-	-	-	-	--
10	Read current safety monitor diagnostics	-	-	-	●	-	-	156
11	Read shut-off diagnostics of a monitor	-	-	-	●	-	-	158
12	Read current safety monitor diagnostics, device allocation has been considered	-	-	-	●	-	-	161
13	Read shut-off diagnostics of a monitor, device allocation has been considered	-	-	-	●	-	-	164
14	Read safety monitor diagnostics	-	-	-	●	●	●	167
15	Reserved/not defined	-	-	-	-	-	-	--
16	Read device name	-	-	-	-	-	●	169

Supported monitor types
Monitor function range "Basic"
Monitor function range "Extended"
Monitor of Generation II "Legacy Mode"
Monitor of Generation II "Extended Mode"
Internal monitor of Generation II "Software Version V4.x"
External monitor of Generation II "Software Version V4.x"

11.5.3.2 Structure of the response buffer

As the string can be longer than a command interface, the string is first saved in a buffer that can be read in sections using the buffer index (i).

The first byte in the response buffer defines the current command. 0xFF signifies transfer is still active, 0xFE signifies transfer interrupted with error. In the correct case, the command from WRITE_ACYC_TRANS is given here.

The first subsection of the string is read using i = 0, the second with i = m-2, etc. The two following bytes (high, low) define the length of the response buffer.

It is recommended to start reading the data always using index i = 0. This message also contains the header. The user data length is therefore reduced by 3 bytes.

Note

Read once using i = 0
Data with i = 0 can be read successfully only once. Each further read command with i = 0 is acknowledged with an error. Additional read processes (subsections) must be carried out with i > 0.

Table 168: Response buffer (Acyclic commands)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	Command1)							
2	Length byte2) n (high)							
3	Length byte n (low)							
4	Data 0							
…	…							
n + 3	Data n-1							

1) 0xFF signifies transfer still active, 0xFE signifies transfer interrupted with error. In the correct case, the command from WRITE_ACYC_TRANS is given here.
2) Transmit buffer length n

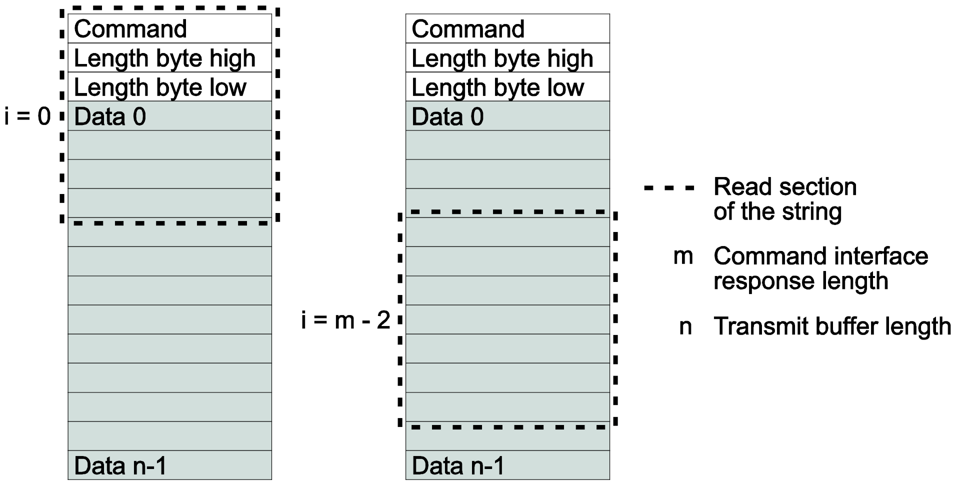


Figure 22: Response buffer (Acyclic commands)

11.5.3.3 Read “S-7.4 ID String“

Command 1

This command is used to read the ID string of a slave according to profile S-7.4.

Table 169:Response buffer read “S-7.4 ID String“

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	ID string byte 0							
2	ID string byte 1							
…	…							
n	ID string byte n-1							

11.5.3.4 Read “S-7.4 Diag String“

Command 2

This command is used to read the diagnostic string of a slave according to profile S-7.4.

Table 170: Response buffer read “S-7.4 Diag String “

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	Diag string byte 0							
2	Diag string byte 1							
...	...							
n	Diag string byte n-1							

11.5.3.5 Read “S-7.4 Param String“

Command 3

This command is used to read the parameter string of a slave according to profile S-7.4.

Table 171: Response buffer read “S-7.4 Param String“

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	Parameter string byte 0							
2	Parameter string byte 1							
...	...							
n	Parameter string byte n-1							

11.5.3.6 Write “S-7.4 Param String“

Command 4

This command is used to write the parameter string of a slave according to profile S-7.4.

Table 172: Request buffer write “S-7.4 Param String“

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	Parameter string byte 0							
2	Parameter string byte 1							
...	...							
n	Parameter string byte n-1							

11.5.3.7 “S-7.5 Transfer“

Command 5

This command is used to transfer the transfer string of a salve according to profile S-7.5. The request/response buffer contains the S-7.5 strings in the same form as they a transferred via AS-i.

Table 173: Request buffer “S-7.5 Transfer“

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	CTT2 command byte (16_{10} - 19_{10})							
2	Index							
3	Length							
4	Data 0							
5	Data 1							
...	...							
n	Data n-4							

Table 174: Response buffer “S-7.5 Transfer“

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	CTT2 response byte (50_{10} - 52_{10}, 90_{10} - 92_{10})							
2	Data 0							
3	Data 1							
...	...							
n	Data n-2							

11.5.3.8 Read “Cyclical S-7.5 16-bit configuration“

Command 6

This command is used to read the "cyclical S-7.5 16-bit configuration" with the analog/transparent bits being deleted in the response.

The cyclical 16-bit configuration could not be determined if the response is 0x08.

Table 175: Response buffer read “Cyclical S-7.5 16-bit configuration“

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	0	Output			Valid	Input		

Input	0:	No input
	1:	1-byte input
	2:	1-word input
	3:	2-word input
	4:	3-word input
	5:	4-word input
Valid	0:	Data valid
	1:	Data invalid
Output	0:	No output
	1:	1-byte output
	2:	1-word output
	3:	2-word output
	4:	3-word output
	5:	4-word output
0	This bit is reserved and may not be evaluated.	

11.5.3.9 Read “Safety Monitor sorted by release circuit“

Command 7

Note

Supported Monitor types
This command only applies to monitors with function range "Basic/Extended" and monitors of Generation II "Legacy Mode".
An overview of the commands and supported monitor types is available in the chapter "Overview of acyclic commands".

This command can be used to read the diagnostics of a safety monitor (sorted by release circuit).

Table 176: Response buffer read "Safety Monitor sorted by release circuit"

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0x00							
1	Monitor state [1]							
2	RC* 1 state [2]							
3	RC* 2 state							
4	Number of "not green" [3] devices, RC 1							
5	Number of "not green" devices, RC 2							
6	Index of device 32, RC 1							
7	Color of device 32 [4] , RC 1							
8	Index of device 33, RC 1							
...	...							
133	Color of device 95, RC 1							
134	Index of device 32, RC 2							
...	...							
261	Color of device 95, RC 2							

1) The description of the codes is available in table "Monitor state".
2) Conclusions about the state of the release circuits can be drawn based on the device colors – see table “Color coding”.
3) The maximum value is 7. Higher values are reduced to 7.
4) Conclusions about the state of the devices can be drawn based on the device colors – see table “Monitor state”.

* RC = Release Circuit

Table 177: Monitor state

Code	Meaning
0	Protected mode, everything OK (output circuits that are not installed, not configured or dependent output circuits are indicated as **OK**)
1	Protected mode, output circuit 1 OFF
2	Protected mode, output circuit 2 OFF
3	Protected mode, both output circuits OFF
4	Configuration mode, power ON
5	Configuration mode
6	Reserved/not defined
7	Configuration mode, fatal device error, reset or device replacement required

Table 178: Color coding

Code	Color	Meaning
0	green	Device is in the ON state (switched on).
1	green flashing	Device is in the ON state (switched on), but already in the transition to the OFF state, e.g. shutdown delay.
2	yellow	Device is ready, but still waiting for a further condition, e.g. local acknowledgement or start button.
3	yellow flashing	Time condition exceeded, action must be repeated, e.g. synchronization time exceeded.
4	red	Device is in the OFF state (switched off).
5	red flashing	The error interlock is active. Clear using one of the following actions: –> Acknowledge using the ESC/Service button –> Power OFF/ON –> AS-Interface OFF/ON
6	gray	RC not used/no communication with the AS-interface slave

Note

Code descriptions
Additional descriptions of the codes used for the state of the monitor, state of the RC and device color are available in the manufacturer's documentation for "Safety-at-Work Monitor".

11.5.3.10 Read “Safety Monitor unsorted by release circuit“

Command 8

Note

Supported monitor types
This command only applies to monitors with function range "Basic/Extended" and monitors of Generation II "Legacy Mode".
An overview of the commands and supported monitor types is available in the chapter "Overview of acyclic commands".

This command can be used to read the diagnostics of a monitor (unsorted).

Table 179: Diagnostics of a monitor (read "Safety Monitor unsorted by release circuit")

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0x00							
1	Monitor state [1]							
2	RC 1 state [2]							
3	RC 2 state							
4	Number of "not green" [3] devices							
5	—							
6	Index of device 32							
7	Color of device [4] 32							
8	Index of device 33							
...	…							
133	Color of device 95							
134	Index of device 32							
135	Allocation [5] of device 32 to RC							
...	...							
261	Allocation of device 95 to RC							

1) The description of the codes is available in table "Monitor state".
2) Conclusions about the state of the release circuits can be drawn based on the device colors – see table "Color coding".
3) The maximum value is 7. Higher values are reduced to 7.
4) Conclusions about the state of the devices can be drawn based on the device colors – see table "Monitor state".
5) Allocation of the devices to the release circuits is available in the following table "Possible allocations of a device to the release circuit".

Table 180: Possible allocations of a device to the release circuit

Value	Description
0x00	Preprocessing
0x01	RC 1
0x02	RC 2
0x03	RC 1+2
0x80	Device does not exist.

Note

Code descriptions
Additional descriptions of the codes used for the state of the monitor, state of the RC, device color and allocation to the RC are available in the manufacturer's documentation for "Safety-at-Work Monitor".

11.5.3.11 Read „Current diagnostics of a monitor“

Command 10

Note

Supported monitor types
This command only applies to monitors of Generation II "Extended Mode".
An overview of the commands and supported monitor types is available in the chapter "Overview of acyclic commands".

If the slave/monitor address is "0", the internal monitor is activated.

Table 181: Request buffer read "Current diagnostics of a monitor"

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
No data bytes in the request buffer								

Table 182: Response buffer read "Current diagnostics of a monitor"

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	reserved 0x00							
1	Monitor state 1)							
2	RC 1 state 2)							
3	RC 2 state							
4	Number of "not green" 3) devices							
5	-							
6	Index of device 32							
7	Color of device 4) 32							
8	Index of device 33							
9	Color of device 33							
...	…							
132	Index of device 95							
133	Color of device 95							
134	Index of device 32							
135	Allocation 5) of device 32 to RC							
...	…							
260	Index of device 95							
261	Allocation of device 95 to RC							

1) The description of the codes is available in table "Monitor state".
2) Conclusions about the state of the release circuits can be drawn based on the device colors – see table "Color coding".
3) The maximum value is 7. Higher values are reduced to 7.
4) Conclusions about the state of the devices can be drawn based on the device colors – see table "Monitor state".
5) Allocation of the devices to the release circuits is available in the following table "Read 'Current diagnostics of a monitor'".

Table 183: Allocation read "Current diagnostics of a monitor"

<table>
<tr><th>Byte</th><th>Bit 7</th><th>Bit 6</th><th>Bit 5</th><th>Bit 4</th><th>Bit 3</th><th>Bit 2</th><th>Bit 1</th><th>Bit 0</th></tr>
<tr><td>n</td><td>Exist</td><td>Change</td><td>0</td><td>0</td><td colspan="4">Assign</td></tr>
<tr><td rowspan="5">Assign</td><td>0:</td><td colspan="7">Device assigned to preprocessing</td></tr>
<tr><td>1:</td><td colspan="7">Device assigned to RC 1</td></tr>
<tr><td>2:</td><td colspan="7">Device assigned to RC 2</td></tr>
<tr><td>3:</td><td colspan="7">Device assigned to RC 1 and RC 2</td></tr>
<tr><td>4 … 15:</td><td colspan="7">Reserved</td></tr>
<tr><td rowspan="2">Change</td><td>0:</td><td colspan="7">Device status has not changed since lasted switched off</td></tr>
<tr><td>1:</td><td colspan="7">Device status has changed since lasted switched off</td></tr>
<tr><td rowspan="2">Exist</td><td>0:</td><td colspan="7">Device exists</td></tr>
<tr><td>1:</td><td colspan="7">Device does not exist</td></tr>
<tr><td>0</td><td colspan="8">This bit is reserved and may not be evaluated.</td></tr>
</table>

Note

Code descriptions
Additional descriptions of the codes used for the state of the monitor, state of the RC, device color and allocation to the RC are available in the manufacturer's documentation for "Safety-at-Work Monitor".

11.5.3.12 Read "Shutdown history of a monitor"

Command 11

Note

Supported monitor types
This command only applies to monitors of Generation II "Extended Mode".
An overview of the commands and supported monitor types is available in the chapter "Overview of acyclic commands".

For Generation II monitors, the shutdown history can be read in addition to diagnostics of the safety device.

If a release circuit leaves the state green, the states of all devices are stored at this moment. By doing so, it is possible to determine the cause of the shutdown later.

If there has been no shutdown of the related release circuit since the start, all devices are "gray".

If the slave/monitor address is "0", the internal monitor is activated.

Table 184: Request buffer read “Shutdown history of a monitor “

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	RC: 0=RC 1; 1=RC 2							

Table 185: Response buffer read "Shutdown history of a monitor"

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	reserved 0x00							
1	Monitor state [1)]							
2	RC 1 state [2)]							
3	RC 2 state							
4	Number of "not green" [3)] devices							
5	-							
6	Index of device 32							
7	Color of device[4)] 32							
8	Index of device 33							
9	Color of device 33							
…	…							
132	Index of device 95							
133	Color of device 95							
134	Index of device 32							
135	Allocation [5)] of device 32 to RC							
…	…							
260	Index of device 95							
261	Allocation of device 95 to RC							

1) The description of the codes is available in table "Monitor state".
2) Conclusions about the state of the release circuits can be drawn based on the device colors – see table "Color coding".
3) The maximum value is 7. Higher values are reduced to 7.
4) Conclusions about the state of the devices can be drawn based on the device colors – see table "Monitor state".
5) Allocation of the devices to the release circuits is available in the following table "Read 'Shutdown history of a monitor'".

Table 186: Allocation read "Shutdown history of a monitor"

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
n	Exist	Change	0	0	Assign			

Assign	0:	Device assigned to preprocessing
	1:	Device assigned to RC 1
	2:	Device assigned to RC 2
	3:	Device assigned to RC 1 and RC 2
	4 … 15:	Reserved
Change	0:	Device status has not changed since lasted switched off
	1:	Device status has changed since lasted switched off
Exist	0:	Device exists
	1:	Device does not exist
0	This bit is reserved and may not be evaluated.	

Note

Code descriptions
Additional descriptions of the codes used for the state of the monitor, state of the RC, device color and allocation to the RC are available in the manufacturer's documentation for "Safety-at-Work Monitor".

11.5.3.13 Read "Current diagnostics of a monitor", device allocation has been considered

Command 12

Note

Supported monitor types
This command only applies to monitors of Generation II "Extended Mode".
An overview of the commands and supported monitor types is available in the chapter "Overview of acyclic commands".

If the slave/monitor address is "0", the internal monitor is activated.

Table 187: Request buffer read "Current diagnostics of a monitor", device allocation has been considered

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
No data bytes in the request buffer								

Table 188: Response buffer read "Current diagnostics of a monitor", device allocation has been considered

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	reserved 0x00							
1	Monitor state 1)							
2	RC 1 state 2)							
3	RC 2 state							
4	Number of "not green" 3) devices							
5	-							
6	Index of device 32							
7	Color of device 4) 32							
8	Index of device 33							
9	Color of device 33							
...	…							
132	Index of device 95							
133	Color of device 95							
134	Index of device 32							
135	Allocation 5) of device 32 to RC							
...	…							
260	Index of device 95							
261	Allocation of device 95 to RC							

1) The description of the codes is available in table "Monitor state".
2) Conclusions about the state of the release circuits can be drawn based on the device colors – see table "Color coding".
3) The maximum value is 7. Higher values are reduced to 7.
4) Conclusions about the state of the devices can be drawn based on the device colors – see table "Monitor state".
5) Allocation of the devices to the release circuits is available in the following table "Allocation read 'Current diagnostics of a monitor', device allocation has been considered".

Table 189: Allocation read "Current diagnostics of a monitor", device allocation has been considered

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
n	Exist	Change	0	0	Assign			

Assign	0:	Device assigned to preprocessing
	1:	Device assigned to RC 1
	2:	Device assigned to RC 2
	3:	Device assigned to RC 1 and RC 2
	4 … 15:	Reserved
Change	0:	Device status has not changed since lasted switched off
	1:	Device status has changed since lasted switched off
Exist	0:	Device exists
	1:	Device does not exist
0	This bit is reserved and may not be evaluated.	

Note

Code descriptions
Additional descriptions of the codes used for the state of the monitor, state of the RC, device color and allocation to the RC are available in the manufacturer's documentation for "Safety-at-Work Monitor".

11.5.3.14 Read “Shutdown history of a monitor", device allocation has been considered

Command 13

Note

Supported monitor types
This command only applies to monitors of Generation II "Extended Mode".
An overview of the commands and supported monitor types is available in the chapter "Overview of acyclic commands".

For Generation II monitors, the shutdown history can be read in addition to diagnostics of the safety unit.

If a release circuit leaves the state green, the states of all devices are stored at this moment. By doing do, it is possible to determine the cause of the shutdown later.

If there has been no shutdown of the related release circuit since the start, all devices are "gray".

If the slave/monitor address is "0", the internal monitor is activated.

Table 190: Request buffer read "Shutdown history of a monitor", device allocation has been considered

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	RC: 0=RC 1; 1=RC 2							

Table 191: Response buffer read "Shutdown history of a monitor", device allocation has been considered

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	reserved 0x00							
1	Monitor state 1)							
2	RC 1 state 2)							
3	RC 2 state							
4	Number of "not green" 3) devices							
5	-							
6	Index of device 32							
7	Color of device 4) 32							
8	Index of device 33							
9	Color of device 33							
…	…							
132	Index of device 95							
133	Color of device 95							
134	Index of device 32							
135	Allocation 5) of device 32 to RC							
…	…							
260	Index of device 95							
261	Allocation of device 95 to RC							

1) The description of the codes is available in table "Monitor state".
2) Conclusions about the state of the release circuits can be drawn based on the device colors – see table "Color coding".
3) The maximum value is 7. Higher values are reduced to 7.
4) Conclusions about the state of the devices can be drawn based on the device colors – see table "Monitor state".
5) Allocation of the devices to the release circuits is available in the following table "Read 'Shutdown history of a monitor', device allocation has been considered").

Table 192: Allocation read "Shutdown history of a monitor", device allocation has been considered

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
n	Exist	Change	0	0	Assign			

Assign	0:	Device assigned to preprocessing
	1:	Device assigned to RC 1
	2:	Device assigned to RC 2
	3:	Device assigned to RC 1 and RC 2
	4 … 15:	Reserved
Change	0:	Device status has not changed since lasted switched off
	1:	Device status has changed since lasted switched off
Exist	0:	Device exists
	1:	Device does not exist
0	This bit is reserved and may not be evaluated.	

Note

Code descriptions
Additional descriptions of the codes used for the state of the monitor, state of the RC, device color and allocation to the RC are available in the manufacturer's documentation for "Safety-at-Work Monitor".

11.5.3.15 Read „Safety Monitor diagnostics“

Command 14

Note

Supported monitor types
This command only applies to monitors of Generation II "Extended Mode" and monitors of Generation II "Software Version V4.x".
An overview of the commands and supported monitor types is available in the chapter "Overview of acyclic commands".

Note

Response buffer length dependent on Safety-at-Work configuration
Because command 14 provides colors for up to 256 devices depending on the Safety-at-Work configuration, its length can vary.

This command can be used to read the diagnostics of a monitor, separate for each release circuit.

Table 193: Request buffer read "Safety Monitor diagnostics"

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	List selection (0=current diagnosis; >0=diagnosis for RC shutdown (history memory)							
2	Number of the release circuit (0=preprocessing)							
3	Diagnosis format (0=complete diagnosis; 1=sorted by diagnosis index)							

Table 194: Response buffer read "Safety Monitor diagnostics

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	Response type (0=device colors; >0=reserved)							
2	Monitor state; byte 1 (see <Table 1-27> for description)							
3	RC type (0=internal RC; 1=peripheral RC)							
4	RC info - RC number, if internal RC (0=preprocessing, 1=RC 1, 2=RC 2) - Slave address, if peripheral RC (address 0 – 63, bit 7 points to AS-i circuit allocated to this slave; 0=circuit 1, 1=circuit 2)							
5	RC state (bit 0 - bit 3 color of the RC; bit 4 - bit 7 reserved)							
6	Color of device 0 (see <Table 1-28> for description)							
...	...							
261	Color of device 255							

Table 195: Monitor state read "Safety Monitor diagnostics"

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
n	Device error	Protec-ted mode	Configu-ration mode	0	0	0	0	0

Configu-ration mode	0:	Monitor not in configuration mode
	1:	Monitor in configuration mode
Protected mode	0:	Monitor not in protected mode
	1:	Monitor in protected mode
Device error	0:	No device error
	1:	Fatal device error, reset or device replacement required
0	This bit is reserved and may not be evaluated.	

Table 196: State and color coding read "Safety Monitor diagnostics"

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
n	Use	Exist	Change	0	0	State/color		

State/ color	0:	Green continuous
	1:	Green flashing
	2:	Yellow continuous
	3:	Yellow flashing
	4:	Red continuous
	5:	Red flashing
	6:	Gray or OFF
	7:	Green/yellow
Change	0:	No device modification at "switch off"
	1:	Device modification at "switch off"
Exist	0:	Device exists
	1:	Device does not exist
Use	0:	Device used in this release circuit
	1:	Device not used in this release circuit
0	This bit is reserved and may not be evaluated.	

11.5.3.16 Read "Device name"

Command 16

Note

Supported monitor types
This command only applies to external monitors of Generation II "Software Version V4.x".
An overview of the commands and supported monitor types is available in the chapter "Overview of acyclic commands".

This command can be used to read the device name.

Table 197: Request buffer read "Device name"

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Number of the device, whose name you want to read (high byte)							
1	Number of the device, whose name you want to read (low byte)							
3	Type of numbering (0: unsorted; 1: sorted)							

Table 198: Response buffer read "Device name"

<table>
<tr><th>Byte</th><th>Bit 7</th><th>Bit 6</th><th>Bit 5</th><th>Bit 4</th><th>Bit 3</th><th>Bit 2</th><th>Bit 1</th><th>Bit 0</th></tr>
<tr><td rowspan="6">0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>Active</td><td>Exist</td></tr>
<tr><td rowspan="2">Exist</td><td>0:</td><td colspan="6">Device is enabled.</td></tr>
<tr><td>1:</td><td colspan="6">Device is disabled.</td></tr>
<tr><td rowspan="2">Active</td><td>0:</td><td colspan="6">Device is present.</td></tr>
<tr><td>1:</td><td colspan="6">Device is not present.</td></tr>
<tr><td>0</td><td colspan="7">This bit is reserved and may not be evaluated.</td></tr>
<tr><td>1</td><td colspan="8">Device name is null-terminated string</td></tr>
</table>

11.6 Fieldbus-specific behavior

11.6.1 CANopen

11.6.1.1 Accessing the process image

The CANopen master accesses the AS-Interface mailbox and process data in the fieldbus coupler/controller with process data objects (PDO).

In the default configuration, the data for the AS-Interface master module are mapped in consecutive PDOs. Each PDO can hold eight bytes of data. The maximum process image of the AS-Interface master of 48 bytes therefore includes six PDOs.

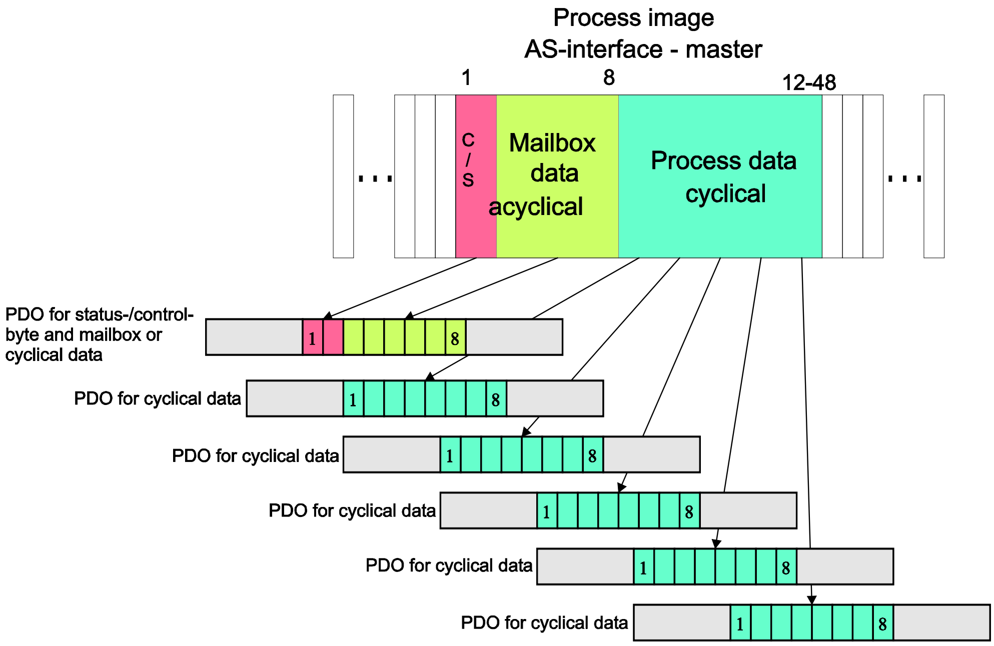


Figure 23: PDO assignment, AS-Interface master module

The first PDO, which is assigned to an AS-Interface master module, contains the status/control byte, one empty byte and up to six bytes of mailbox or process data. The subsequent PDOs contain AS-Interface process data.

Note

Note maximum mailbox size!
When using a CANopen coupler / controller, the maximum mailbox size is limited to six bytes.

The following table shows the assignment of the process image size to the number of occupied PDOs when the mailbox is permanently superimposed (Mode 1).

Table 199: Assignment of the process image size

Process image size	12 Byte	20 Byte	24 Byte	32 Byte	40 Byte	48 Byte
n. PDO	1 status/ control byte 1 empty byte 6 byte mailbox	1 status-/ control byte 1 empty byte 6 byte mailbox	1 status-/ control byte 1 empty byte 6 byte mailbox	1 status-/ control byte 1 empty byte 6 byte mailbox	1 status-/ control byte 1 empty byte 6 byte mailbox	1 status-/ control byte 1 empty byte 6 byte mailbox
n+1. PDO	4 byte process data (flags and Slave 1/1A … Slave 7/7A) 4 bytes empty (reserved)	8 byte process data (flags and Slave 1/1A … Sl. 15/15A)	8 byte process data (flags and Slave 1/1A … Sl. 15/15A)	8 byte process data (flags and Slave 1/1A … Sl. 15/15A)	8 byte process data (flags and Slave 1/1A … Sl. 15/15A)	8 byte process data (flags and Slave 1/1A … Sl. 15/15A)
n+2. PDO	free for next module	4 byte process data (Sl. 16/16A … Sl. 23/23A) 4 bytes empty (reserved)	8 byte process data (Sl. 16/16A … Sl. 31/31A)	8 byte process data (Sl. 16/16A … Sl. 31/31A)	8 byte process data (Sl. 16/16A … Sl. 31/31A)	8 byte process data (Sl. 16/16A … Sl. 31/31A)
n+3. PDO		free for next module	free for next module	8 byte process data (Slave 1B … Slave 15B)	8 byte process data (Slave 1B … Slave 15B)	8 byte process data (Slave 1B … Slave 15B)
n+4. PDO				free for next module	8 byte process data (Slave 16B … Slave 31B)	8 byte process data (Slave 16B … Slave 31B)
n+5. PDO					free for next module	8 bytes empty (reserved)
n+6. PDO						free for next module

Here, the n-th PDO represents the first PDO occupied by the AS-Interface Master module. It contains the status/control byte, one empty byte and up to six bytes of mailbox data.

If the length of the permanently superimposed mailbox is 0 bytes, then the n-th PDO only contains the status / control byte and one empty byte.

If the process image of the AS-Interface Master module is 12 bytes or 20 bytes in size, the last PDO is not fully occupied. A further module then starts with the next PDO.

Note

Use smallest possible mailbox size!
When the mailbox size is 6 bytes and 62 AS-Interface slaves are connected, a process image size of 40 bytes is sufficient to transmit all process data. The module then occupies five PDOs.

The following assignment of the process image size to the number of occupied PDOs applies in the operating mode with suppressable mailbox (Mode 2).

Table 200: Assignment of the process image size to the number of occupied PDOs

Process image size	12 bytes	20 bytes	24 bytes	32 bytes	40 bytes	48 bytes
n. PDO	1 status/ control byte 1 empty byte 6 byte mailbox or 6 byte process data (flags and Slave 1/1A … Sl. 11/11A)	1 status/ control byte 1 empty byte 6 byte mailbox or 6 byte process data (flags and Slave 1/1A … Sl. 11/11A)	1 status/ control byte 1 empty byte 6 byte mailbox or 6 byte process data (flags and Slave 1/1A … Sl. 11/11A)	1 status/ control byte 1 empty byte 6 byte mailbox or 6 byte process data (flags and Slave 1/1A … Sl. 11/11A)	1 status/ control byte 1 empty byte 6 byte mailbox or 6 byte process data (flags and Slave 1/1A … Sl. 11/11A)	1 status/ control byte 1 empty byte 6 byte mailbox or 6 byte process data (flags and Slave 1/1A … Sl. 11/11A)
n+1. PDO	4 byte process data (Sl. 12/12A …. Sl. 19/19A) 4 bytes empty (reserved)	8 byte process data (Sl. 12/12A … Sl. 27/27A)	8 byte process data (Sl. 12/12A … Sl. 27/27A)	8 byte process data (Sl. 12/12A … Sl. 27/27A)	8 byte process data (Sl. 12/12A … Sl. 27/27A)	8 byte process data (Sl. 12/12A … Sl. 27/27A)
n+2. PDO	free for next module	4 byte process data (Sl. 28/28A … Slave 3B) 4 bytes empty (reserved)	8 byte process data (Sl. 28/28A … Slave 11B)	8 byte process data (Sl. 28/28A … Slave 11B)	8 byte process data (Sl. 28/28A … Slave 11B)	8 byte process data (Sl. 28/28A … Slave 11B)
n+3. PDO		free for next module	free for next module	8 byte process data (Slave 12B … Slave 27B)	8 byte process data (Slave 12B … Slave 27B)	8 byte process data (Slave 12B … Slave 27B)
n+4. PDO				free for next module	2 byte process data (Slave 28B … Slave 31B) 6 bytes empty (reserved)	2 byte process data (Slave 28B … Slave 31B) 6 bytes empty (reserved)
n+5. PDO					free for next module	8 bytes empty (reserved)
n+6. PDO						free for next module

The n-th PDO contains the status/control byte, one empty byte and six bytes of mailbox data when the mailbox is superimposed, or the first six bytes of process data. The subsequent PDOs contain the further process data.

Note

Limited access to process data when mailbox is displayed!
When the mailbox is superimposed, it is not possible to access the first six bytes of process data (flags and Slave 1/1A to Slave 11/11A).

If the process image of the AS-Interface Master module is 12, 20, 40 or 48 bytes in size, the last PDO is not fully occupied. A further module then starts with the next PDO.

11.6.1.1.1 Example

Let a node contain the following modules with an input/output process image:

3 x 750-402	each with 4 bits of input data,
1 x 750-452	4 bytes of input data,
1 x 750-655	12 bytes of input data and 12 bytes of output data,
1 x 750-550	4 bytes of output data,
1 x 750-452	4 bytes of input data,
1 x 750-550	4 bytes of output data,
1 x 750-452	4 bytes of input data,
1 x 750-504	4 bits of output data.

By default, PDO 1 to PDO 4 are reserved for and occupied by digital and analog modules; further PDOs are not required for digital and analog modules.

Apart from an AS-Interface master module, no further special modules are fitted.

The AS-Interface master module occupies a process image of 12 bytes when the mailbox size is 6 bytes. The mailbox is permanently superimposed.

The 5th PDO and the 6th PDO are therefore assigned to this module. The 6th PDO contains only 4 bytes of process data.

The 7th PDO and the subsequent PDOs are free for further modules.

Table 201: Data in the process image

Byte	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Content	C/S	--	MB1	MB2	MB3	MB4	MB5	MB6	D1	D2	D3	D4

C/S	Control / status byte
MB1 - MB6	Mailbox data, byte 1 - byte 6
D1 - D4	Process data, byte 1 - byte 4

Table 202: Entries in the object list

Sub0	6 (Number of sub-indices)							
Sub1	8 (Length of mailbox string (Sub2))							
Sub2	C/S	-	MB1	MB2	MB3	MB4	MB5	MB6
Sub3	D1 (Process data flags + Slave 1/1A)							
Sub4	D2 (Process data Slave 2/2A + Slave 3/3A)							
Sub5	D3 (Process data Slave 4/4A + Slave 5/5A)							
Sub6	D4 (Process data Slave 6/6A + Slave 7/7A)							

The AS-Interface flags and process data from 7 AS-Interface slaves can be transmitted with this configuration.

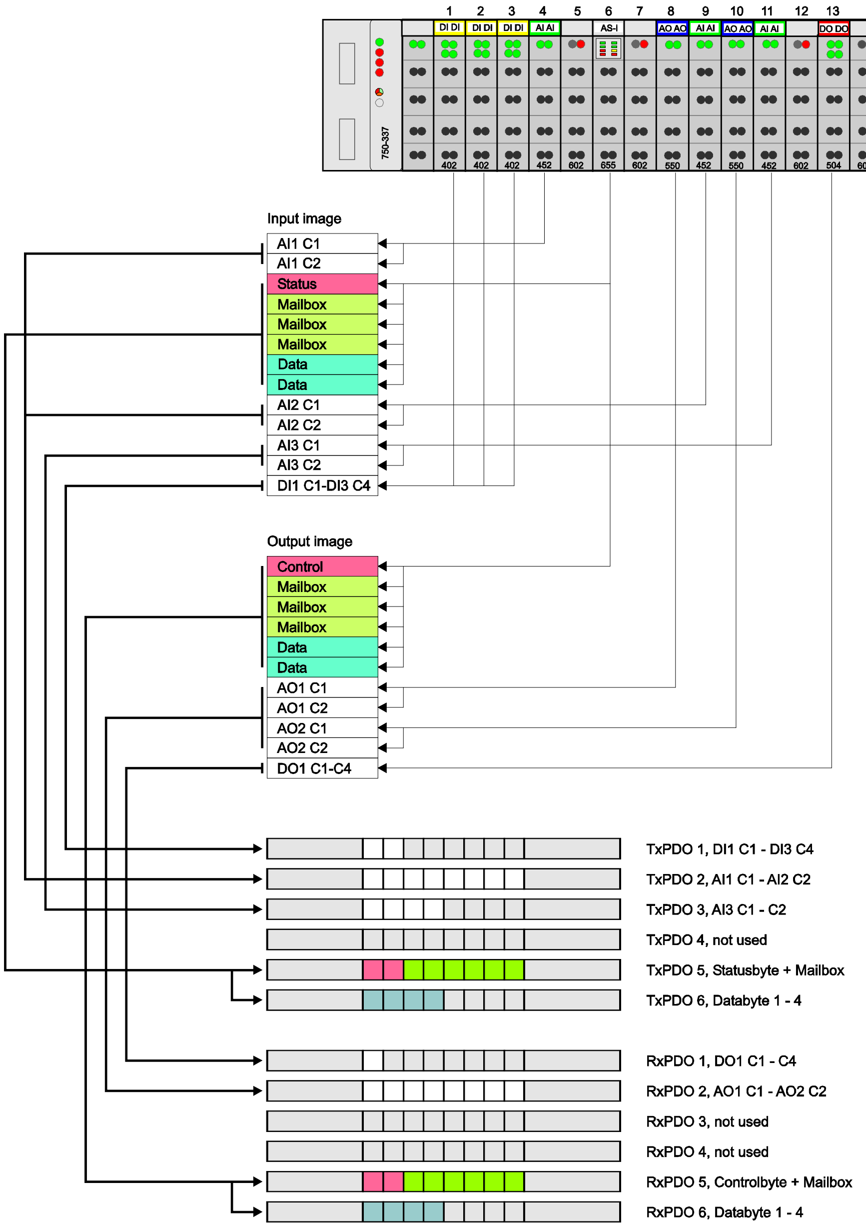


Figure 24: PDO assignment, AS-Interface master module

11.6.2 DeviceNet

11.6.2.1 Accessing the process image

The DeviceNet Master can access the AS-Interface data in two ways.

With pre-defined instances of the assembly object, digital and analog input and output data of a node are transferred to or from the master with one command. The application in the master can then address the data in the memory. The data are stored in the master in the same way as with mapping in the coupler / controller. The byte-orientated module data (analog modules and special modules) and the bit-orientated module data (digital modules) are stored separately in the memory in arrays of bytes according to the input and output image. The appropriate array and the associated memory address can thus be determined from the type and position of the module.

The data in the AS-Interface master can be directly addressed with the analog input point object or the analog output point object. The instance number of the respective object is given by the position of the module in the node.

11.6.2.1.1 Example

Let a node contain the following modules with an input/output process image:

3 x 750-402	each with 4 bits of input data,
1 x 750-452	4 bytes of input data,
1 x 750-655	12 bytes of input data and 12 bytes of output data,
1 x 750-550	4 bytes of output data,
1 x 750-452	4 bytes of input data,
1 x 750-550	4 bytes of output data,
1 x 750-452	4 bytes of input data,
1 x 750-504	4 bits of output data.

The AS-Interface master module occupies a process image of 12 bytes when the mailbox size is 6 bytes. The mailbox is permanently superimposed.

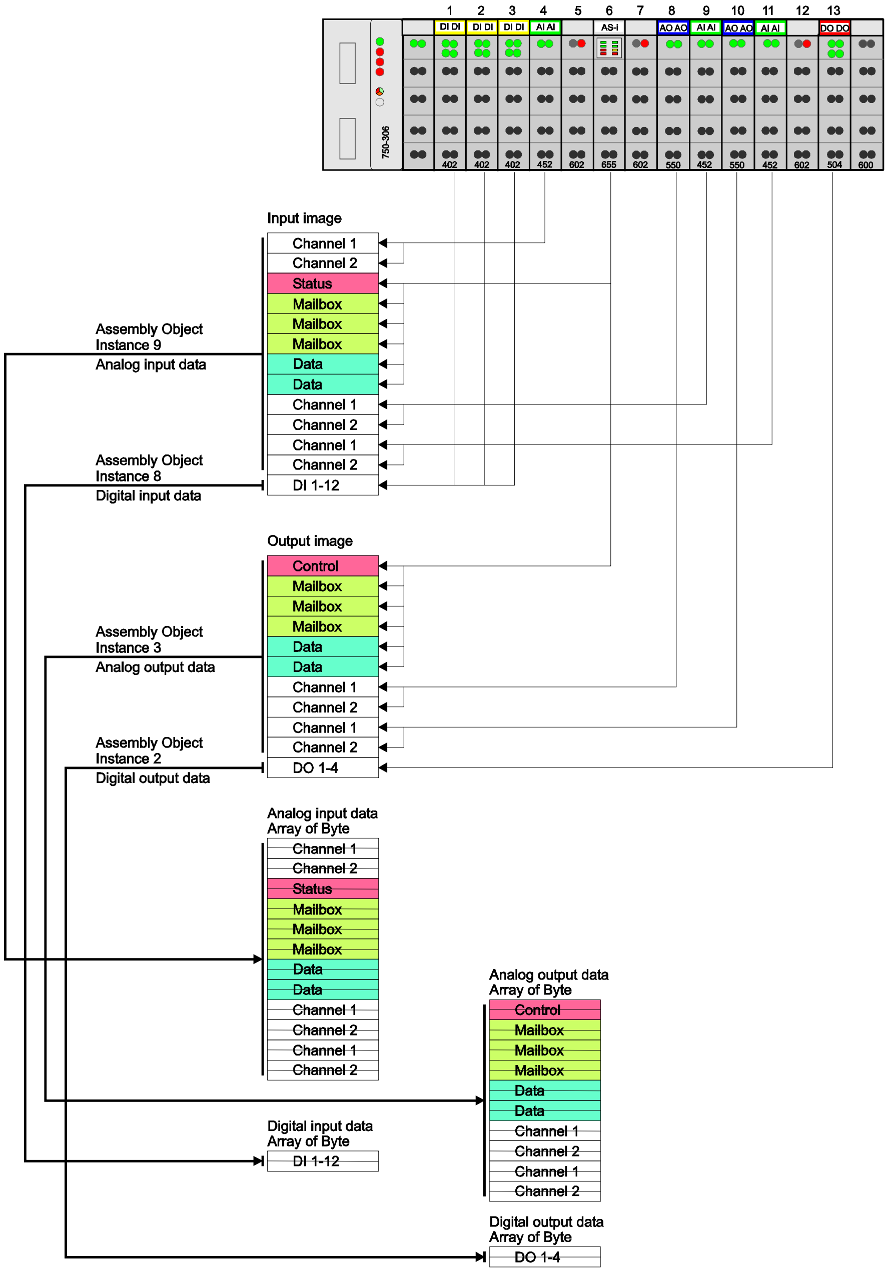


Figure 25: Array assignment, AS-Interface master module

11.6.3 ETHERNET

11.6.3.1 Accessing the process image

11.6.3.1.1 Modbus protocol

The data in the AS-Interface master are accessed by means of the functions for reading and writing registers. The registers can be read and written in blocks or individually. One register contains two bytes.

The assignment of the registers to the module I/O data is dependent on the order and the type of the modules.

The registers are written separately according to input and output data, in increasing order, first with the data of the byte-orientated modules (analog and special modules) and then subsequently with the data of the bit-orientated modules (digital modules).

The first input or output register, which is assigned to an AS-Interface master module, contains the status / control byte and one empty byte.

The registers for the permanently superimposed mailbox are attached to this.

If the mailbox is set up to be superimposed, these registers contain the mailbox or process data.

The further registers associated with an AS-Interface master module contain the remaining process data.

With blockwise access, the data are transmitted with one command (e.g. FC 3 – Read Multiple Registers, FC 16 – Write Multiple Registers or FC 23 – Read/Write Multiple Registers). The start address and the number of registers to be transmitted are specified in the function call. The individual data are then accessed in the higher-level controller.

The command FC 6 (Write Single Register) can be used for direct access to individual registers or the above commands can be used by setting the number of registers to be transmitted to 1

11.6.3.1.1.1 Example

Let a node contain the following modules with an input/output process image:

3 x 750-402	each with 4 bits of input data,
1 x 750-452	4 bytes of input data,
1 x 750-655	12 bytes of input data and 12 bytes of output data,
1 x 750-550	4 bytes of output data,
1 x 750-452	4 bytes of input data,
1 x 750-550	4 bytes of output data,
1 x 750-452	4 bytes of input data,
1 x 750-504	4 bits of output data.

The AS-Interface master module occupies a process image of 12 bytes when the mailbox size is 6 bytes. The mailbox is permanently superimposed.

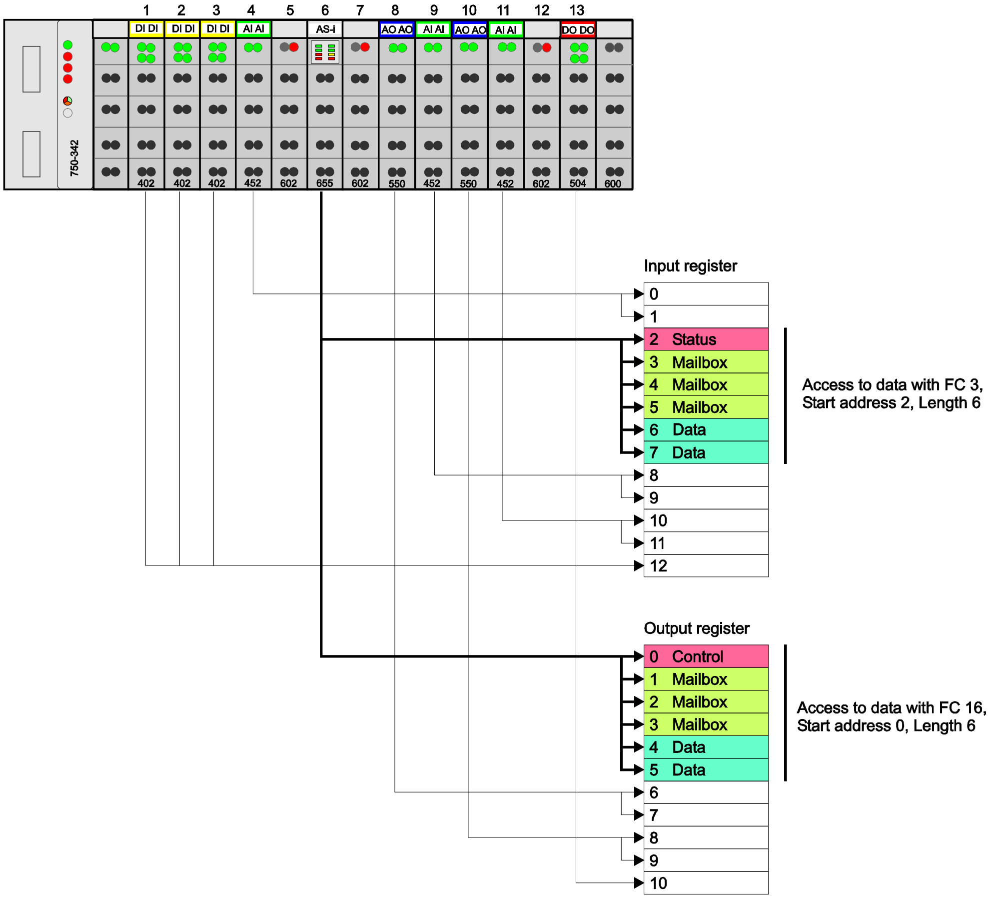


Figure 26: Register assignment, AS-Interface master module

The input data for the AS-Interface master module are mapped onto input registers 2 to 7. Register 2 contains the status byte and one empty byte. Registers 3 to 5 contain the mailbox data. Registers 6 and 7 contain the process data.

The data can be read with FC 3 (start address 2, length 6).

The output data are mapped onto output registers 0 to 5. Register 0 contains the control byte and one empty byte. Registers 1 to 3 contain the mailbox data. Registers 4 and 5 contain the process data.

The data can be written with FC 16 (start address 0, length 6).

11.6.3.1.2 ETHERNET IP protocol

The AS-Interface data can be accessed in two ways with the ETHERNET IP protocol.

With pre-defined instances of the assembly object, digital and analog input and output data of a node are transferred to or from the master with one command. The application in the master can then address the data in the memory. The data are stored in the master in the same way as with mapping in the fieldbus coupler/ controller. The byte-orientated module data (analog modules and special modules) and the bit-orientated module data (digital modules) are stored separately in the memory according to the input and output image. The memory address can thus be determined from the type and position of the module.

The data in the AS-Interface master can be directly addressed with the analog input point object or the analog output point object. The instance number of the respective object is given by the position of the module in the node.

11.6.3.1.2.1 Example

Let a node contain the following modules with an input/output process image:

3 x 750-402	each with 4 bits of input data,
1 x 750-452	4 bytes of input data,
1 x 750-655	12 bytes of input data and 12 bytes of output data,
1 x 750-550	4 bytes of output data,
1 x 750-452	4 bytes of input data,
1 x 750-550	4 bytes of output data,
1 x 750-452	4 bytes of input data,
1 x 750-504	4 bits of output data.

The AS interface master module occupies a process image of 12 bytes with a mailbox size of 6 bytes. The mailbox is permanently superimposed.

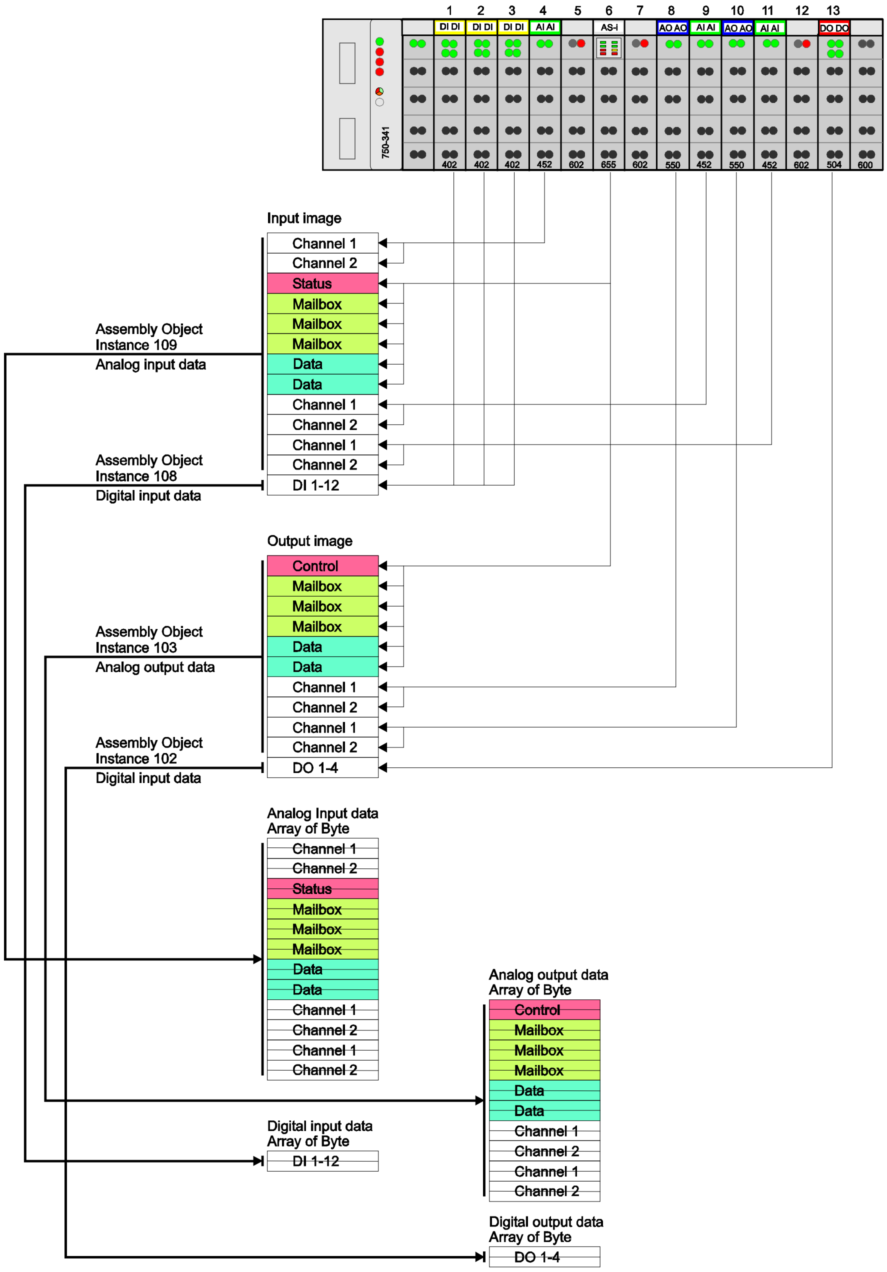


Figure 27: Array assignment, AS-Interface master module

11.6.4 PROFIBUS-DP

11.6.4.1 Accessing the process image

The data in the AS-Interface master is accessed via the process image of the PROFIBUS master. To ensure data consistency at a 12 to 48-byte data width, the data must be mapped with system functions for consistent reading and writing in an appropriately sized array. The PLC program can then process the data in this array.

11.6.4.1.1 Example

Let a node contain the following modules with an input/output process image:

3 x 750-402	each with 4 bits of input data,
1 x 750-452	4 bytes of input data,
1 x 750-655	12 bytes of input data and 12 bytes of output data,
1 x 750-550	4 bytes of output data,
1 x 750-452	4 bytes of input data,
1 x 750-550	4 bytes of output data,
1 x 750-452	4 bytes of input data,
1 x 750-504	4 bits of output data.

The AS-Interface master module occupies a process image of 12 bytes when the mailbox size is 6 bytes. The mailbox is permanently superimposed.

In the PROFIBUS master, the I/O configuration can be designed as follows:

Table 203: PROFIBUS master, the I/O configuration

No.	Function	Module Identification	PI Master *	
			Inputs	Outputs
1	Digital input	750-402 4 DI/24 V DC/3.0 ms 0x10	EB12.0	
	Digital input		EB12.1	
	Digital input		EB12.2	
	Digital input		EB12.3	
2	Digital input	*750-402 4 DI/24 V DC/3.0 ms 0x00	EB12.4	
	Digital input		EB12.5	
	Digital input		EB12.6	
	Digital input		EB12.7	
3	Digital input	750-402 4 DI/24 V DC/3.0 ms 0x10	EB13.0	
	Digital input		EB13.1	
	Digital input		EB13.2	
	Digital input		EB13.3	
4	Analog input	750-452 2 AI/0-20 mA/diff. 0x51	EW0	
	Analog input		EW2	
5	Power supply	Power supply module	---	---
6	Status/Control	750-655 AS-Interface Master 12 Byte PA 0x8B	EW20	AW10
	Mailbox		EW22	AW12
	Mailbox		EW24	AW14
	Mailbox		EW26	AW16
	Data		EW28	AW18
	Data		EW30	AW20
7	Power supply	Power supply module	---	---
8	Analog output	750-550 2 AO/0-10 V 0x61		AW0
	Analog output			AW2
9	Analog input	750-452 2 AI/0-20 mA/diff. 0x51	EW4	
	Analog input		EW6	
10	Analog output	750-550 2 AO/0-10 V 0x61		AW4
	Analog output			AW6
11	Analog input	750-452 2 AI/0-20 mA/diff. 0x51	EW8	
	Analog input		EW10	
12	Power supply	Power supply module	---	---
13	Digital output	750-504 4 DO/24 V DC/0.5 A 0x20		AB8.0
	Digital output			AB8.1
	Digital output			AB8.2
	Digital output			AB8.3
14	End module	End module	---	---

* The master addresses listed in the table correspond to the allocation of the process data given in the master configuration.

If the PROFIBUS master is a Siemens S7 PLC, the data will be consistently read and written with system functions SFC14 or SFC15.

To map the IW20 to IW30 input data in the MW100 to MW110 array, the function to be called is:

CALL SFC 14
LADDR := W#16#14 (read from input address IW20)
RECORD := P#M100.0 BYTE 12 (write 12 bytes to MW100)
RET_VAL := MW112 (write error messages to MW112)

To map the QW10 to QW20 output data in the MW114 to MW124 array, the function to be called is:

CALL SFC 15
LADDR := W#16#0A (write to output address QW10)
RECORD := P#M114.0 BYTE 12 (read 12 bytes from MW114)
RET_VAL := MW126 (write error messages to MW126)

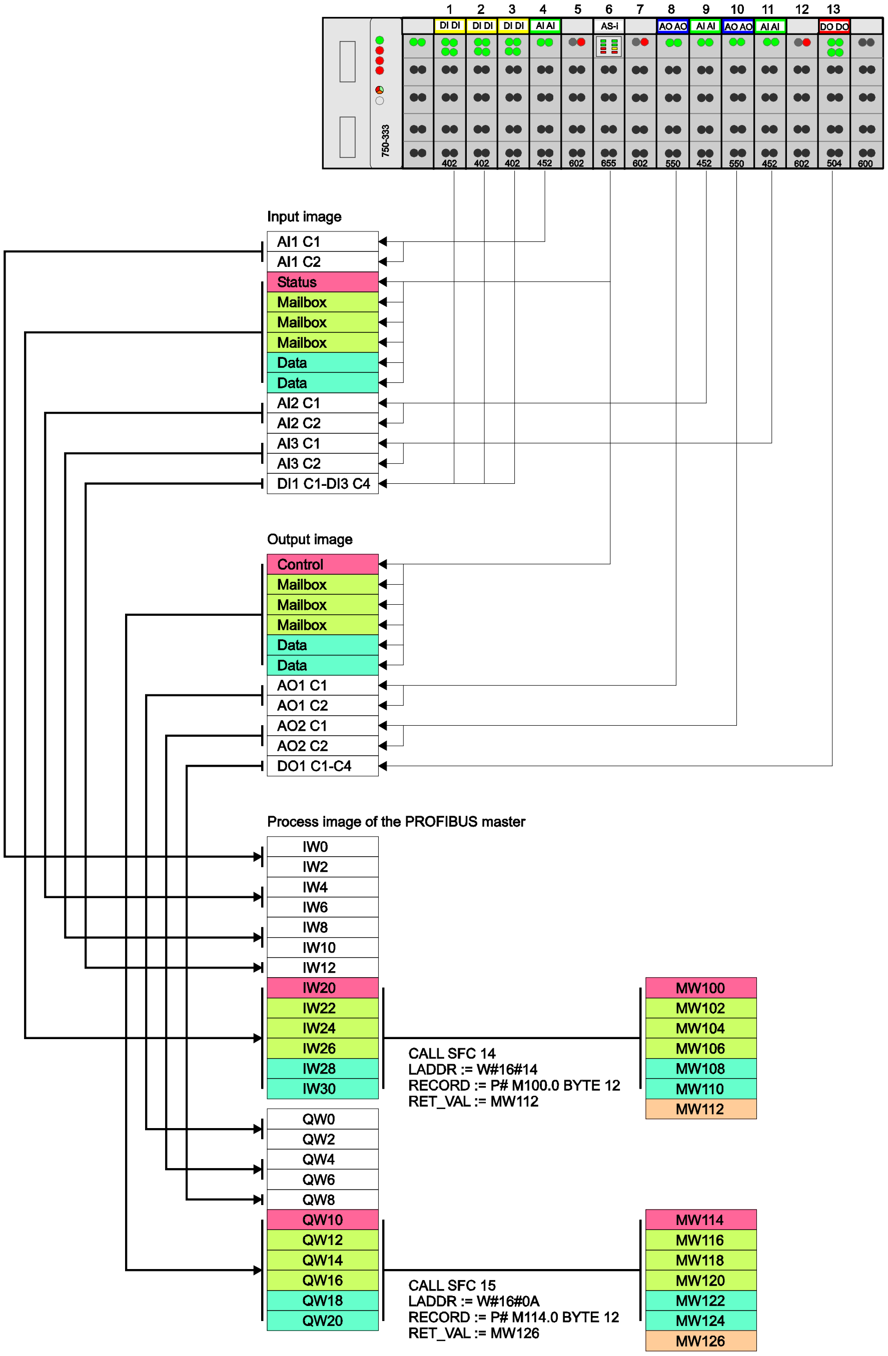


Figure 28: Process image assignment, AS-Interface master module

11.6.5 LON

The AS-Interface master 750-655 is supported by the LON fieldbus coupler 750-319 and by the programmable LON fieldbus controller 750-819.

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