


X-gateway Interface Addendum

# AS-Interface Master

Doc.Id. SCM-1200-013  
Rev. 2.13

HMS Industrial Networks AB

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## About This Document

### How To Use This Document

This document describes the various features of the AS-Interface Master for the X-gateway, basic network installation procedures and other network specific details. General information and operating instructions for the gateway is available in the Generic Gateway User Manual.

The reader of this document is expected to be familiar with the AS-Interface networking system, and communication systems in general.

For further information, documentation etc., please visit the HMS website, 'www.anybus.com'.

### Important User Information

The data and illustrations found in this document are not binding. We, HMS Industrial Networks AB, reserve the right to modify our products in line with our policy of continuous product development. The information in this document is subject to change without notice and should not be considered as a commitment by HMS Industrial Networks AB. HMS Industrial Networks AB assumes no responsibility for any errors that may appear in this document.

There are many applications of this product. Those responsible for the use of this device must ensure that all the necessary steps have been taken to verify that the application meets all performance and safety requirements including any applicable laws, regulations, codes, and standards.

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The examples and illustrations in this document are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular implementation, HMS Industrial Networks cannot assume responsibility or liability for actual use based on these examples and illustrations.

<b>Warning:</b>	This is a class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.
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<b>ESD Note:</b>	This product contains ESD (Electrostatic Discharge) sensitive parts that may be damaged if ESD control procedures are not followed. Static control precautions are required when handling the product. Failure to observe this may cause damage to the product.
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## Related Documents

Document	Author
Anybus-X Generic Gateway User Manual	HMS
Anybus-M AS-i Fieldbus Appendix	
AS-i Complete Specification (publ. CS 3.0 rev. 1)	AS-International Association
AS-i Profiles (Annex A and B, ver 3.0, rev. 1)	
-	-

## Document History

### Summary of Recent Changes (2.12... 2.13)

Change	Page(s)
ASi flag status information added	3-9
-	-

### Revision List

Revision	Date	Author(s)	Chapter(s)	Description
<2.00	-	-	-	(see older documents)
2.00	2007-06-04	PeP	All	First release
2.10	2007-12-04	PeP	-	Minor update
2.11	2008-02-25	PeP	-	Minor update
2.12	2008-09-18	StK	3	Minor update
2.13	2009-08-25	KeL	3	Minor update

## Conventions & Terminology

The following conventions are used throughout this manual:

- Numbered lists provide sequential steps
- Bulleted lists provide information, not procedural steps
- The term 'Master interface' refers to the AS-Interface Master Interface for the X-gateway
- The term 'Slave interface' or 'other network' refers to the other, non AS-Interface side of the gateway.
- The term 'user manual' is used when referring to the Anybus-X Generic Gateway User Manual.
- Hexadecimal values are written in the format NNNNh, where NNNN is the hexadecimal value.

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# About the AS-Interface Master

## General Description

The AS-Interface Master interface for the Anybus X-gateway implements an extended AS-Interface master (M4), and complies to version 3.0 of the AS-i Complete Specification.

The interface features an on-board configuration interface; providing user friendly access to AS-Interface specific parameters, as well as the settings for each slave. It can also be used to monitor the activity on the AS-Interface network.

Like all X-gateway interfaces, the AS-Interface Master exchanges data via two buffers as follows:

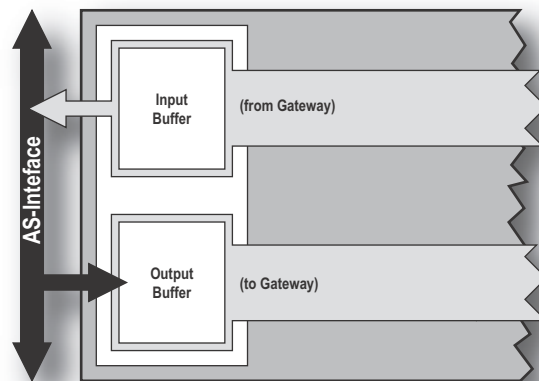
- **Input Buffer**

This buffer holds data *from* the other network, i.e. data which will be sent *to* the slaves on the AS-Interface network.

- **Output Buffer**

This buffer holds data *from* the slaves on the AS-Interface network, i.e. data which will be sent *to* the other network.

Apart from network I/O, this can optionally also include general status information from the AS-Interface network.



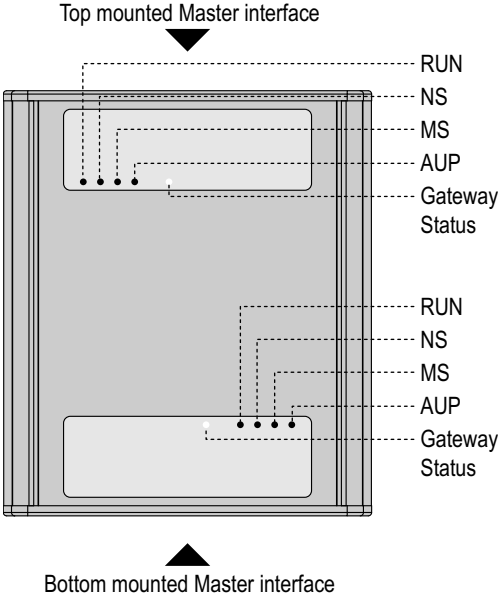
## Features

- Controls up to 62 slaves
- Supports Combined Transaction Types 1, 2, 3, 4 and 5<sup>1</sup>
- Up to 248 digital inputs and 186 digital outputs
- Up to 124 (16-bit) analog values
- Synchronous I/O (optional)
- Galvanically isolated bus electronics
- On-board configuration button
- Terminal-based Monitoring & Configuration interface (RS232)

1. Some profile-specific features are not supported, see 4-1 “AS-Interface Implementation Details”

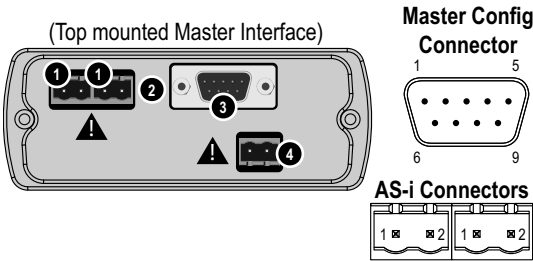
# Status LEDs

LED	State	Indication
RUN	Green	Running
	Red	Idle
NS	Green	On line, no connections
	Green, 1Hz	On line according to configuration
	Red	Offline
MS	Green	Configuration mode
	Green, 8Hz	Auto Configuration in progress
	Green, 1Hz	Protected mode
	Red	Power Fail bus
AUP	Green, 8Hz	Auto programming possible
	Green, 1Hz	Slave address 0 exist
	Red	Periphery error
	Red, 8Hz	Periphery error - auto-programming possible
	Red, 1Hz	Periphery error - slave with address 0 exist
Gateway Status	(Consult the user manual for further details)	

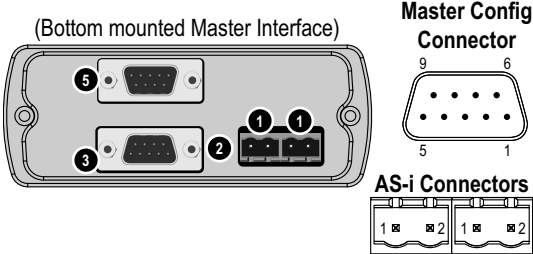


# Connectors & Buttons

#	Description
1	AS-Interface connector (See A-1 "AS-Interface Connector Pinout")
2	Configuration Button (See 4-3 "Configuration Button")
3	Master Config connector (See A-1 "Master Config Interface Pinout")
4	Gateway Power connector (Consult the user manual for further details)
5	Gateway Config connector (Consult the user manual for further details)



**Note:** Make sure not to mix up the gateway power connector with the AS-Interface connectors. Failure to observe this may cause damage to the gateway and/or other equipment connected to the gateway.



# Installation and Configuration

## Gateway Config Interface

### Configuration Settings

The 'Change Configuration'-menu features the following AS-Interface-specific settings:

```

-----
Change configuration
-----
AS-Interface Master (Upper)

Offline option (+/-):                Clear
Control / Status word (+/-):        Disabled
Live list:                            Disabled
Valid data list:                     Disabled
Data Representation:                 Byte Mode
Synchronous I/O mode:                Disabled

```

- **Offline option**  
(Consult the Anybus X-gateway User Manual for further information).
- **Control / Status word**  
This settings enables/disables representation of the Control/Status word.  
(Consult the Anybus X-gateway User Manual for further information).
- **Live list**  
This settings enables/disables representation of the Live List on the other network.
- **Valid Data List**  
This settings enables/disables representation of Valid Data List on the other network.
- **Data Representation**  
This affects the representation of the Digital I/O image (byte- or nibble-mode).
- **Synchronous I/O Mode**  
This settings enables/disables Synchronous I/O mode.

See also...

- 3-4 "Live List"
- 3-5 "Valid Data List"
- 4-3 "Synchronous Data I/O"

## Change Operation Mode

The master features the following Operation Modes:

Operation Mode	Description
Idle - DE Active	AS-Interface network is idle, but the communication is still active (i.e. the DE-flag is set)
Idle - DE Inactive	AS-Interface network is idle, but no data exchange messages are issued on the AS-Interface network (i.e. the DE-flag is cleared). Slaves which implement watchdog functionality will, after a timeout, go to a "fail-safe" state with default values.
Running	AS-Interface network is running, DE-flag is set. <b>Note:</b> It is required to shift to this mode in order for the gateway to start exchanging data.

**Note:** When shifting from 'Idle - DE Inactive', all slaves will be included again one by one, a process which may take as long as 1 second to complete on a fully populated AS-Interface network.

See also...

- 3-8 "Control Word"

# Master Config Interface

## General Information

The Master Config Interface can be accessed via RS232 using standard terminal emulation software.

The interface uses the following communication settings:

Emulation:	ASCII
Baud rate:	57600bps
Data bits:	8
Stop bits:	1
Parity:	None
Flow control:	None

The interface features a hierarchical menu system as follows:

	Menu Level 1	Menu Level 2	Menu Level 3	Menu Level 4
(Main Menu)	View scan-lists			
	View all slaves	Select Slave	Change Param	Parameter
			Change NV Param	NV Parameter
			Change NV I/O	NV I/O
			Change NV ID	NV ID
			Change NV Ext ID1	NV Ext ID1
			Change NV Ext ID2	NV Ext ID2
			Change Node address	Node address
	View all detected slaves	Select Slave	Change Param	Parameter
			Change NV Param	NV Parameter
			Change NV I/O	NV I/O
			Change NV ID	NV ID
			Change NV Ext ID1	NV Ext ID1
			Change NV Ext ID2	NV Ext ID2
			Change Node address	Node address
	View single slave	Select Slave	Change Param	Parameter
			Change NV Param	NV Parameter
			Change NV I/O	NV I/O
			Change NV ID	NV ID
			Change NV Ext ID1	NV Ext ID1
			Change NV Ext ID2	NV Ext ID2
			Change Node address	Node address
			I/O Monitor	I/O Data
	Toggle Mode	Select Configuration	Configuration Mode	
		Select Protected	Protected Mode	
	Toggle online/offline	Select online	Online	
		Select offline	Offline	
	Toggle auto address enabled / disabled	Enable Auto Address	Enabled	
Disable Auto Address		Disabled		
Save Configuration	Configuration Saved			

## Invoking the Configuration Interface

When the interface detects a connection on the Master Config Interface, the following message is displayed.

```
-----
Press Enter for configuration menu
-----
NOTE: I/O exchange will be halted
-----
```

To open the Configuration Interface, press <Enter>.

## Main Menu

The main menu holds the following menu entries.

Menu Command	Description
View scan-lists	Display AS-i scan lists
View all slaves	Display all slaves together with their actual configuration (Note that only detected slaves contain configuration information)
View all detected slaves	Display all detected slaves together with their actual configuration
View single slave	Display the actual and permanent configuration of a specified slave
Toggle Mode	Toggle between Protected Mode and Configuration Mode
Toggle online/offline	Toggle between online / offline status
Toggle auto address enabled / disabled	Enable / Disable automatic slave 0 addressing
Save Configuration	Store actual configuration in EEPROM and use as permanent configuration

```
Anybus-M AS-i Main Menu
-----
```

```
1 - View scan-lists
2 - View all slaves
3 - View all detected slaves
4 - View single slave
5 - Toggle Protected/Configuration
6 - Toggle Online/Offline
7 - Toggle auto addressing On/Off
8 - Save configuration
-----
```

```
Offline phase active: False  Power fail:           False
Normal operation:      True   Slave 0 exists:      False
Configuration match:  False  Periphery fault:    False
Address collision:     False  EEPROM status:      Ok
Auto address enable:  On     Auto address assign: False
Offline mode:          Online
Autoprogramming:      Not possible
Operation mode:        Configuration
```

```
>
```

*This section reflects the state of the AS-i flag bytes. For more information, consult the AS-i Specification.*

## View Scanlists

This menu displays an overview of the state of the slaves on the AS-Interface network as follows:

```

-----
Anybus-M AS-i View Scan-lists
-----
Detected Slaves
 0  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15
-  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -
16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
-  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -
32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47
-  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -
48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63
-  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -
Configured Slaves
 0  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15
-  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -
16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
-  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -
32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47
-  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -
48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63
-  -  -  -  -  -  -  -  -  -  -  -  -  -  -  X
Activated Slaves
 0  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15
-  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -
16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
-  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -
32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47
-  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -
48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63
-  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -
List of periphery faulted slaves
 0  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15
-  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -
16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
-  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -
32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47
-  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -
48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63
-  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -
>

- : No slave present
x : Slave present

```

## View All Slaves

This menu displays the I/O configuration, ID codes etc. for each slave on the network.

```

-----
Anybus-M AS-i View All Slaves
-----
  Select slave to view (dec)
  Back - Esc
-----
Slave  0  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15
I/O    -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -
ID     -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -
Param  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -
Slave 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
I/O    -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -
ID     -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -
Param  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -
Slave 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47
I/O    -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -
ID     -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -
Param  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -
Slave 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63
I/O    -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -
ID     -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -
Param  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -
>

```

To alter the settings for a particular slave, enter the slave address and press <Enter>.

## View Detected Slaves

This menu displays all detected slaves on the AS-Interface network.

```

-----
Anybus-M AS-i View All Detected Slaves
-----
  Select slave to view (dec)
  Back - Esc
-----

Slave  ID  I/O  ID1  ID2  Param
>

```

To alter the settings for a particular slave, enter the slave address and press <Enter>.

## View Single Slave

This menu provides access to the settings of an individual AS-Interface slave.

```

-----
Anybus-M AS-i View single slave
-----
  Enter slave number (dec)
-----

```

To view or alter the settings for a particular slave, enter the slave address and press <Enter>.

## Toggle Mode

This menu is used when switching between Protected- and Configuration Mode.

```
-----  
Anybus-M AS-i Toggle Protected/Configuration  
-----  
1 - Configuration  
2 - Protected  
-----  
  
Module in configuration mode
```

Specify the mode of operation or press <ESC> to cancel.

## Toggle Online / Offline Mode

This menu is used when switching between online- and offline mode.

```
-----  
Anybus-M AS-i Toggle Online/Offline  
-----  
1 - Offline  
2 - Online  
-----  
  
AS-i bus online
```

Specify the mode of operation or press <ESC> to cancel.

## Auto Address

This menu is used when enabling/disabling the automatic address programming feature.

```
-----  
Anybus-M AS-i Toggle Auto address On/Off  
-----  
1 - Auto addressing On  
2 - Auto addressing Off  
-----  
  
Auto addressing enabled
```

Specify the mode of operation or press <ESC> to cancel.

## Save Configuration

This menu is used when storing the current configuration in non-volatile memory.

```
-----  
Anybus-M AS-i Save configuration  
-----  
Press Enter to save configuration  
-----
```

Press <Enter> to store the current configuration, or <ESC> to cancel.

**Note:** Saving the configuration is not permitted in Protected Mode.

## Slave Settings

The following menu appears when altering the settings for a particular slave (main menu entries 1... 4).

```

-----
      Select value to change
-----
1 - Change Parameter
2 - Change NV Parameter
3 - Change NV I/O
4 - Change NV ID
5 - Change NV Ext ID1
6 - Change NV Ext ID2
7 - Change Node address
-----

Values for node number: 45

I/O      f          NV I/O    f
ID       f          NV ID     f
ID1     f          NV ID1    f
ID2     f          NV ID2    f
Param   f          NV Param  f
>

```

To alter a particular setting, enter the corresponding digit and press <Enter>. An additional menu appears, allowing the specified setting to be altered. Specify the new value and press <Enter>.

```

-----
      Change Parameter
-----
      Enter new value
      Back - Esc
-----

Value for node number: 45

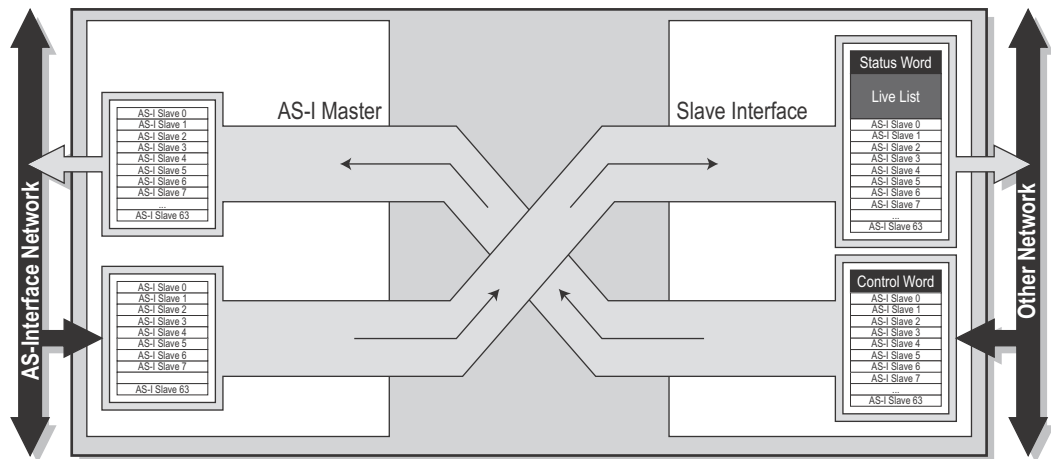
Old value    f
>

```

# Data Exchange

## General Information

The following figure illustrates the flow of data through the gateway:



Due to the nature of the AS-Interface networking system, a few things need to be kept in mind:

- The Control- and Status Words cannot be accessed from the AS-Interface network
- AS-Interface slave 0A (0) is used for automatic slave address assignment and cannot be used for data exchange.
- Slave 0B (32) is reserved and cannot carry any data.
- The Live List, Valid Data List and the Control/Status Words can be completely disabled via the Gateway Config interface.

For more information, consult the user manual.

# Data Format

## General Information

The following data is forwarded to/from the other network side:

- **Input Buffer**
  - Status Word (Consult the user manual for further information)
  - Live List (3-4 “Live List”)
  - Valid Data List (3-5 “Valid Data List”)
  - Input Data Image (3-3 “Digital I/O Image”)
  - Analog Input Image (3-4 “Analog I/O”)
  
- **Output Buffer**
  - Control Word (3-8 “Control & Status Word Implementation”)
  - Output Data Image (3-3 “Digital I/O Image”)
  - Analog Output Image (3-4 “Analog I/O”)

**Note:** The Control- and Status Words are not represented on the AS-Interface side.

## Digital I/O Image

AS-Interface is nibble-oriented; each slave carries 4 bits in each direction. This is reflected in the Digital I/O block, where data can be represented either in packed (nibble) mode or in byte-mode. The former packs the data of two slaves into a single byte, while the latter assigns a full byte to each slave (in such case, the upper 4 bits will not carry any data).

Since most other networks are either byte- or word-oriented; this must be taken in account when setting up the network communication.

- **Byte Mode (Default)**

(The data is located in the lower nibble of each byte)

Offset	Slave no.															
0... 7		0		1		2		3		4		5		6		7
8... 15		8		9		10		11		12		13		14		15
16... 23		16		17		18		19		20		21		22		23
24... 31		24		25		26		27		28		29		30		31
32... 39		-		1B		2B		3B		4B		5B		6B		7B
40... 47		8B		9B		10B		11B		12B		13B		14B		15B
48... 55		16B		17B		18B		19B		20B		21B		22B		23B
56... 63		24B		25B		26B		27B		28B		29B		30B		31B

- **Nibble Mode**

(Even slaves = low nibble, odd slaves = high nibble)

Offset	Slave no.															
0... 7	1	0	3	2	5	4	7	6	9	8	11	10	13	12	15	14
8... 15	17	16	19	18	21	20	23	22	25	24	27	26	29	28	31	30
16... 23	1B	-	3B	2B	5B	4B	7B	6B	9B	8B	11B	10B	13B	12B	15B	14B
24... 31	17B	16B	19B	18B	21B	20B	23B	22B	25B	24B	27B	26B	29B	28B	31B	30B

**Note:** Slaves 0A (0) and 0B (32) are reserved for special purposes and does not carry any data.

See also...

- 2-1 “Configuration Settings” (‘Data Representation’)

## Analog I/O

The Analog I/O block holds data exchanged over Combined Transaction Types 1... 5.

The actual layout of this block depends on the profile of each slave.

*Example:*

Offset	Word no.	Description
0... 1	1	Analog Input Data for slave 1, channel 0
2... 3	2	Analog Input Data for slave 1, channel 1
4... 5	3	Analog Input Data for slave 1, channel 2
6... 7	4	Analog Input Data for slave 1, channel 3
8... 9	5	Analog Input Data for slave 2, channel 0
10... 11	6	Analog Input Data for slave 2, channel 1
12... 13	5	Analog Input Data for slave 2B, channel 0
14... 15	6	Analog Input Data for slave 2B, channel 1
...	...	...
246... 247	124	Analog Input Data for slave 31, channel 3

See also...

- 3-5 “Valid Data List”

## Live List

The Live List is an 8-byte bitfield which holds the active status of each slave on the AS-Interface network.

**Note:** The Live List can be disabled through the Gateway Configuration Interface.

See also...

- 2-1 “Configuration Settings”

## Valid Data List

The Valid Data List indicates the validity of each analog/transparent (CTT) data channel through a single bit, and is refreshed every 5ms.

Offset:	b7 (MSB)	b6	b5	b4	b3	b2	b1	b0 (LSB)
0	Slave: 2:3/2B:1	Slave: 2:2/2B:0	Slave: 2:1/2A:1	Slave: 2:0/2A:0	Slave: 1:3/1B:1	Slave: 1:2/1B:0	Slave: 1:1/1A:1	Slave: 1:0/1A:0
1	Slave: 4:3/4B:1	Slave: 4:2/4B:0	Slave: 4:1/4A:1	Slave: 4:0/4A:0	Slave: 3:3/3B:1	Slave: 3:2/3B:0	Slave: 3:1/3A:1	Slave: 3:0/3A:0
2	Slave: 6:3/6B:1	Slave: 6:2/6B:0	Slave: 6:1/ 6A:1	Slave: 6:0/6A:0	Slave: 5:3/5B:1	Slave: 5:2/5B:0	Slave: 5:1/5A:1	Slave: 5:0/5A:0
3	Slave: 8:3/8B:1	Slave: 8:2/8B:0	Slave 8:1/ 8A:1	Slave: 8:0/8A:0	Slave: 7:3/7B:1	Slave: 7:2/7B:0	Slave: 7:1/7A:1	Slave: 7:0/7A:0
4	Slave: 10:3/10B:1	Slave: 10:2/10B:0	Slave: 10:1/10A:1	Slave: 10:0/10A:0	Slave: 9:3/9B:1	Slave: 9:2/9B:0	Slave: 9:1/9A:1	Slave: 9:0/9A:0
5	Slave: 12:3/12B:1	Slave: 12:2/12B:0	Slave: 12:1/12A:1	Slave: 12:0/12A:0	Slave: 11:3/11B:1	Slave: 11:2/11B:0	Slave: 11:1/11A:1	Slave: 11:0/11A:0
6	Slave: 14:3/14B:1	Slave: 14:2/14B:0	Slave: 14:1/14A:1	Slave: 14:0/14A:0	Slave: 13:3/13B:1	Slave: 13:2/13B:0	Slave: 13:1/13A:1	Slave: 13:0/13A:0
7	Slave: 16:3/16B:1	Slave: 16:2/16B:0	Slave: 16:1/16A:1	Slave: 16:0/16A:0	Slave: 15:3/15B:1	Slave: 15:2/15B:0	Slave: 15:1/15A:1	Slave: 15:0/15A:0
8	Slave: 18:3/18B:1	Slave: 18:2/18B:0	Slave: 18:1/18A:1	Slave: 18:0/18A:0	Slave: 17:3/17B:1	Slave: 17:2/17B:0	Slave: 17:1/17A:1	Slave: 17:0/17A:0
9	Slave: 20:3/20B:1	Slave: 20:2/20B:0	Slave: 20:1/20A:1	Slave: 20:0/20A:0	Slave: 19:3/19B:1	Slave: 19:2/19B:0	Slave: 19:1/19A:1	Slave: 19:0/19A:0
10	Slave: 22:3/22B:1	Slave: 22:2/22B:0	Slave: 22:1/22A:1	Slave: 22:0/22A:0	Slave: 21:3/21B:1	Slave: 21:2/21B:0	Slave: 21:1/21A:1	Slave: 21:0/21A:0
11	Slave: 24:3/24B:1	Slave: 24:2/24B:0	Slave: 24:1/24A:1	Slave: 24:0/24A:0	Slave: 23:3/23B:1	Slave: 23:2/23B:0	Slave: 23:1/23A:1	Slave: 23:0/23A:0
12	Slave: 26:3/26B:1	Slave: 26:2/26B:0	Slave: 26:1/26A:1	Slave: 26:0/26A:0	Slave: 25:3/25B:1	Slave: 25:2/25B:0	Slave: 25:1/25A:1	Slave: 25:0/25A:0
13	Slave: 28:3/28B:1	Slave: 28:2/28B:0	Slave: 28:1/28A:1	Slave: 28:0/28A:0	Slave: 27:3/27B:1	Slave: 27:2/27B:0	Slave: 27:1/27A:1	Slave: 27:0/27A:0
14	Slave: 30:3/30B:1	Slave: 30:2/30B:0	Slave: 30:1/30A:1	Slave: 30:0/30A:0	Slave: 29:3/29B:1	Slave: 29:2/29B:0	Slave: 29:1/29A:1	Slave: 29:0/29A:0
15	-	-	-	-	Slave: 31:3/31B:1	Slave: 31:2/31B:0	Slave: 31:1/31A:1	Slave: 31:0/31A:0
16 <sup>a</sup>	ASI Flag 7	ASI Flag 6	ASI Flag 5	ASI Flag 4	ASI Flag 3	ASI Flag 2	ASI Flag 1	ASI Flag 0
17 <sup>b</sup>	ASI Flag 15	ASI Flag 14	ASI Flag 13	ASI Flag 12	ASI Flag 11	ASI Flag 10	ASI Flag 9	ASI Flag 8

a. See 3-9 "Status Flags 1 (698h, RO)"

b. See 3-9 "Status flags 2 (699h, RO)"

**Note:** The Valid Data List can be disabled through the Gateway Configuration Interface.

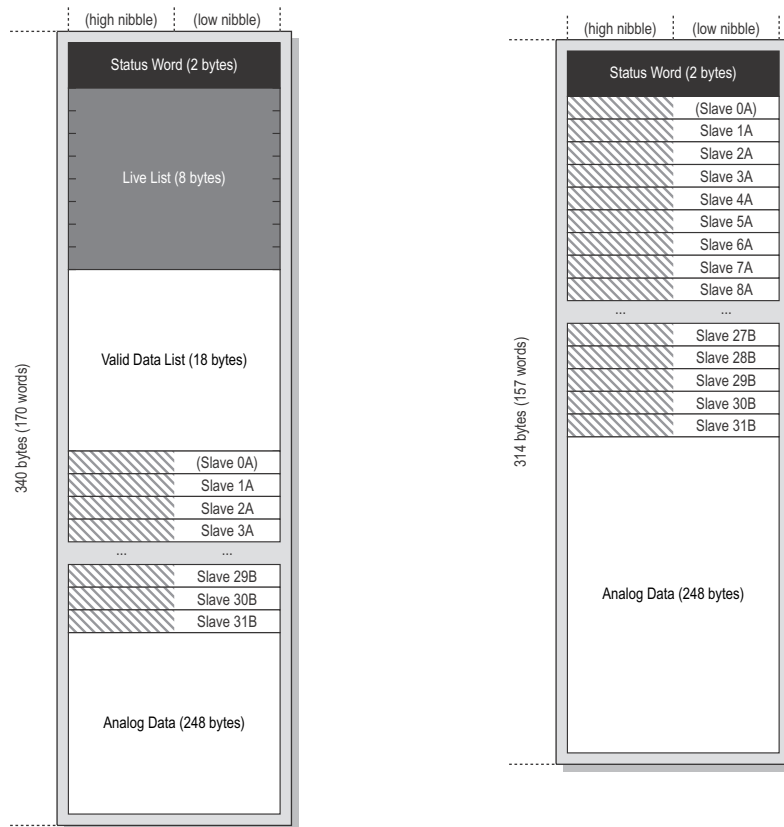
See also...

- 3-4 "Analog I/O"
- 2-1 "Configuration Settings"

# Configuration Examples

## Input Data

The following examples illustrates how data from the AS-Interface network appears on the other network side.



### Example A:

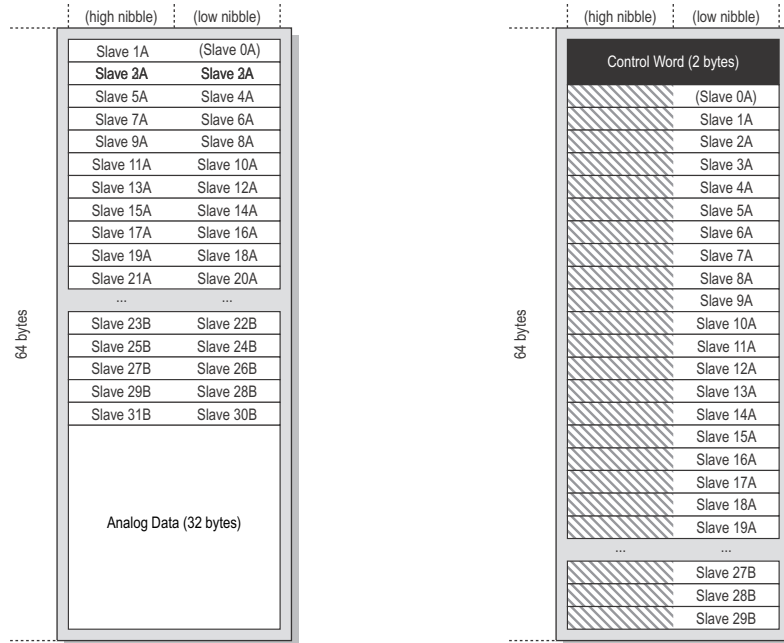
Live List = Enabled  
 Valid Data List = Enabled  
 Control & Status Word = Enabled  
 Data Representation = Byte Mode

### Example B:

Live List = Disabled  
 Valid Data List = Disabled  
 Control & Status Word = Enabled  
 Data Representation = Byte Mode

## Output Data

The following examples illustrate how the gateway interprets data from the other network, and forwards information to the slaves on the AS-Interface network.



### Example A:

Live List = N/A  
 Valid Data List = N/A  
 Control & Status Word = Disabled  
 Data Representation = Nibble Mode

### Example B:

Live List = N/A  
 Valid Data List = N/A  
 Control & Status Word = Enabled  
 Data Representation = Byte Mode

## Control & Status Word Implementation

### Status Word

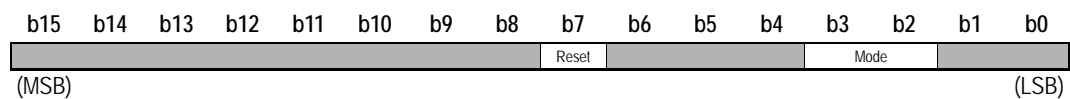
The Status Word holds general status information from the gateway.

(Consult the user manual for further information.)

### Control Word

The Control Word, if enabled, controls the communication towards the slaves on the AS-Interface network.

Control Word Contents:



Mode	Meaning	Comments
00b	Idle - DE Active	These settings are also available from the Gateway Config interface.  See also... - 2-2 "Change Operation Mode"
01b	Idle - DE Inactive	
10b	Running	
11b		

**Note:** When shifting from 'Idle - DE Inactive', all slaves will be included again one by one, a process which may take as long as 1 second to complete on a fully populated AS-Interface network.

Reset	Meaning	Comments
0b	Normal operation	-
1b	Reset gateway	Setting this bit causes the gateway to perform a self-reset.

**Note:** The Control- and Status Words can be disabled through the Gateway Configuration Interface. In such case, the master interface will enter 'Running' mode automatically after having completed the start up initialisation sequence.

## AS-i Status Flags

### Status Flags 1 (698h, RO)

For more information, please consult the AS-i Specification.

Bit	Content	Comment
0 (LSB)	Get_Flag_Offline_Ready()	Offline phase active
1	Status, Flag = Get_Flag_apf()	Voltage on AS-i too low
2	Get_Flag_Normal_Operation_Active()	Normal operation
3	Operation Mode	0: Protected mode 1: Configuration Mode
4	Get_Flag_Auto_Prog_Available()	Automatic address assignment will be processed as soon as a slave with zero address and valid configuration data is connected
5	Auto Address Assign	Automatic address assignment possible
6	Get_Flag_LDS.0()	Slave with address 0 exists
7 (MSB)	Get_Flag_Config_OK()	Actual configuration matches configured configuration

### Status flags 2 (699h, RO)

For more information, please consult the AS-i Specification.

Bit	Content	Comment
0 (LSB)	Offline mode	Offline mode
1	-	(reserved)
2	EEPROM OK	EEPROM OK
3	Mode = Get_Auto_Address_Enable	Automatic addressing enabled (set by the user)
4	Get_Flag_Periphery_OK()	Periphery fault detected
5	Address Collision	Address collision detected
6	-	(reserved)
7 (MSB)		

# AS-Interface Implementation Details

## General Information

The AS-Interface network interface is implemented according to the AS-i Complete Specification (CS) Version 3.0, rev. 1.

### Supported Slave Types

- **Standard Slaves**  
4 bits of I/O in each direction.
- **Slaves w. Extended Addressing Mode**  
3 bits out, 4 bits in, can be configured as A- or B-slaves, allowing up to 62 slaves to be used.
- **Slaves w. support for Combined Transactions**  
Up to 4 analog I/O channels, or other types of I/O which requires one or more bytes of data. The following Combined Transaction types are supported:

Type	Slave Profile	Comments
Type 1	S-7.1	(not supported)
Type 1	S-7.2	(not supported)
Type 1	S-7.3	16-bit I/O
Type 1	S-7.4 <sup>a</sup>	Complex field devices
Type 2	S-7.5.5 <sup>b</sup>	Combi field devices
Type 2	S-7.A.5 <sup>b</sup>	Combi field devices
Type 2	S-B.A.5	Serial communication field devices
Type 3	S-7.A.7	4I/4O in extended address mode
Type 3	S-7.A.A	8I/8O in extended address mode
Type 4	S-7.A.8	16-bit inputs in extended address mode
Type 5	S-6.0	High speed 16-bit I/O
Safety at Work	S-0.B	Safety at Work input slaves
Safety at Work	S-7.B	Safety at Work input slaves with standard outputs

a. Acyclic STRING services operating on 7.4 slaves are not supported.

b. 'Issue CTT2 command' (CTT2\_CMD) is not supported

**Note:** The AS-i Master interface does not implement support for the 'Reset' and 'Read Status' services on individual slaves.

### Master Profiles

The master interface supports the following master profiles:

- **Profile M3**  
Full extended master, Combined Transaction type 1.
- **Profile M4**  
Support for Combined Transaction types 2, 3, 4 and 5.

## Network Security

The Master Interface offers two modes of operation related to network security; Configuration Mode and Protected Mode. For network security reasons, certain functions that are available in Configuration Mode are not available in Protected Mode and vice versa.

- **Configuration Mode**

All slaves attached to the network are active instantly. Automatic slave address assignment is not possible in this mode.

- **Protected Mode**

Slaves must be detected and configured in order to become active. Automatic slave address assignment is possible in this mode.

See also...

- 4-3 “Configuration Button”
- 2-7 “Toggle Mode”

## Automatic Slave Address Assignment

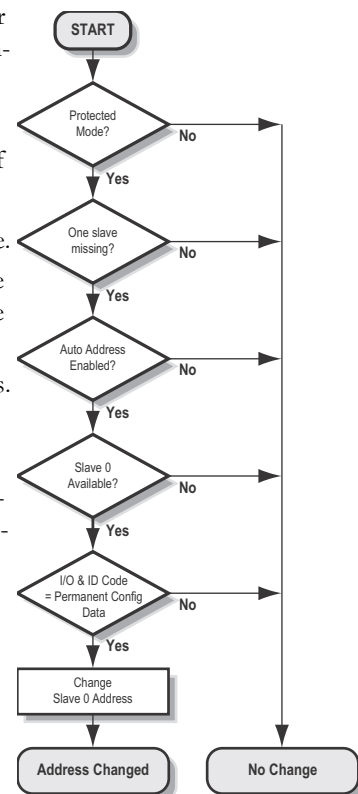
This is a powerful feature which allows a failed sensor or actuator to be exchanged without requiring time consuming network configuration procedures.

This is a critical procedure which can potentially lead to errors if not cautious. Hence, certain restrictions apply:

- The Master Interface must be running in Protected Mode.
- The network must be projected, i.e. the Master Interface must hold information about the type and address of the slaves in error-free operation.
- Only one slave can be missing in the List of Active Slaves.
- Automatic Slave Addressing must be enabled
- The replacement slave must be of the same type as the failed one, i.e. I/O configuration and ID-code must correspond to the permanent configuration data in the Master Interface.

See also...

- 4-2 “Network Security”
- 2-8 “Auto Address”



## Synchronous Data I/O

The Master interface supports Synchronous Data I/O, which enables synchronous I/O operations for a specific range of slaves on the network. This functionality is based on the concept of exchanging data in the normal cycle, and validating that data based on an additional trigger event.

See also...

- 2-1 “Configuration Settings”

## Configuration Button

The on-board configuration button serves two purposes:

- **Mode Change**  
Pushing the button for less than two seconds causes the master interface to toggle between Configuration Mode and Protected Mode.
- **Initiate Auto Configuration**  
Pushing and holding the button for more than five seconds enables Auto Configuration; the master interface will upload the network configuration and save it as the pre-set configuration. This is only permitted in Configuration Mode.

**Note:** Bus power must be present in order for this functionality to be available.

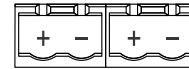
See also...

- 1-2 “Status LEDs”
- 4-2 “Network Security”

# Technical Specification

## AS-Interface Connector Pinout

Pin	Signal
+	AS-Interface +
-	AS-Interface -



## Master Config Interface Pinout

Pin	Signal
1	-
2	RS232 Receive
3	RS232 Transmit
4	-
5	Ground
6	-
7	-
8	-
9	-
Housing	Protective Earth

