WAGO I/O SYSTEM 750

Fieldbus Independent I/O Modules

2 AO 0/+-10V DC 16 Bit 750-562

Manual

Version 1.1.1

WAGO®
INNOVATIVE CONNECTIONS

WAGO Kontakttechnik GmbH & Co. KG
Hansastraße 27
D-32423 Minden

Phone.: +49 (0) 571/8 87 – 0
Fax: +49 (0) 571/8 87 – 1 69

E-Mail: info@wago.com

Web: http://www.wago.com

Technical Support
Phone.: +49 (0) 571/8 87 – 5 55
Fax: +49 (0) 571/8 87 – 85 55

E-Mail: support@wago.com

Every conceivable measure has been taken to ensure the correctness and completeness of this documentation. However, as errors can never be fully excluded, we would appreciate any information or ideas at any time.

E-Mail: documentation@wago.com

We wish to point out that the software and hardware terms as well as the trademarks of companies used and/or mentioned in the present manual are generally trademark or patent protected.

Content

1.1 Scope

This manual describes the Analog Output Module 750-562
2 AO 0/+-10V DC 16 Bit of the modular WAGO-I/O-SYSTEM 750.

Handling, assembly and start-up are described in the manual of the Fieldbus Coupler. Therefore this documentation is valid only in the connection with the appropriate manual.

2 I/O Modules

2.1 Analog Output Modules

2.1.1 750-562 [2 AO 0/+-10V DC 16 Bit]

2-channel analog output module, 0 ... 10 V / -10 ... +10 V DC,
16 Bit, configurable

2.1.1.1 View

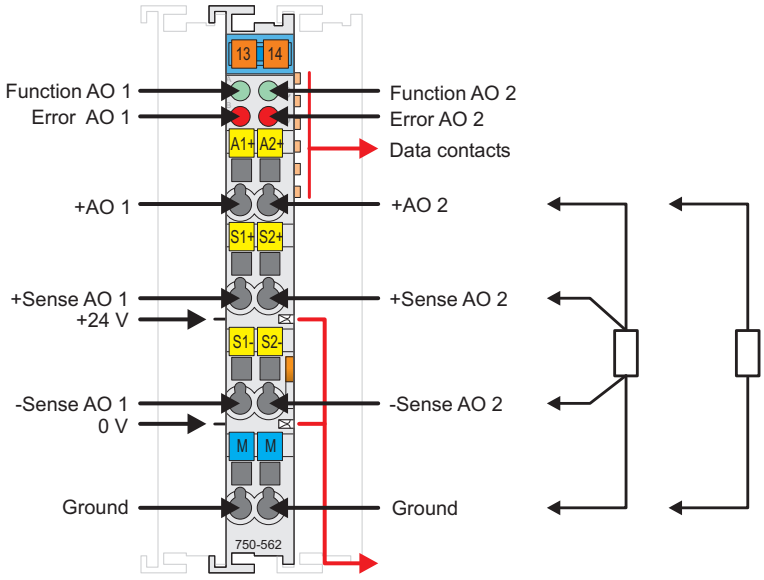

Fig. 2.1.1-1: View g056200e

2.1.1.2 General Description

The 750-562 analog output module generates output voltages in the range from 0 ... 10 V or –10 ... +10 V for the field area.

The module has two short circuit-proof output channels and enables the direct cabling of two 2-line actuators on the connections AO 1 and ground or AO2 and ground. The output of the signals occurs via AO 1 or AO 2.
In addition, the sense lines from 4-line actuators can be connected to the connections Sense AO1 and +Sense AO1 or Sense AO2 and +SenseAO2.

The integrated drivers of the end levels are temperature-monitored.

Both output channels have a common ground potential.

The output signal is electrically isolated from the system level and will be output with a resolution of 16 bits.

The readiness for operation and the disturbance-free I/O module communication of the module is indicated with one green function LED per channel.
An overload or a short circuit of an output is indicated by one red error LED per channel.

The calibration data is stored individually for each operating mode and can be scaled. For the process data output, a lower and an upper limit value can be specified.

Furthermore, a variety of adjustment possibilities can be made, including calibration data switching, numeric format and numeric display switching, output behavior for I/O module timeout, (repeat) switch-on delay after excessive temperature switch-off, etc. The individual output modules can be arranged in any combination when configuring the fieldbus node. An arrangement in blocks is not necessary.

The internal system supply is used for the power supply. The field power supply is only forwarded to the downstream I/O modules.

The system voltage is monitored for undervoltage.

The output module receives the 0 V potential and the 24 V for downstream I/O modules via an upstream I/O module or via a supply module. Power connections are made automatically from module to module via the internal power jumper contacts when the output modules are snapped onto the DIN rail.

Warning
The maximum current that is permitted to flow through the power jumper contacts is 10A. When configuring the system, ensure that this total current is not exceeded. If this should happen, an additional supply module has to be used.

The output module can be operated on all couplers/controllers (with the exception of the economy variants 750-320, -323, -324, and -327) of the WAGO-I/O-SYSTEM 750.

2.1.1.3 Connecting Elements

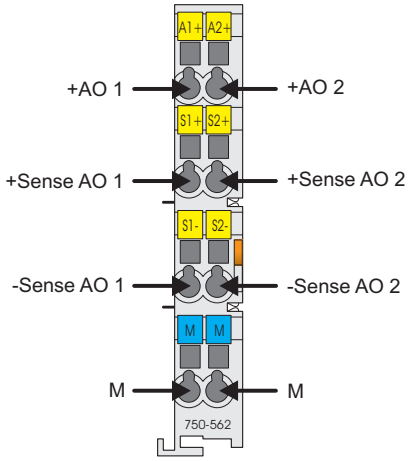

Fig. 2.1.1-2: Connecting elements
g056203x

Connection	Name	Function
1	A1+	Analog output 1
2	S1+	Positive sense connection for analog output 1
3	S1-	Negative sense connection for analog output 1
4	M	Ground for analog outputs
5	A2+	Analog output 2
6	S2+	Positive sense connection for analog output 2
7	S2-	Negative sense connection for analog output 2
8	M	Ground for analog outputs

2.1.1.4 Indicators

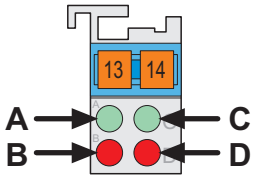

Fig. 2.1.1-3: Indicators
g056002x

LED	Channel	Name	Status	Function
A	1	RUN	off	I/O module timeout
			green	Internal data bus OK
B	1	ERROR	off	No group error
			red	Group error
C	2	RUN	off	Internal data bus timeout
			green	Internal data bus OK
D	2	ERROR	off	No group error
			red	Group error

2.1.1.5 Operating Elements

The 750-562 analog output module has no operating elements.
The configuration and the parameters can be changed via the higher-level controller or with the WAGO-I/O-CHECK configuration tool.

2.1.1.6 Schematic Diagram

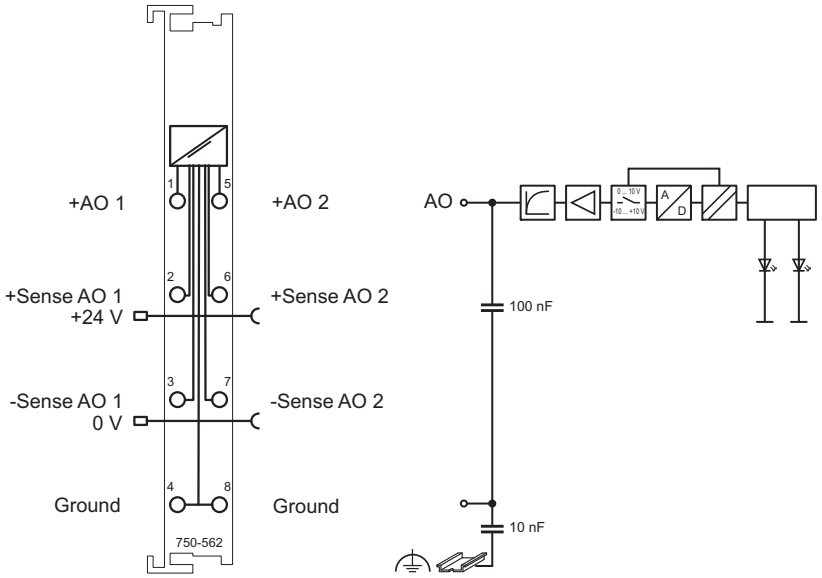

Fig. 2.1.1-4: Schematic circuit diagram g056201e

2.1.1.7 Process Image

The analog output module 750-562 transmits 16 Bit data and 8 status bits per channel.

The digitalized output value is transmitted in a data word (16 bits) as output byte 0 (low) and output byte 1 (high) via the process image of the coupler/controller.
This value is represented with a 16 bit resolution on bit B0 ... B15.

Some fieldbus systems can process the status information using by means of a status byte.
However, processing of the status byte via the coupler/controller is optional, which means that accessing or parsing the status information depends on the fieldbus system.

2.1.1.7.1 Process Values

Data format 0 ... 65535		
Manufacturer calibration, without user scaling		
0 ... 10 V, [U_A] = V	Numeric value	
	hexadecimal	decimal
0.0	0000	0
2.5	3FFF	16383
5.0	7FFF	32767
7.5	BFFF	49151
10.0	FFFF	65535

Data format 0 ... 65535		
Manufacturer calibration, without user scaling		
-10 ... +10 V, [U_A] = V	Numeric value	
	hexadecimal	decimal
-10.0	0000	0
-5.0	3FFF	16383
0.0	7FFF	32767
+5.0	BFFF	49151
+10.0	FFFF	65535

Data format –32768 ... +32767 (twos complement)		
Manufacturer calibration, without user scaling		
-10 ... +10 V, [U_A] = V	**Numeric value**	
	hexadecimal	**decimal**
-10.0	8000	32768
-5.0	C000	49152
0.0	0000	0
+5.0	3FFF	16383
+10.0	7FFF	32767

Data format –32767 ... +32767 (leading sign/amount)		
Manufacturer calibration, without user scaling		
-10 ... +10 V, [U_A] = V	**Numeric value**	
	hexadecimal	**decimal**
-10.0	FFFF	65535
-5.0	BFFF	49151
0.0	0 or 8000	0 or 32768
+5.0	3FFF	16383
+10.0	7FFF	32767

Numeric formats							
Display	**-10 V** **0 V**						**+10 V** **10 V**
0 ...65535	0x0000 0	→	0x7FFF 32767		0x8000 32768	→	0xFFFF 65535
Twos complement	0x8000 -32768	→	0xFFFF -1		0x0001 0	→	0x7FFF 32767
Leading sign/amount	0xFFFF -32767	→	0x8001 -1		0x0001	→	0x7FFF 32767

Setting of the upper and lower limit value depending on the numeric format:

In the +/- numeric ranges, the limit values must be re-calculated to a positive equivalent in the range from 0 ... 65535 (see table).

1. Example: twos complement

Lower limit: -10 -> underrange limit value (register 41): 32758
Upper limit: +10 -> overrange limit value (register 42): 32778

2. Example: leading sign/amount

Lower limit: -10 -> underrange limit value (register 41): 32758
Upper limit: +10 -> overrange limit value (register 42): 32778

Setting the upper and lower limit value depending on a scaling:

3. Example: scaling

–10000 should correspond to –10 V, +10000 should correspond to +10 V.

This way, the scaling factor is: 32767 / 10000 = 3,2767.

3,2767 * 256 (increment with scaling) = 839.

839 is the amplification factor (gain, register 34). The offset (register 33) remains 0.

If limit values should now be determined, these must be multiplied by 3.2767 and then re-calculated as in the first example to a numeric equivalent in the range from 0 ... 65535.

2.1.1.8 Function Description

The conversion algorithm takes into account all calculation and evaluation steps of the process data up to the analog output value. The individual steps will be explained in this chapter. The figure below provides a graphic overview of the stepwise processing of the input value.

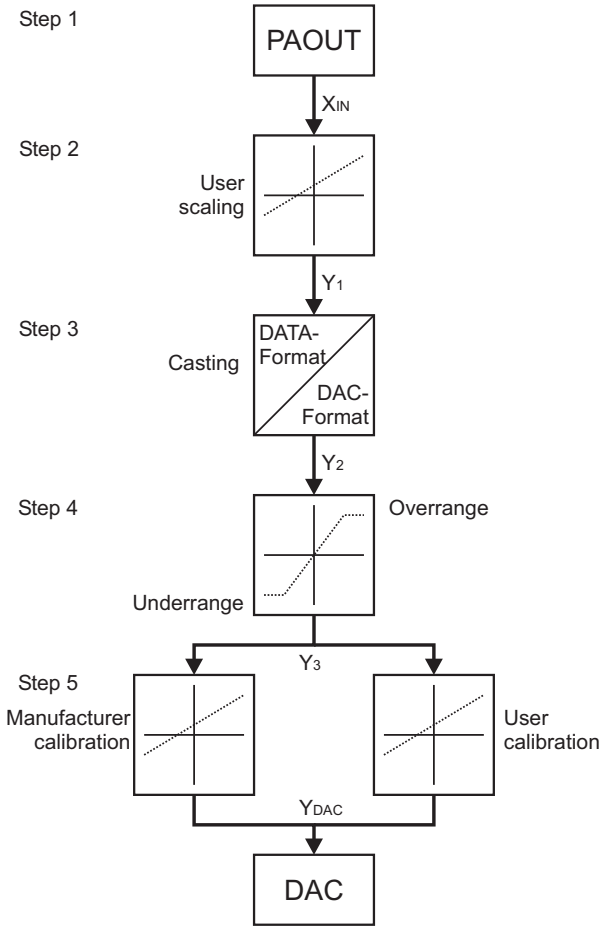

Fig. 2.1.1-5: Conversion algorithm g056204e

2.1.1.8.1 Step 1 – Reading Out X_{IN} Process Data

X_{IN} is transmitted to the module with the process data communication. The 16 bit-wide value depends on the data format. The data format is determined by bit 3 and bit 6 in register 32.
The following data formats are possible:

Bit width	Description	Minimum value	Maximum value
16 bits	Integer without leading sign	0	65535
16 bits	Integer with leading sign	-32768	+32767
15 bits	Integer with leading sign bit	-32767 (leading sign bit = 1)	+32767 (leading sign bit = 0)

2.1.1.8.2 Step 2 – Y_1 User Scaling

The value for Y_1 is generated with the user scaling if this is approved through bit 0 of the register 32. The value X_{IN} serves as input value for the user scaling. For switched-off user scaling, the value X_{IN} is transferred unchanged to Y_1.

The calculation occurs taking into account the configured data format and the quality rating of the results is determined by an amplification factor and an offset.

Configuration of the user scaling	Description
Register 33 - $Offset_{AS}$	Offset
Register 34 - $Gain_{AS}$	Amplification factor

Calculation formula:

$$Y_1 = X_{IN} * Gain_{AS} / 256 + Offset_{AS}$$

The user scaling serves to adjust a desired process value range to the analog output range specified through the calibration.

Thus, for example, with a module calibrated from -10V to +10V, the process data value range with a leading sign of -10000 to +10000 can be mapped to this output value range.

The calculation for the user scaling is carried out module-internally in the 32 bit numeric range.

With the use of the user scaling, the required precision of the resolution of the analog adjusting range is changed, but not essentially limited. It is at the discretion of the user whether the user scaling should be used or not. With a GainAS = 256, the resolution remains uninfluenced in the 16-bit wide numeric range.

The value of 1/256 permits amplifications in the range from 0.0039 to 255,9960 and thus offers the user scaling a very high variation range.

2.1.1.8.3 Step 3 – Y_2 Conversion of the Data Format

In this step, the value Y_1 determined through the configured data format is converted into the DAC format, leading sign-less 16 bit integer. The context of the conversion is described below:

Integer without leading sign	Integer with leading sign	Integer with leading sign bit	DAC format
0	-32768	undefined	0
1	-32767	-32767	1
...	...	...	...
32768	0	0	32768
...	...	...	...
65535	+32767	+32767	65535

2.1.1.8.4 Step 4 – Y_3 Limit Control

The limit control monitors whether the value Y_2 in DAC format is in the desired value range. This value range is defined by the parameter underrange limit value (UNR) and the overrange limit value (OVR). Via bit 7 of the register 32, it is also possible to activate a limit of the value Y_3 to this range.

During the determination of the calibration values for the manufacturer or user calibration, no limit should be placed. You can achieve this by configuring the overrange and underrange limit values to the maximum or minimum value (65535 or 0) or by writing a 0 to bit 7 of register 32.

Configuration of the overrun limit		
Register	**Name**	**Description**
41		Underrange limit value
42		Overrange limit value

If you would like to set the limits to defined analog output values, then these must be determined either like the calibration values in step 5 or calculated from these.

2.1.1.8.5 Step 5 – Y_{DAC} Calibration

This level serves to calibrate an analog output range to the process data value range. AS parameter for the calibration, the module will only transmit the basic value for the minimum value of the analog output range as offset. The basic value for the maximum value serves to calculate a linear gain. The degree of the gain is entered as amplification factor in register 37.

The amplification factor is calculated as follows:

$$Gain_{(A/H)K} = 8192*((BasicValue_{max} – BasicValue_{min}) / 65535)$$

Two calibration sets are provided for the module. These are divided into the manufacturer and user calibration. Only one calibration set is ever active. The selection occurs via bit 1 of register 32.

Configuration of the manufacturer calibration		
Register	**Name**	**Description**
17	$Offset_{HK}$	Manufacturer calibration offset
18	$Gain_{HK}$	Manufacturer calibration amplification factor

Configuration of the user calibration		
Register	**Name**	**Description**
36	$Offset_{AK}$	User calibration offset
37	$Gain_{AK}$	User calibration amplification factor

Calculation formula:

$$Y_{DAC} = X_3 * Gain_{(A/H)K} / 8192 + Offset_{(A/H)K}$$

With the activation of the user calibration, the analog output range can be selected freely taking into account the operating mode. In reality, the minimum and maximum possible analog output values lie a little below or above the named analog limits.

2.1.1.9 Parameter Setting

2.1.1.9.1 Register Assignment

The following tables display the assignments and factory settings for the individual registers. The factory settings are the same for both channels.

Register	Function	Memory	Access	Factory setting
17	Manufacturer calibration offset	RAM	R/W	0xXXXX
16 bit integer value with leading sign. The manufacturer calibration is active if bit 1 is set in register 32. **$Y_{DAC} = Y_3 * R18 / 8192 + R17$**				

Register	Function	Memory	Access	Factory setting
18	Manufacturer calibration gain	RAM	R/W	0xXXXX
16 bit fixed point value without leading sign. The manufacturer calibration is active if bit 1 is set in register 32. **$Y_{DAC} = Y_3 * R18 / 8192 + R17$**				

Register	Function	Memory	Access	Factory setting
19	Manufacturer substitution value	RAM	R/W	MA: 0x0000 MB: 0x7FFF
16 bit in X_{IN} coordinates, depending on the numeric format. The substitute value is placed on the output of the module after a system reset or a watchdog timer overflow (module has received no process data for 100 ms). The substitute value is selected via register 32, bit 9.				

Register	Function	Memory	Access	Factory setting
32	Mode setting	EEPROM	R/W	0x8006

Bit 0: activation of the user scaling	
0: *	User scaling (register 33 and register 34) is not active.
1:	User scaling (register 33 and register 34) is active.
Bit 1: Activation of user calibration or manufacturer calibration	
0:	User calibration (register 36 and register 37) is active.
1: *	Manufacturer calibration (register 18 and register 19) is active.
Bit 2: Behavior of the RUN LEDs on I/O module timeout	
0:	The RUN LED always lights up and the last output value is retained. On I/O module timeout immediately after power up, 0 V is output. This is achieved by switching off the scaling and calibration mechanisms and outputting values according to the operating mode. This produces approximately 0 V with an imprecision in the lower two-digit millivolt or microampere range.
1: *	The RUN LED goes out after 100 ms inactivity on the bus and the lower register 32 bit 10/11 configured reaction is carried out.
Bit 3: Process data display (cf. table "Setting the numeric display," see below)	
0: *	Takeover of the process data in 2 complement display (that is, -1 = 0xFFFF)
1:	Takeover of the process data in amount/leading sign display (that is, -1 = 0x8001)

Bit 4, 5: Operating mode

Bit 5	Bit 4		Mode	Operating mode
0	0	*	EMPL	0 ... 10 V
0	1		MB	-10 V ... +10 V
1	0		MC	Not permissible, causes malfunctions!
1	1		MD	Not permissible, causes malfunctions!

Bit 6: Data format (cf. table "setting the numeric display," see below)	
0: *	Data format 0 ... +65535
1:	Data format -32768 ... 0 ... +32767
Bit 7: Overrun limit	
0: *	In case of exceeding or undershooting the limit values in register 42 (OVR) and register 41 (UNR), only the corresponding bits are set in the status byte.
1:	In case of exceeding or undershooting the limit values in register 42 (OVR) and register 41 (UNR), only the corresponding bits are set in the status byte and the output value is kept to the limit value.
Bit 8: Switch-on behavior	
0: *	Ready for operation in the configured operating mode
1:	Outputs are high-ohm

Register	Function	Memory	Access	Factory setting

Bit 9: Substitute value after I/O module timeout

0: *	Manufacturer substitution value
1:	User substitute value

Bits 10, 11: Behavior after I/O module timeout

The reaction depends on register 32, bit 2.

Bit 11	Bit 10		Behavior
0	0	*	Output 0 V. This is achieved by switching off the scaling and calibration mechanisms and outputting values according to the operating mode, which produces approximately 0 V with an imprecision in the lower two-digit millivolt or microampere range.
0	1		Retain last value
1	0		Substitute value, as configured in register 32, bit 9
1	1		Put output in tri-state

Bit 12: Reserved

Bit 13 .. 15: Switch-on delay

The switch-on delay is the time that should pass after an ongoing overtemperature error of the output driver until the error state is left. This way, for example, pulsing can be avoided, which otherwise could be misinterpreted by the actuator as a strong value change.
The values of the time fluctuate by ±10ms.

Bit 15	Bit 14	Bit 13		Switch-on delay
0	0	0		0 ms
0	0	1		100 ms
0	1	0		200 ms
0	1	1		300 ms
1	0	0	*	500 ms
1	0	1		750 ms
1	1	0		1 s
1	1	1		2 s

* Factory setting

Setting the numeric display (cf. register 32, bit 3, and bit 6)									
Bit 6	Bit 3	Display	-10 V 0 V				+10 V 10 V		
0	X	0 ...65535	0x0000 0	→	0x7FFF 32767		0x8000 32768	→	0xFFFF 65535
1	0	Twos complement	0x8000 -32768	→	0xFFFF -1		0x0001 0	→	0x7FFF 32767
1	1	Leading sign/amount	0xFFFF -32767	→	0x8001 -1		0x0001	→	0x7FFF 32767

Register	Function	Memory	Access	Factory setting
33	User scaling offset	RAM	R/W	0x0000
16 bit integer value with leading sign. The user scaling is activated or deactivated via bit 0 in register 32. **$Y_1 = X_{IN} * R34 / 256 + R33$**				

Register	Function	Memory	Access	Factory setting
34	User scaling gain	RAM	R/W	0x0100
16 bit fixed point value without leading sign. The user scaling is activated or deactivated via bit 0 in register 32. **$Y_1 = X_{IN} * R34 / 256 + R33$**				

Register	Function	Memory	Access	Factory setting
35	User substitute value	RAM	R/W	MA: 0x0000 MB: 0x7FFF
16 bit in X_{IN} coordinates, depending on the numeric format. The substitute value is placed on the output of the module after a system reset or an I/O module timeout (module has received no process data for 100 ms). The substitute value is selected via register 32, bit 9.				

Register	Function	Memory	Access	Factory setting
36	User calibration offset	RAM	R/W	0xXXXX
16 bit integer value with leading sign. The user calibration is active if bit 1 is not set in register 32. **$Y_{DAC} = Y_3 * R37 / 8192 + R36$**				

Register	Function	Memory	Access	Factory setting
37	User calibration gain	RAM	R/W	0xXXXX
16 bit fixed point value without leading sign. The user calibration is active if bit 1 is not set in register 32. **$Y_{DAC} = Y_3 * R37 / 8192 + R36$**				

Register	Function	Memory	Access	Factory setting
41	Underrange limit (UNR)	RAM	R/W	0x0000
16 bit integer value without leading sign according to the DAC output format. The value Y_2 is compared to this limit value and in case of undershooting, the UNDERFLOW bit (UNR_x) is set in the status byte. With activated overrun limit (register 32, bit 7), the value Y_3 is limited to this limit value. If values are written below the limit value, then these are declined by the module.				

Register	Function	Memory	Access	Factory setting
42	Overrange limit (OVR)	RAM	R/W	0xFFFF
16 bit integer value without leading sign according to the DAC output format. The value Y_2 is compared to this limit value and in case of overrunning, the OVERFLOW bit (UNR_x) is set in the status byte. With activated overrun limit (register 32, bit 7), the value Y_3 is limited to this limit value. If values are written above the limit value, then these are declined by the module.				

2.1.1.9.2 Data Structures

2.1.1.9.2.1 Configuration Concept

In addition to direct register access, the registers 32, 33 ... 37, and 41 ... 42 are also accessible via addresses of the parameter channel. The relationship between these registers and the addresses of the parameter channel are described in Chapter 4.6.

Die Register 32 der beiden Kanäle sind neben dem direkten Registerzugriff auch über Adressen des Parameterkanals erreichbar. (see chapter 2.1.1.9.4, „Parameterization via GSD“) (übersetzen!!!)

2.1.1.9.2.2 Switching the Operating Mode

The switching of the operating mode occurs via the bits 4 and 5 in register 32.

When writing register 32 for switching the operating mode of a channel, the user must make sure that in addition to the desired operating mode, all other configuration values of the register are set correctly, because various settings are possible per operating mode and channel.

If the module detects an operating mode change, then the associated data is loaded from the associated permanent bank into the register. This also applies for the transition from an undefined into a defined operating mode.

2.1.1.9.2.3 Register Access and EEPROM Banks

All registered on the parameter channel but for register 32 are really in the RAM area. So that the contents are stored permanently, when writing to the register via register communication or parameter channel, the content is copied depending on the operating mode into the associated bank.

In the case of a configured undefined operating mode, this is refused and the old operating mode is retained. If the access occurs via pure register communication, no response is generated; for parameter channel communication, the parameter channel error flag is set.

The principal behavior of the module when writing and reading the configuration register is explained in the following descriptions.

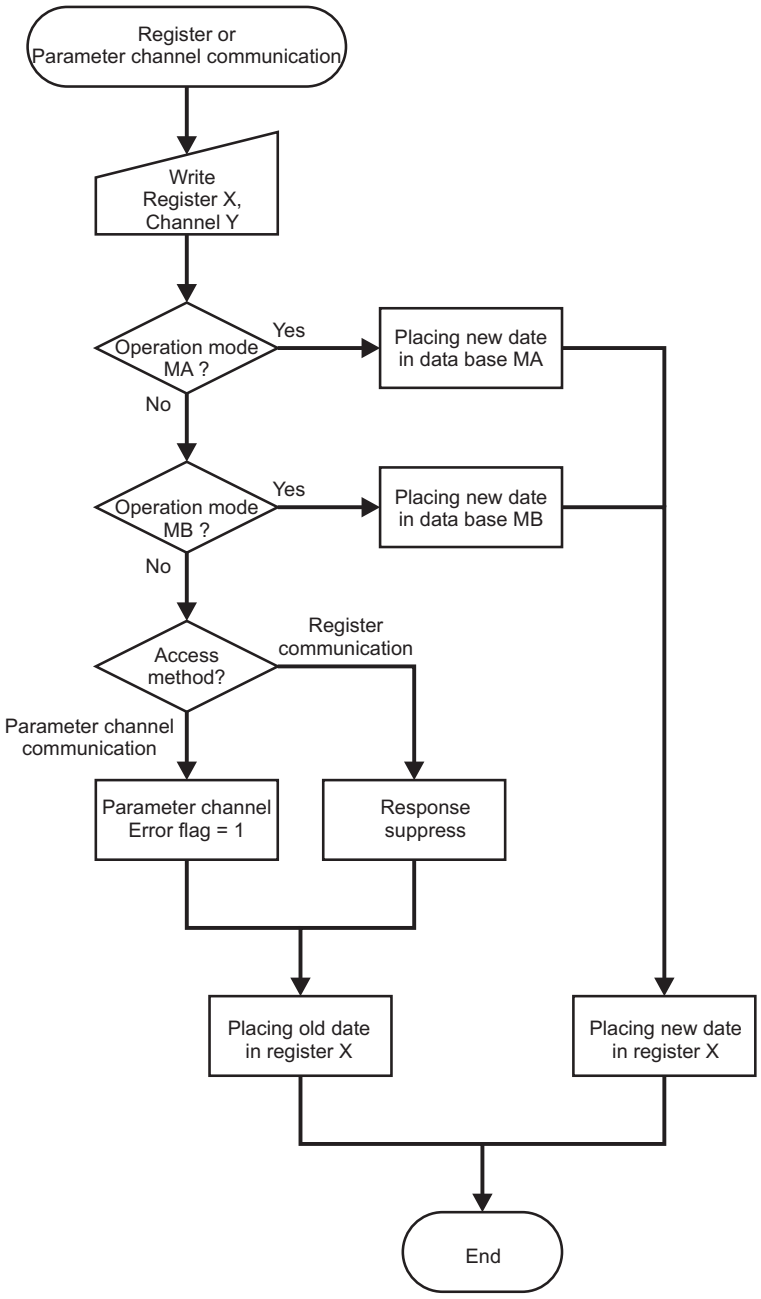

Fig. 2.1.1-6: Storage access

g056206e

2.1.1.9.3 Parameterization via WAGO-I/O-CHECK

The module can be parameterized easily with the start-up tool WAGO-I/O-CHECK.

2.1.1.9.3.1 User Interface

The user interface of the 2-channel output module parameterizing dialog is divided into the following areas.

Fig. 2.1.1-7: User interface of the parameterization dialog

1. Title bar (see chapter 2.1.1.9.3.1.1, “Title Bar”)

2. Toolbar (see chapter 2.1.1.9.3.1.2, “Toolbar”)

3. Navigation bar (see chapter 2.1.1.9.3.1.3, “Navigation Bar”)

4. Input and selection fields (see chapter 2.1.1.9.3.1.4, “Input and Selection Fields”)

5. Status indicator (see chapter 2.1.1.9.3.1.5, “Status Indication”)

These areas will be explained in more detail in the following chapters.

2.1.1.9.3.1.1 Title Bar

The position of the module within the mode as well as its name, item, and version number are displayed on the title bar of the parameterizing dialog.

2.1.1.9.3.1.2 Toolbar

The toolbar on the 2-channel output module parameterization dialog contains the following buttons:

Fig. 2.1.1-8: Buttons on the parameterization dialog

Button	Description
	**[Exit]** closes the active window. If you have changed settings, you are requested for the final assumption of the values into the device.
	**[Open]** displays the **Open File** window to select a parameter file. **Remark:** The I-parameters will be read only from this file to display them into the first column of the table. They will not be transferred to the I/O module.
	**[Save]** displays the **Save File** window to select a parameter file. **Remark:** The actual I-parameters will be saved to this file.
	**[Read]** read out the current settings from the attached device.
	**[Write]** transfers the indicated settings into the attached device.
	**[Help]** shows the help for this window.

2.1.1.9.3.1.3 Navigation Bar

With the navigation bar on the left side, you can change between the channels of the module.

Fig. 2.1.1-9: Navigation between channels

You can select from among the following menu items:

Menu item	Description
Channel 1	**[Channel 1]** opens a tree structure with Settings, Offset/Gain and Process data for Channel 1.
Settings	**[Settings]** opens a page where settings, e.g. Operation Mode, Number Format, Output etc., are made (see chapter 2.1.1.9.3.1.4.1, ”Settings”).
Offset/Gain	**[Offset/Gain]** opens a page for setting Offset/Gain (see chapter 2.1.1.9.3.1.4.2, „Offset/Gain“).
Process Data	**[Process data]** opens a page for setting the Process data (see chapter 2.1.1.9.3.1.4.3, „Process data“).
Channel 2	**[Channel 2]** opens a tree structure with Settings, Offset/Gain and Process data for Channel 2.
Settings	**[Settings]** opens a page where settings, e.g. Operation Mode, Number Format, Output etc., are made (see chapter 2.1.1.9.3.1.4.1, „Settings“).
Offset/Gain	**[Offset/Gain]** opens a page for setting Offset/Gain (see chapter 2.1.1.9.3.1.4.2, „Offset/Gain“).
Process Data	**[Process data]** opens a page for setting the Process data (see chapter 2.1.1.9.3.1.4.3, „Process data “).

2.1.1.9.3.1.4 Input and Selection Fields

This area of the 2-channel output module consists of 3 pages.
On the **Settings** and **Offset/Gain** pages, you can change and set the parameters.
The **Process data** page displays information about the process value of the module and displays the status messages.

Changing and saving data

Changed settings are marked with a change symbol in order to indicate that the values displayed now no longer match the values originally queried from the module. In order to transmit the new values to the module, click the **[Write]** button. The change symbols disappear.

2.1.1.9.3.1.4.1 Settings

The **Settings** page enables the setting of the general module parameters.

Fig. 2.1.1-10: Settings

The following parameters can be changed and loaded onto the module.

Description	Input/Selection	Description
Operation Mode	0 ... 10 V*	Selection of the operating mode of the device
	-10 ... +10 V	
Number Format	0 … +65535*	Setting of the numeric display
	-32768 … +32767 (two´s complement)	
	-32768 … +32767 (sign and magnitude)	
Output	Output process value*	Setting of the switch-on behavior
	Output high-impedance	
Power-On Delay After Excess Temperature Shutdown	0 ms	Setting of the switch-on delay
	100 ms	
	200 ms	
	300 ms	
	500 ms*	
	750 ms	
	1 sec	
	2 sec	
Keep Limit Values	Off*	Setting of the overrun limitation
	On	
Lower Limit Value	0* ... +65535	Setting of the lower limit value underrange limit (UNR)
Upper Limit Value	0 ... +65535*	Setting of the upper limit value overrange limit (OVR)
K-Bus Timeout Behaviour	Keep last output value	Behavior of the RUN LEDs on I/O module timeout RUN LED is always lit
	Execute the function below*	Behavior of the RUN LEDs on I/O module timeout RUN LED goes out after 100 ms
Action at Timeout	Output 0 V / 0 A*	Behavior after I/O module timeout
	Keep last value	
	Output high-impedance	
	User power-on value	Substitute value after I/O module timeout
	WAGO power-on value	

Description	Input/Selection	Description
User Power-On Value	0* ... +65535	Setting of the user substitute value
WAGO Power-On Value	0* ... +65535	Setting of the manufacturer substitute value

* Factory setting

Note
The values for the lower and upper limit value must be entered in raw data format, that is, if a user scaling is set, it must be taken into account for the entry of the limit values.
If in addition a numeric display in the (+/-) range is selected, the limit values must be converted into equivalent values for a positive numeric range.

2.1.1.9.3.1.4.2 Offset/Gain

The **Offset/Gain** page enables the setting of the offset and amplification values of the user and manufacturer scalings.

Fig. 2.1.1-11: Offset/Gain

The following parameters can be changed and loaded onto the module.

Description	Input/Selection	Description
User Scaling	Off*	Activation of the user scaling
	On	
Offset	0* ... +65535	Setting of the offset of the user scaling
Gain	0 ... 256* ... +65535	Setting of the amplification of the user scaling
User Calibration		Switching on or off of the user calibration.
	Off*	If the user calibration is switched off, the manufacturer calibration is switched on automatically.
	On	If the user calibration is switched on, the manufacturer calibration is switched off automatically.
Offset	0 ... +65535	Setting of the offset of the user calibration
Gain	0 ... +65535	Setting of the amplification of the user calibration
WAGO Calibration		Switching on and of of the manufacturer calibration.
	Active*	If the user calibration is switched off, the manufacturer calibration is active automatically.
	Deactivate user calibration to activate	If the user calibration is switched on, the manufacturer calibration is switched off automatically.
Offset	0 ... +65535	Setting of the offset of the manufacturer calibration
Gain	0 ... +65535	Setting of the amplification of the manufacturer calibration

* Factory setting

2.1.1.9.3.1.4.3 Process data

This page displays the process value and the status messages of the module.

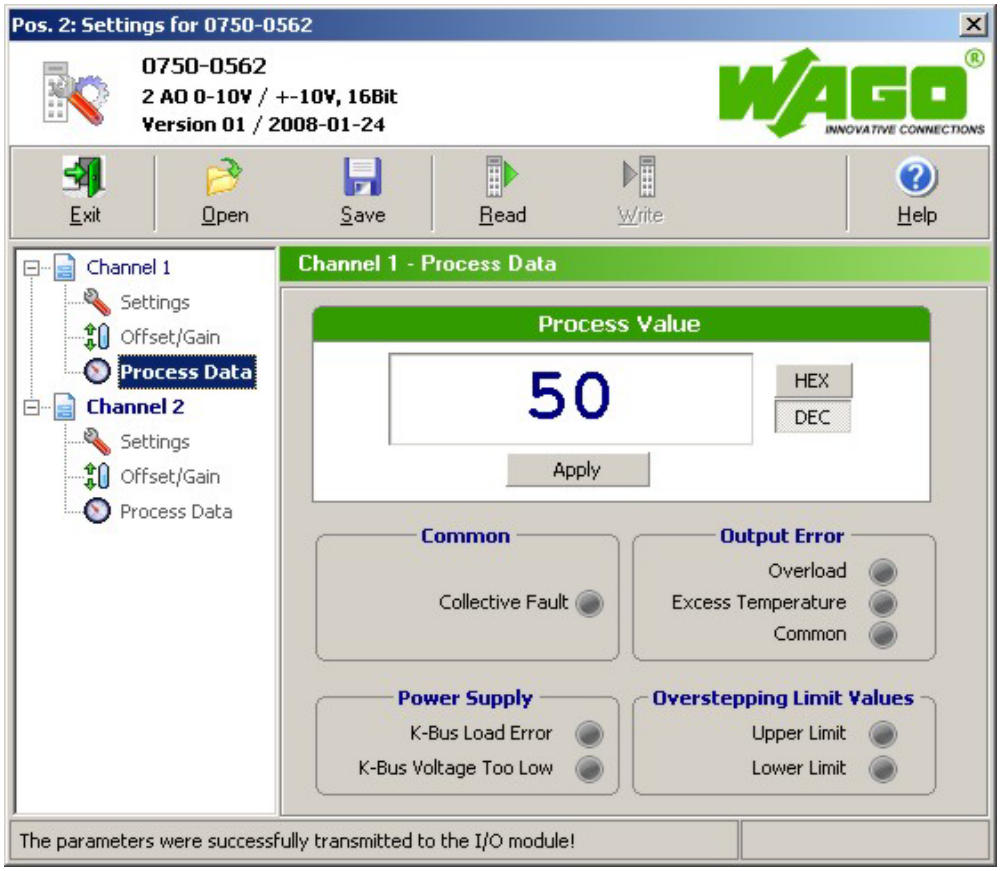

Fig. 2.1.1-12: Process data

Under "Process Value" the value can be set as follows:

Menu item	Description
Input field	
50	**[__]** Input possibility for the process value.
Buttons	
HEX	**[HEX]** displays the value in hexadecimal format.
DEZ	**[DEZ]** displays the value in decimal format.
Apply	**[Apply]** brings the value to the output.

The display field offers the following diagnostic possibilities:

Name	Input/ Selection	Description
Common		
Collective Fault		No group error.
		Group error present.
Output Error		
Overload		No output driver error (LAST).
		Output driver error (LAST) present.
Excess Temperature		No output driver error (TEMP).
		Output driver error (TEMP) present.
Common		No output driver error (COM).
		Output driver error (COM) present.
Power Supply		
K-Bus Load Error		Load on 5 V system voltage OK.
		Load on 5 V system voltage too great.
K-Bus Voltage Too Low		5 V system voltage OK.
		5 V system voltage smaller 4.65 V.
Overstepping Limit Values		
Upper Limit		Underrange limit value is not undershot.
		Underrange limit value is undershot.
Lower Limit		Overrange limit value is not exceeded.
		Overrange limit value is exceeded.

2.1.1.9.3.1.5 Status Indication

Status messages are output on the status indicator in the lower area of the parameterizing dialog.

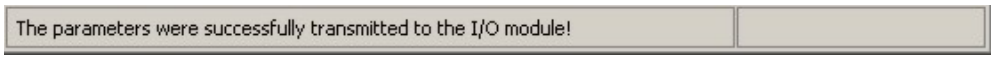

Fig. 2.1.1-13 Status indication

2.1.1.9.4 Parameterization via GSD

With use of a Profibus fieldbus system, the module can be parameterized via the presetting in the GSD.

Dazu erfolgt der Zugriff auf den Parameter 0 und 1 (entspricht Register 32 Kanal 1 und Register 32 Kanal 2) über den Parameterkanal. (übersetzen!!!)

Note
The values for the lower and upper limit value must be entered in raw data format, that is, if a user scaling is set, it must be taken into account for the entry of the limit values.
If in addition a numeric display in the (+/-) range is selected, the limit values must be converted into equivalent values for a positive numeric range.

2.1.1.10 Technical Data

Outputs	
No. of outputs	2
Connection type	2 or 4-wire technology
Output voltage (switchable)	0 V ... 10 V (-0.5 V ... +10.5 V) -10 V ... +10 V (-10.5 V ... +10.5 V)
Output current max.	±24 mA
Capacitative load $_{max.}$	1 µF
Load impedance	> 5 kΩ
Resolution	16 bits
Settling time to ±0.05 % FS, depending on external load impedance	< 300 µs
Output slew rate $_{typ.}$, depending on external load impedance	1 V/µs
Linearity $_{25°C}$	<± 0.05 % of the scale end value
Temperature stability	<± 100 ppm
Module-specific data:	
Voltage supply	via system voltage DC/DC
Current consumption $_{typ.}$ (internal) depending on output values	80 … 170 mA
Current consumption $_{max.}$ (internal), short circuit	260 mA
Voltage via power jumper contacts	24 V DC (-15 % … +20 %)
Isolation	500 V (field/system)
Data width	2 x 16 Bit data 2 x 8 Bit control/status
Dimensions B x H* x T * from upper-edge of DIN 35 rail	12 mm x 64 mm x 100 mm
Weight	approx. 55 g

Standards and directives (see section 2.2 in manual on coupler/controller)		
EMC CE Immunity to interference	acc. to EN 61131-2 (2003)	
EMC CE emission of interference	acc. to EN 61131-2 (2003)	
EMC immunity to interference for shipbuilding	in accordance with Germanischer Lloyd (2003)	
EMC emission of interference for shipbuilding	in accordance with Germanischer Lloyd (2003)	
Approvals (see section 2.2 in manual on coupler/controller):		
CE	Conformity marking	
cULus	$_{C}UL_{US}$ (UL508)	
BSH	Federal Maritime and Hydrographic Agency	

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

TÜV 07 ATEX 554086 X

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

Permissible operation temperature: 0 °C ≤ T_A ≤ +60 °C

TÜV TUN 09.0001X

Ex db I Mb
Ex nAc IIC T4 Gc
Ex tc IIIC T135°C Dc

Permissible operation temperature: 0 °C ≤ T_A ≤ +60 °C

Additional information
Detailed information about approval can be found in the document "Overview WAGO-I/O-SYSTEM 750 Approvals" on the ELECTRONIC Tools and Docs.
This document is found in the CD-ROM ELECTRONICC Tools and Docs (Item No.: 0888-0412) or online:
www.wago.com → Documentation → WAGO-I/O-SYSTEM 750 → System description

3 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.

3.1 Marking Configuration Examples

3.1.1 Marking for Europe according to CENELEC and IEC

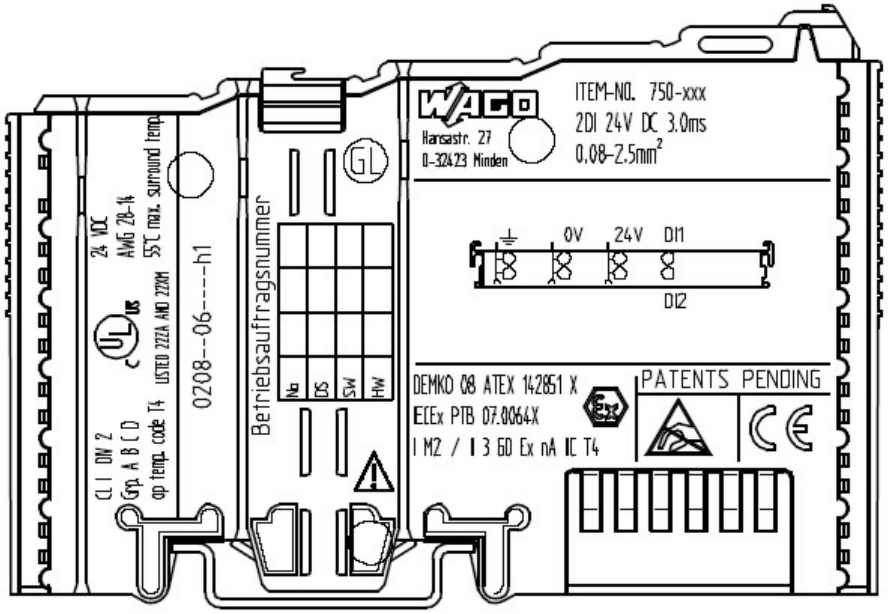

Figure 1: Side marking example for ATEX and IEC Ex approved I/O modules according to CENELEC and IEC

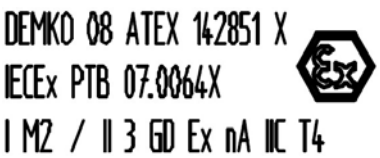

Figure 2: Printing Text detail – Marking example for ATEX and IEC Ex approved I/O modules according to CENELEC and IEC

Table 1: Description of marking example for ATEX and IEC Ex approved I/O modules according to CENELEC and IEC

Printing on Text	Description
DEMKO 08 ATEX 142851 X IECEx PTB 07.0064X	Approval body and/or number of the examination certificate
I M2 / II 3 GD	Explosion protection group and Unit category
Ex nA	Type of ignition and extended identification
IIC	Explosion protection group
T4	Temperature class

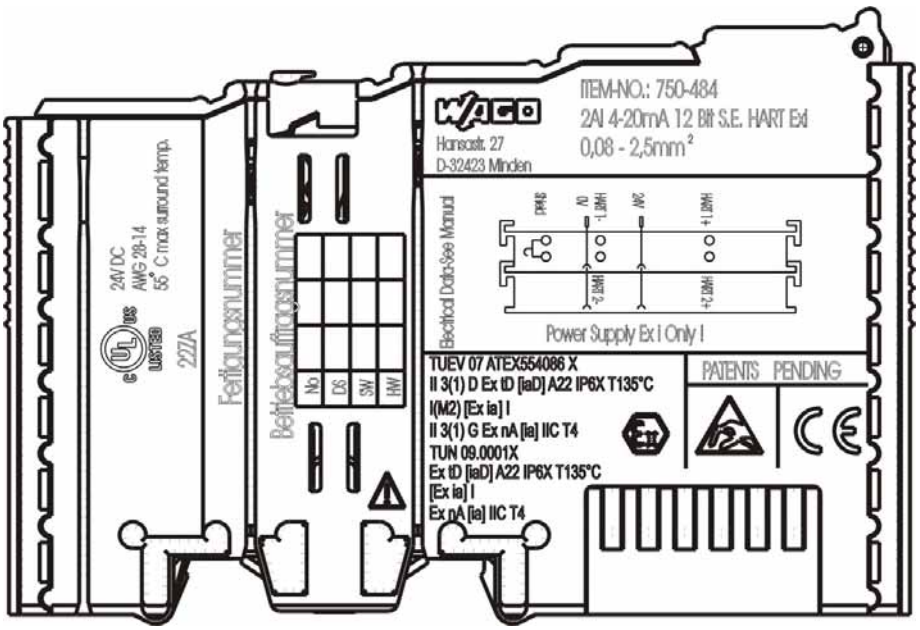

Figure 3: Side marking example for Ex i and IEC Ex i approved I/O modules according to CENELEC and IEC

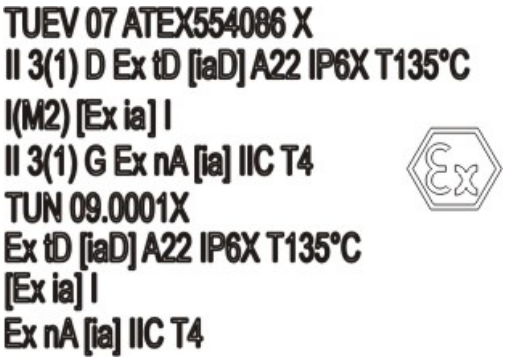

Figure 4: Text detail – Marking example for Ex i and IEC Ex i approved I/O modules according to CENELEC and IEC

Table 2: Description of marking example for Ex i and IEC Ex i approved I/O modules according to CENELEC and IEC

Inscription text	Description
TÜV 07 ATEX 554086 X TUN 09.0001X	Approving authority or certificate numbers
Dust	
II	Device group: All except mining
3(1)D	Device category: Zone 22 device (Zone 20 subunit)
Ex	Explosion protection mark
tD	Protection by enclosure
[iaD]	Approved in accordance with "Dust intrinsic safety" standard
A22	Surface temperature determined according to Procedure A, use in Zone 22
IP6X	Dust-tight (totally protected against dust)
T 135°C	Max. surface temp. of the enclosure (no dust bin)
Mining	
I	Device group: Mining
(M2)	Device category: High degree of safety
[Ex ia]	Explosion protection: Mark with category of type of protection intrinsic safety: Even safe when two errors occur
I	Device group: Mining
Gases	
II	Device group: All except mining
3(1)G	Device category: Zone 2 device (Zone 0 subunit)
Ex	Explosion protection mark
nA	Type of protection: Non-sparking operating equipment
[ia]	Category of type of protection intrinsic safety: Even safe when two errors occur
IIC	Explosion Group
T4	Temperature class: Max. surface temperature 135°C

3.1.2 Marking for America according to NEC 500

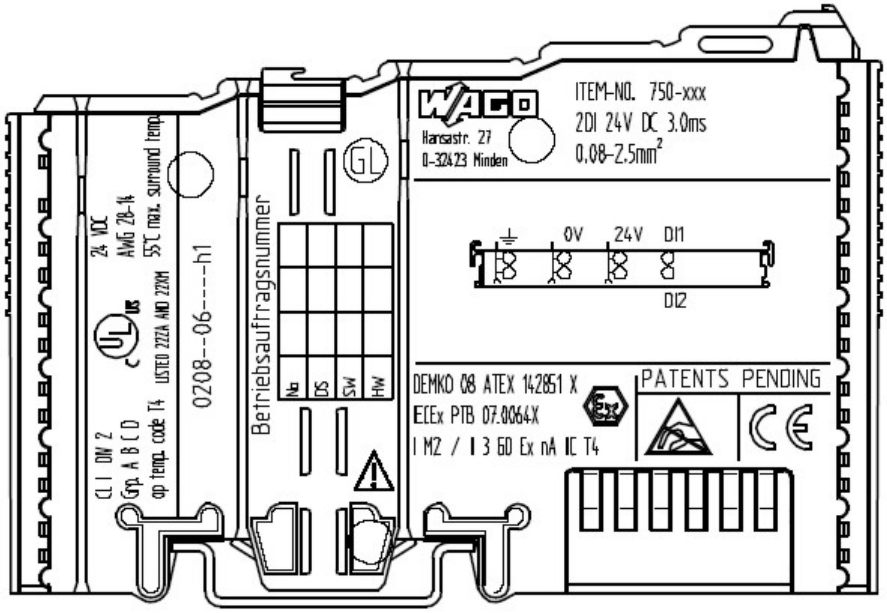

Figure 5: Side marking example for I/O modules according to NEC 500

Figure 6: Text detail – Marking example for I/O modules according to NEC 500

Table 3: Description of marking example for I/O modules according to NEC 500

Printing on Text	Description
CL 1	Explosion protection group (condition of use category)
DIV 2	Area of application (zone)
Grp. ABCD	Explosion group (gas group)
Optemp code T4	Temperature class

3.2 Installation Regulations

In the **Federal Republic of Germany**, various national regulations for the installation in explosive areas must be taken into consideration. The basis for this forms the working reliability regulation, which is the national conversion of the European guideline 99/92/E6. They are complemented by the installation regulation EN 60079-14. The following are excerpts from additional VDE regulations:

Table 4: VDE Installation Regulations in Germany

DIN VDE 0100	Installation in power plants with rated voltages up to 1000 V
DIN VDE 0101	Installation in power plants with rated voltages above 1 kV
DIN VDE 0800	Installation and operation in telecommunication plants including information processing equipment
DIN VDE 0185	lightning protection systems

The **USA** and **Canada** have their own regulations. The following are excerpts from these regulations:

Table 5: Installation Regulations in USA and Canada

NFPA 70	National Electrical Code Art. 500 Hazardous Locations
ANSI/ISA-RP 12.6-1987	Recommended Practice
C22.1	Canadian Electrical Code

NOTICE

Notice the following points
When using the **WAGO-I/O SYSTEM 750** (electrical operation) with Ex approval, the following points are mandatory:

3.2.1 Special Conditions for Safe Operation of the ATEX and IEC Ex (acc. DEMKO 08 ATEX 142851X and IECEx PTB 07.0064)

The fieldbus-independent I/O modules of the WAGO-I/O-SYSTEM 750-.../...-... must be installed in an environment with degree of pollution 2 or better. In the final application, the I/O modules must be mounted in an enclosure with IP 54 degree of protection at a minimum with the following exceptions:

- I/O modules 750-440, 750-609 and 750-611 must be installed in an IP 64 minimum enclosure.
- I/O module 750-540 must be installed in an IP 64 minimum enclosure for 230 V AC applications.
- I/O module 750-440 may be used up to max. 120 V AC.

When used in the presence of combustible dust, all devices and the enclosure shall be fully tested and assessed in compliance with the requirements of IEC 61241-0:2004 and IEC 61241-1:2004.

When used in mining applications the equipment shall be installed in a suitable enclosure according to EN 60079-0:2006 and EN 60079-1:2007.

I/O modules fieldbus plugs or fuses may only be installed, added, removed or replaced when the system and field supply is switched off or the area exhibits no explosive atmosphere.

DIP switches, coding switches and potentiometers that are connected to the I/O module may only be operated if an explosive atmosphere can be ruled out.

I/O module 750-642 may only be used in conjunction with antenna 758-910 with a max. cable length of 2.5 m.

To exceed the rated voltage no more than 40%, the supply connections must have transient protection.

The permissible ambient temperature range is 0 °C to +55 °C.

3.2.2 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, EN 61241-0 and EN 61241-1. 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. If the interface circuits are operated without the field bus coupler station type 750-3../…-… (DEMKO 08 ATEX 142851 X), measures must be taken outside of the device so 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 “CF-Card”, “USB”, “Fieldbus connection“, “Configuration and programming interface“, “antenna socket“, “D-Sub“ 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 and 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 the type 750-601 the following shall be considered: Do not remove or replace the fuse when the apparatus is energized.

7. The ambient temperature range is: $0°C \leq T_a \leq +55°C$ (for extended details please note certificate).

8. The following warnings shall be placed nearby the unit:

Do not remove or replace fuse when energized!
If the module is energized do not remove or replace the fuse.

Do not separate when energized!
Do not separate the module when energized!

Separate only in a non-hazardous area!
Separate the module only in a non-hazardous area!

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

1. For use as Dc- or Gc-apparatus (in zone 2 or 22) the fieldbus 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, IEC 61241-0 and IEC 61241-1. 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 “CF-Card”, “USB”, “Fieldbus connection“, “Configuration and programming interface“, “antenna socket“, “D-Sub“ 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 and 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 the type 750-601 the following shall be considered: Do not remove or replace the fuse when the apparatus is energized.

7. The ambient temperature range is: $0°C \leq T_a \leq +55°C$ (For extensions please see the certificate).

8. The following warnings shall be placed nearby the unit:

Do not remove or replace fuse when energized!
If the module is energized do not remove or replace the fuse.

Do not separate when energized!
Do not separate the module when energized!

Separate only in a non-hazardous area!
Separate the module only in a non-hazardous area!

3.2.4 ANSI/ISA 12.12.01

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

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

⚠ WARNING

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

⚠ WARNING

Disconnect device when power is off and only in a non-hazardous area!
Do not disconnect equipment unless power has been switched off or the area is known to be non-hazardous near each operator accessible connector and fuse holder." 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.”

For devices with Ethernet connectors:
”Only for use in LAN, not for connection to telecommunication circuits”.

⚠ WARNING

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

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 nonhazardous. Connection or disconnection in an explosive atmosphere could result in an explosion.

⚠ WARNING

Devices containing fuses must not be fitted into circuits subject to over loads!
Devices containing fuses must not be fitted into circuits subject to over loads, e.g. motor circuits!

⚠ WARNING

Do not connect or disconnect SD-Card unless the area known to be free of ignitable concentrations of flammable gases or vapors!
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.

WAGO Kontakttechnik GmbH & Co. KG
Postfach 2880 • D-32385 Minden
Hansastraße 27 • D-32423 Minden
Telefon: 05 71/8 87 – 0
Telefax: 05 71/8 87 – 1 69
E-Mail: info@wago.com

Internet: http://www.wago.com