

**Product information**

The function block (FB) FB\_BFS33\_IOL enables parameterizing of the Balluff True-Color Sensor BFS 33M (BFS000M) as well as operation in *Best Fit* mode on a Siemens S7-300/400 controller.

This demo block is intended to assist in programming and project planning of PLC applications and to suggest solution approaches.

**The FB supports the following functions:**

- Activating *Best Fit* mode
- Sensor calibration
- Environment compensation
- Basic parameters
- Calling status messages
- Teaching, activating, deactivating product/background
- Calling the current values for CIELab and tristimulus
- Reset Device
- Factory setting

**i** For communication between the FB\_BFS33\_IOL (FB110) and the True-Color Sensor the Siemens function block FB\_IO\_LINK\_DEVICE (FB5001) is required.

**i** **Additional information**  
 More information about the IO-Link-parameters for the BFS 33M True-Color Sensor can be found in the manual for the sensor. More information about the function and error/status messages of the Siemens FB\_IO\_LINK\_DEVICE (FB5001) can be found in the description of the Siemens function block and on the Siemens homepage.

**Notes to the user**

Instructions are indicated by a preceding triangle. The result of an action is indicated by an arrow.

- ▶ Instruction 1  
 ⇒ Action result

Action sequences are numbered consecutively:

1. Instruction 1
2. Instruction 2

**i** **Note, tip**  
 This symbol indicates general notes.

**Safety notes**

**Intended use**

This function block is used for coupling the BFS 33M (BFS000M) True-Color Sensor to a Siemens S7 controller.

**Disclaimer**

The free demo block available here is an application example only.

The user is not entitled to make any claims for warranty, fault rectification or updates. Balluff GmbH expressly excludes in particular any liability for damages resulting from use of the demo function block! This limitation of liability does not apply in the case of loss of life, personal injury or damage to health, nor does it preclude liability according to the Product Liability Act or in cases of intentional breach of duty.

By using the example presented here you acknowledge the limitation of warranty and liability!

Before using it in equipment and machines verify whether the demo block provided here is usable for your application!

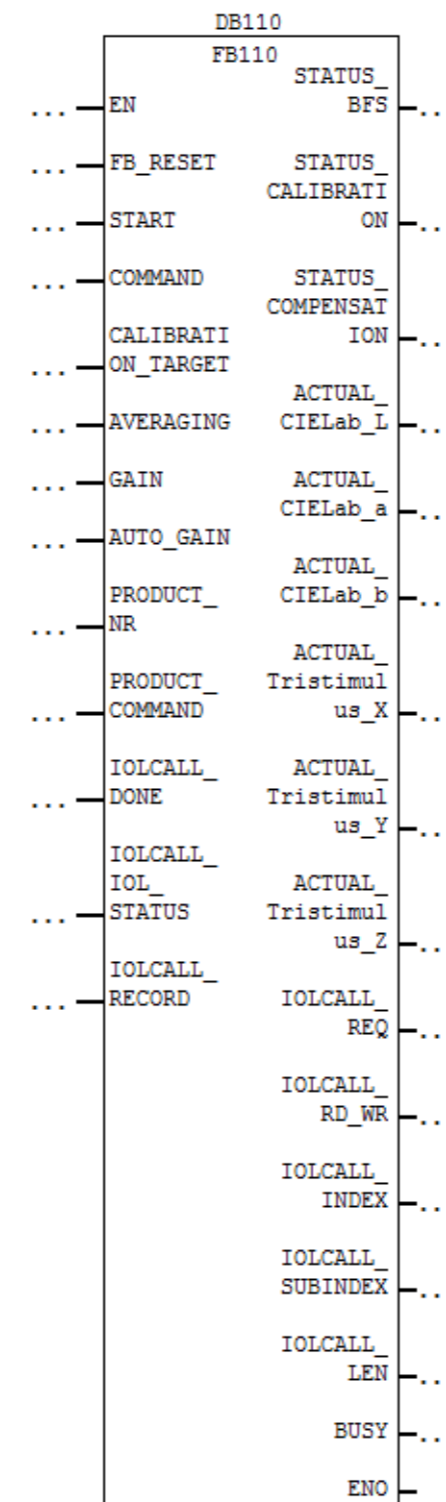
**Function block FB\_BFS33\_IOL (FB110)**

**FB\_BFS33\_IOL:**  
**Balluff function block for switching the IO-Link parameters to *Best-Fit* mode**

Block number	FB110
Block name	FB_BFS33_IOL
Version number	1.0
Instance data block	DB110
Integrated blocks	None
Reserved flags	None
Reserved timers	None
Reserved counters	None
Addressing	Absolute
Controller compatibility	Siemens Simatic Step7

**Function block FB\_BFS33\_IOL (FB110)**

**FB\_BFS33\_IOL**



**Input variables (IN Variable)**

For a more detailed description of the input variables, see page 3.

IN Variable	Function
EN	Activates the block with TRUE
FB_Reset	FB Reset in case of error
START	Start FB-Function
COMMAND	Specify FB function
CALIBRATION_TARGET	Specify nominal value for calibration (BFS 33M gray value card)
AVERAGING	Specify averaging
GAIN	Specify gain
AUTO_GAIN	Specify AUTO_GAIN ON/OFF
PRODUCT_NR	Specify product number
PRODUCT_COMMAND	Function for product/background
IOLCALL_DONE	"FB_IOL_CALL" OUT-DONE_VALID
IOLCALL_IOL_STATUS	"FB_IOL_CALL" OUT-IOL_STATUS
IOLCALL_RECORD	"FB_IOL_CALL" OUT-RECORD_IOL_DATA

**Output variables (OUT Variable)**

For a more detailed description of the input variables, see page 5.

OUT Variable	Function
STATUS_BFS	Output Status Sensor
STATUS_CALIBRATION	Output Status Calibration Sensor
STATUS_COMPENSATION	Output Status environment compensation
ACTUAL_CIELab_L	Output actual measurement value CIELab L
ACTUAL_CIELab_a	Output actual measurement value CIELab a
ACTUAL_CIELab_b	Output actual measurement value CIELab b
ACTUAL_TRISTIMULUS_X	Output actual measurement value Tristimulus X
ACTUAL_TRISTIMULUS_Y	Output actual measurement value Tristimulus Y
ACTUAL_TRISTIMULUS_Z	Output actual measurement value Tristimulus Z
IOLCALL_REQ	"FB_IOL_CALL" IN-REQ
IOLCALL_RD_WR	"FB_IOL_CALL" IN - RD_WR
IOLCALL_RECORD	"FB_IOL_CALL" IN/OUT - RECORD_IOL_DATA
RECORD_INDEX	"FB_IOL_CALL" IN - INDEX
RECORD_SUBINDEX	"FB_IOL_CALL" IN - SUBINDEX
BUSY	Parameter transfer active

Functions of the function block FB\_BFS33\_IOL (FB110)

Description of the input variables (IN Variable) and their function

- a) **IN Variable EN**  
Enables the block for processing.
- b) **IN Variable FB\_Reset**  
Resets the FB in case of error.
- c) **IN Variable START**  
Starts the selected FB function with transfer.
- d) **IN Variable COMMAND**  
Specifies the function for program processing of the FB.

**COMMAND 1**  
= Calibration sensor

- Function for calibrating the BFS 33M to the gray card included in the scope of delivery.
1. Enter indicated Y-value for the reference card on the variable input CALIBRATION\_TARGET.
  2. Insert reference card in measurement position.
  3. Start FB function.

**i** Processing for the calibration may take up to 20 seconds!

**COMMAND 2**  
= Compensate environment

- This optional FB function is needed only for critical applications and ambient conditions!  
The BFS 33M automatically compensates for disturbing ambient light conditions.
1. Clear measurement position of all objects.
  2. Start FB function.

**i** Processing for the calibration may take up to 20 seconds!

**COMMAND 3**  
= Basic settings

Function for transferring the previously entered basic settings for the BFS 33M.

GAIN	Index 0x00BE Sub 0x01
AUTO_GAIN ON/OFF	Index 0x00BE Sub 0x02
AVERAGING	Index 0x00BD Sub 0x00
Work mode (fixed value for mode <i>Best Fit</i> , not settable!)	Index 0x0402 Sub 0x00

▶ Start FB function.

**COMMAND 4**

- = Status BFS 33M (Status Sensor)  
FB function for reading out the actual status of the BFS 33M.
- ▶ Start FB function.

⇒ Reply of status messages for the following output variables:

STATUS_BFS	Index 0x0407 Sub 0x01
STATUS_CALIBRATION	Index 0x0407 Sub 0x02
STATUS_COMPENSATION	Index 0x0407 Sub 0x03

**COMMAND 5**  
= Product, Background

FB function for teaching, activating and deactivating products and the background.

**Teach product function**

1. Insert product in measurement position.
2. Enter IN Variable PRODUCT\_NR – Product number.
3. Enter IN Variable PRODUCT\_COMMAND – Value "1".
4. Start FB function.

⇒ Reply after successful transfer: Output product number in Byte 1 of process data (product is automatically activated in BFS)

**Teach background function**

1. Remove product (sensor detects the background)
2. Enter IN Variable PRODUCT\_NR – Value 65535.
3. Enter IN Variable PRODUCT\_COMMAND – Value "1".
4. Start FB function.

⇒ Reply after successful transfer: Output of the bit for the background in Byte 0 Bit 4 of the process data (background is automatically activated in BFS)

**Activate Product/Background function**

1. Enter IN Variable PRODUCT\_NR – Product number and value for background.
2. Enter IN Variable PRODUCT\_COMMAND – Value "2".
3. Start FB function.

⇒ Reply after successful transfer: Output of the product number/background in the process data

**i** For information about the process data structure please see the user's manual for the BFS 33M.

Functions of the function block FB\_BFS33\_IOL (FB110)

**Activate Product/Background function**

1. Enter IN Variable PRODUCT\_NR – Product number and value for background.
2. Enter IN Variable PRODUCT\_COMMAND – Value "3".
3. Start FB function.

⇒ Reply after successful transfer: No output of the product number/background in the process data

**COMMAND 6**  
= Actual CIELab, Tristimulus

Function for reading out the actual measurement values for CIELab and tristimulus.

1. Insert object in measurement position.
2. Start FB function.

⇒ Reply of status messages for the following output variables:

ACTUAL_CIELab_L	Index 0x0408 Sub 0x01
ACTUAL_CIELab_a	Index 0x0408 Sub 0x02
ACTUAL_CIELab_b	Index 0x0408 Sub 0x03
ACTUAL_Trstimulus_X	Index 0x0409 Sub 0x01
ACTUAL_Trstimulus_Y	Index 0x0409 Sub 0x02
ACTUAL_Trstimulus_Z	Index 0x0409 Sub 0x03

**COMMAND 80**  
= Device reset (Warmstart Sensor)

FB function for a warmstart of the BFS 33M.

▶ Start FB function.

**COMMAND 82**  
= Restore factory setting

FB function for resetting the BFS 33M to its factory defaults

▶ Start FB function.

e) **IN Variable CALIBRATION\_TARGET**

- Index 0x0401 Sub 0x00
- Specification for the FB COMMAND 1
- Y-value according to BFS 33M gray card

f) **IN Variable AVERAGING**

- Index 0x00BD Sub 0x00
- Specification for the FB COMMAND 3
- Value for averaging
- Permissible values: 1/2/4/16/64/256/1024

g) **IN Variable GAIN**

- Index 0x00BE Sub 0x01
- Specification for the FB COMMAND 3
- Value for gain
- Permissible values: 1/2/3/4/5/6/7/8

h) **IN Variable AUTO\_GAIN**

- Index 0x00BE Sub 0x02
- Specification for the FB COMMAND 3
- AUTO\_GAIN ON/OFF
- 0 = OFF
- 1 = ON

i) **IN Variable PRODUCT\_NR**

- Index 0x0400 Sub 0x01
- Index 0x0404 Sub 0x00
- Specification for the FB COMMAND 5
- Product number
- Product number 1...255
- Background 65535

j) **IN Variable PRODUCT\_COMMAND**

- Specification for the FB COMMAND 5
- Function for product
- 1 = Teach
- 2 = Activate
- 3 = Deactivate

k) **IOLCALL\_DONE**

- "FB\_IOL\_CALL" OUT-DONE\_VALID

l) **IOLCALL\_IOL\_STATUS**

- "FB\_IOL\_CALL" OUT-IOL\_STATUS

m) **IOLCALL\_RECORD**

- "FB\_IOL\_CALL" OUT-RECORD\_IOL\_DATA

Functions of the function block FB\_BFS33\_IOL (FB110)

Description of the output variables (OUT Variable) and their function

a) OUT Variable STATUS\_BFS

Output of sensor status:

Byte 0 / Bit 1	AUTO_GAIN is active
Byte 0 / Bit 2	Environment compensation is active
Byte 0 / Bit 3	Light source is turned on
Byte 0 / Bit 4	Sensor channel Red overdrive
Byte 0 / Bit 5	Sensor channel Green overdrive
Byte 0 / Bit 6	Sensor channel Blue overdrive
Byte 1 / Bit 4	Best-Fit mode is active
Byte 1 / Bit 6	Reset to factory setting being performed

b) OUT Variable STATUS\_CALIBRATION

Provides the actual calibration status:

0 = Idle	Initialization value after sensor start
1 = Success	Calibration successfully finished
5 = Busy	Sensor being calibrated
7 = Error	Error during calibration

c) OUT Variable STATUS\_COMPENSATION

Provides the actual environment compensation (stray light compensation):

0 = Idle	Initialization value after sensor start
1 = Success	Environment compensation successfully finished
5 = Busy	Sensor environment compensation being carried out
7 = Error	Error in compensating the sensor

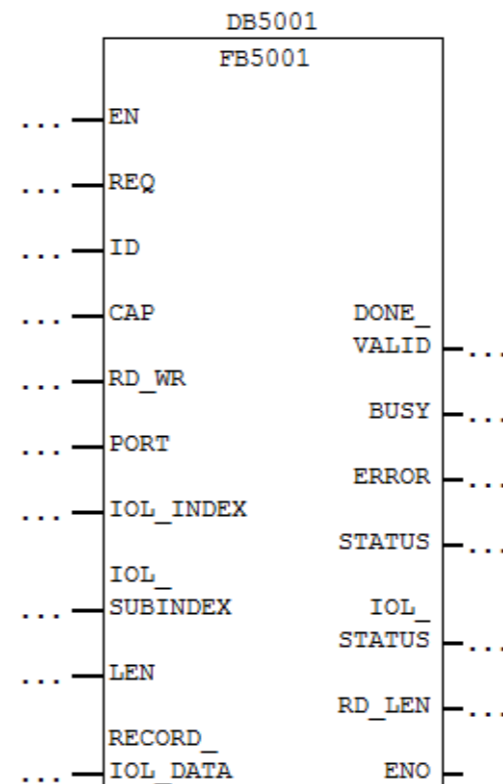
Function block FB\_IO\_LINK\_DEVICE (FB5001)

FB\_IO\_LINK\_DEVICE:  
Siemens function block for IO-Link communication

Block number	FB5001
Block name	FB_IO_LINK_DEVICE
Version number	3.1
Instance data block	DB1
Integrated blocks	SFB3, SFB4, SFB52, SFB53
Reserved flags	None
Reserved timers	None
Reserved counters	None
Addressing	Absolute
Controller compatibility	Siemens Simatic Step7

Description of the inputs

Parameter	Function
EN	Activates the block with TRUE
REQ	Start data transmission IO-Link
ID	Logical address IO-Link-Master
CAP	Access point for IO-Link communication
RD_WR	Read or write access 0 = read 1 = write
PORT	Port number on which the IO-Link device is operated
IOL_INDEX	Address parameter Index (IO-Link Device)
IOL_SUBINDEX	Address parameter Subindex (IO-Link Device)
LEN	Length of data to write
RECORD_IOL_DATA	Source/destination area for read/write data (max. 232 bytes)



Description of the outputs

Parameter	Function
DONE_VALID	Data transmission value 0 = Data not valid 1 = Data valid
BUSY	Job in progress 0 = Job finished
ERROR	Error status 0 = No error 1 = Cancel with error
STATUS	Communication error status (SFB52, SFB53)
IOL_STATUS	IO-Link error status
RD_LEN	Length of data which were read

Variable assignment for function block FB\_BFS33\_IOL (FB110)

Assignment of in- and output variables for  
FB\_IO\_LINK\_DEVICE and FB\_BFS33\_IOL

