

# LM Process Data Function

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11/15/2022

This document covers the installation and use of a function for Siemens's TIA Portal software package. This function handles cyclic IO-Link Process Data In and Process Data Out from a Banner LM sensor via an IO-Link Master to a Siemens PLC. The function covers parsing and display of the LM sensor Process Data In and Process Data Out.

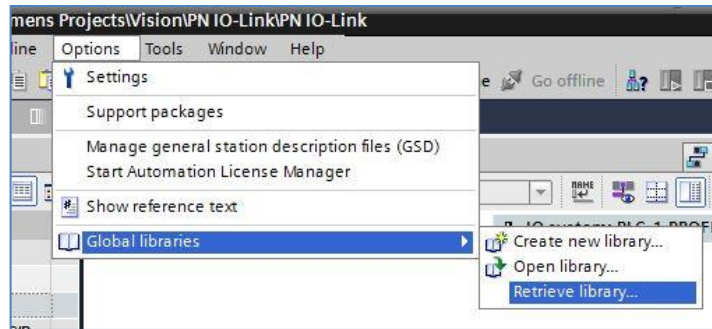
## **Components**

Banner LM Library.zal14

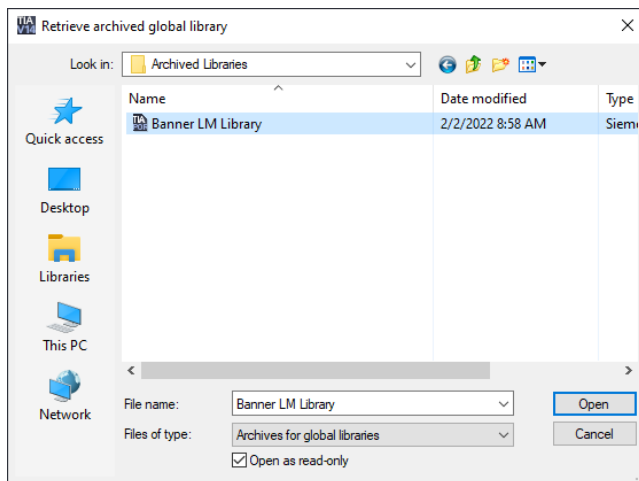
There are two methods for the process data. The first is used when creating a connection to Banner's IO-Link masters. The second set of instructions are for systems using other manufacturer's IO-Link masters.

## **Installation Instructions**

1. Open a project.
2. Go to Options > Global Libraries > Retrieve Library.



3. Select the Banner LM Library. Click Open.



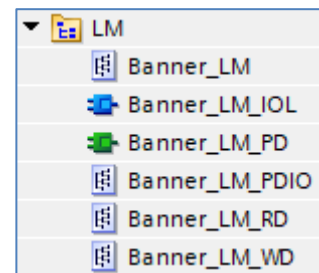
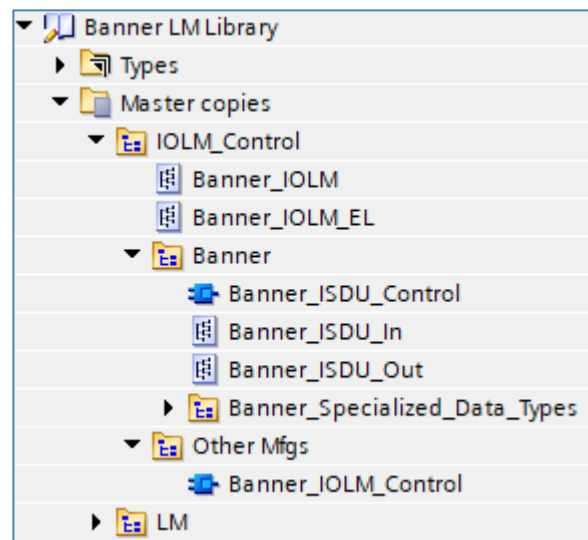
4. The library is now accessible in the Libraries tab.
5. Go to page 3 for Banner IO-Link Masters and to page 7 for all other IO-Link Masters.

### **Setup of LM with a Banner DXMR90-4K**

1. Go to Device and Networks to configure the DXMR90-4K. Add the DXMR90-4K if it has yet to be added to the system.
2. Add Banner IO-Link Master Info to Slot 1. This sets the DXMR90-4K for IO-Link mode.
3. Open the IO-Link Generic Devices and select the proper module. The 4/4 byte option has been selected for port 1. Make note of the I address for the Slot 2 which represents Port 1. Slot 2 starts are 10. The other number needed is I14. The data for the port start at that point (I14). The previous four bytes represents Port Status, Process Data In Size, and Process Data Out Size.

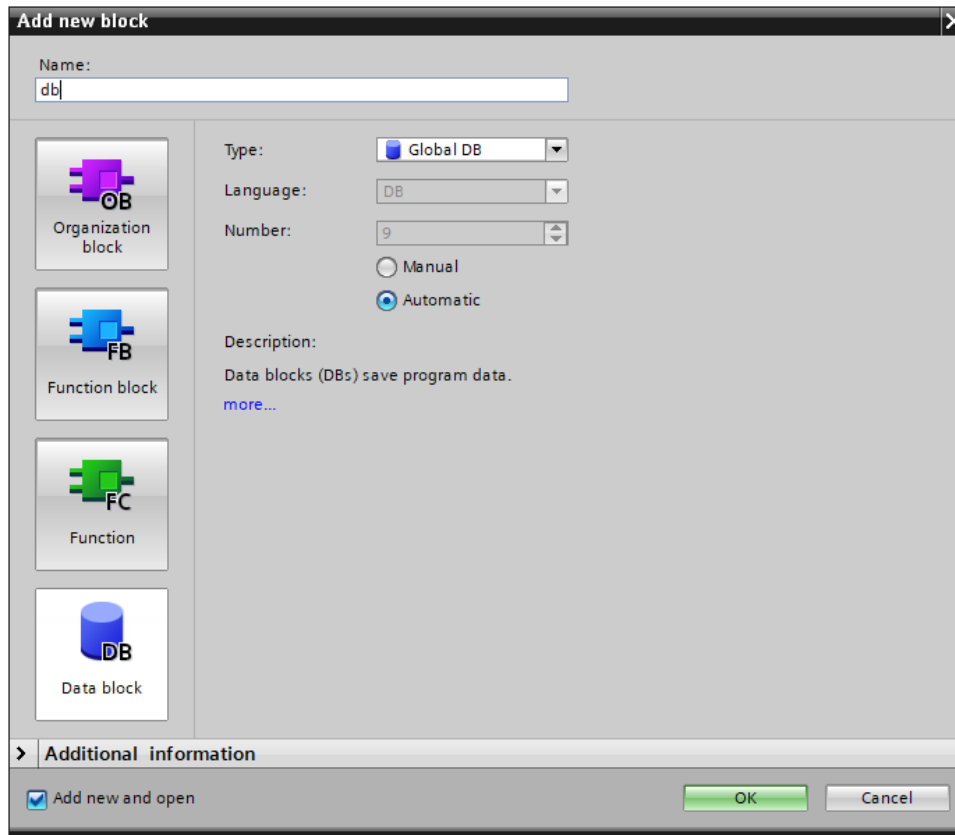
Module	Rack	Slot	I address	Q address	Type
▼ dxm	0	0			1-port Device
▶ Interface	0	0 X1			dxm
Banner IO-Link Master Info_1	0	1	1...9		Banner IO-Link Master Info
IO-Link In/Out 4/ 4 Byte + Status_1	0	2	10...17	1...18	IO-Link In/Out 4/ 4 Byte + Status

4. Drag the Banner\_LM\_PDI to the PLC Data Types area under your PLC. Banner\_LM\_PDI is found in the LM folder in the library. Drag the Banner\_LM\_PD to the Program Blocks area.
5. Drag the necessary tags from IOLM\_Control > Banner > Banner\_Specialized\_Data\_Types. The tags used in this example is "Banner\_4in" and "Banner\_4out". This tag represents the full raw process data along with port status information.
6. Go to PLC Tags. Create four tags. Two of the tags are for the full data structure while the second set represents the raw Process Data from the IO-Link Master. In this example, Tag table\_1 was created, the tags "LM IOLM1 01 PDI" and "LM IOLM1 01 PDO" was created using a Data Type of "Banner\_4In" and "Banner\_4Out". This naming convention calls out the type of sensor in question as well as the specific IO-Link Master and port number where the sensor is connected. A different IO-Link Master might be named IOLM2 or IOLM3, for instance, and other specific sensors may be connected to different port numbers. The "I" address found in step 2 is tied to this new tag. The second set of tags use "LM IOLM1 01 inRaw" and "LM IOLM1 01 outRaw". These are the tags that will be used in the Function block.



Name	Data type	Address
▶ LM IOLM1 01 PDI	"Banner_4In"	%I0.0
LM IOLM1 01 inRaw	DWord	%ID4
LM IOLM1 01 outRaw	Byte	%QB3
▶ LM IOLM1 01 PDO	"Banner_4Out"	%Q1.0

7. Go to Program blocks. Add a new Data block if necessary. In this example the new data block is named “db”.



8. In the new data block, create a new tag to represent the parsed Process Data In and Out for our LM. The tag name again calls out the type of sensor, the IO-Link Master, and the port number. Use the data type “Banner\_LM\_PDIO” for the new tag.

Name	Data type
▼ Static	
■ ▼ LE IOLM1 01 PD	"Banner_LM_PDIO"
■ Channel 1 Output State	Bool
■ Analog State	Bool
■ Stability	Bool
■ Measurement Value 1	Real
■ Measurement Value 2	Real
■ Laser Transducer	SInt

9. Add the “Banner\_LM\_PD” function to an OB ladder. Link the “Process Data In” and the “Process Data Out” to the raw process data variable from step 5. The tag name again calls out the type of device, IO-Link Master, and the port number. The “LM Process Data” needs to be linked to the variable created in step 7. It was called “db”. “LE IOLM1 01 PD” for this example.

The last two variables, “Include Binary” and “Process Measurement 1”, allow the function to correctly interpret the Process Data. In the case of the LM. This function needs to know what choice has been made in the TL50 Pro Select for this Operational Mode variable.

There are two ways to achieve this goal. We can simply type in the correct number for entries (see Fig. 1), or we can link this LM Function to the LM Data Function Block (see Fig. 2). See Appendix A for more information about LM Process Data.

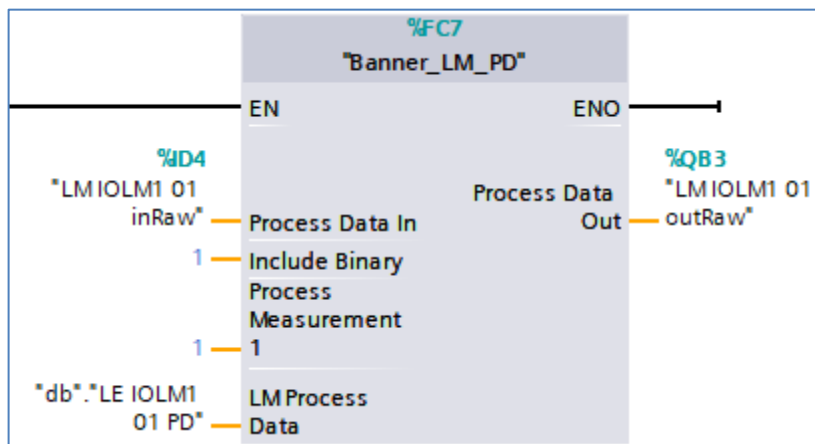


Figure 1: Hand typed correct numbers for Include Binary and Process Measurement 1

**NOTE:** if you type in the incorrect number, you will get incorrectly displayed Process Data information.

**Include Binary:** the options here are “0” (Don’t Include) and “1” (Include). The default is “1”.

**Process Measurement 1:** the options here are “0” (Disabled) “1” (Distance Measurement), “2” (Displayed Measurement), and “3” (Analog Output Value), and “4” (BDC1 Dual Mode Percent); where the entire tower light behaves as a level indicator). The default is “1”.

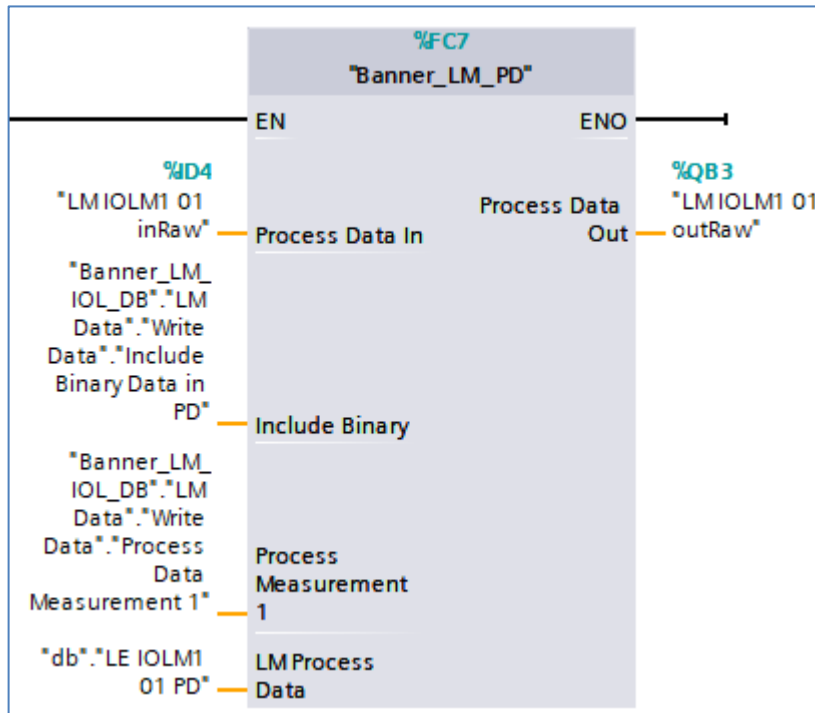
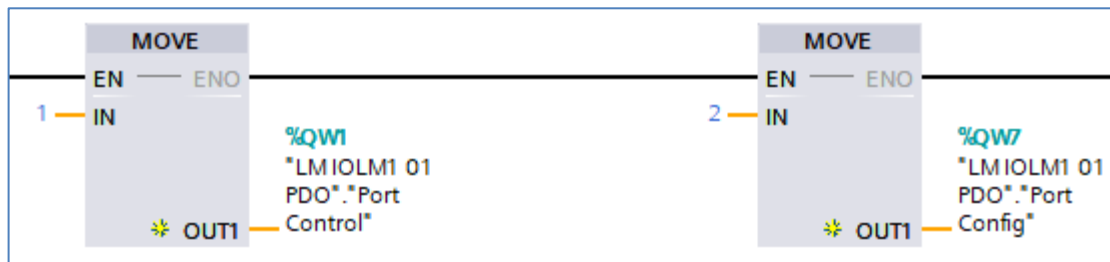


Figure 2: Linking Operational Mode variable to TL50 Pro Parameter Data Function Block

10. The final step is to configure the IO-Link output control. This is done by sending a 1 to Port Control and a 2 to Port Config. Both parameters are part of the tag created in step 6 "LM IOLM1 01 PDO".

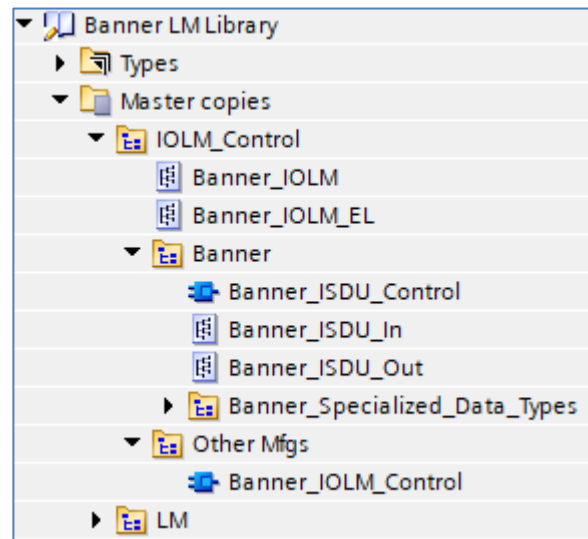


11. Process Data setup is complete.  
 12. Compile and download the configuration to the PLC, then go online. Open the "db" data block and click Monitor all. You should see parsed LM Process Data In, like that shown below.

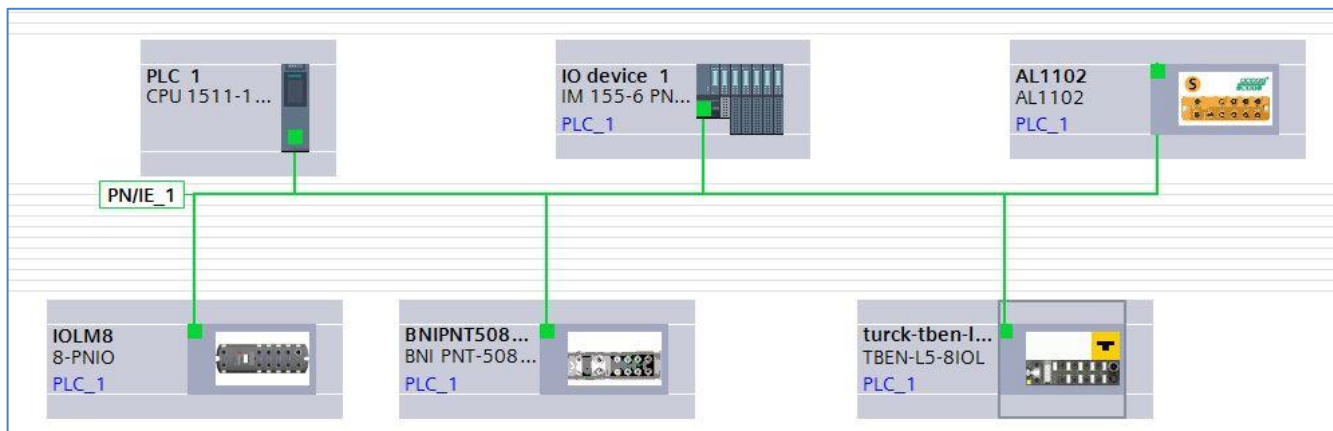
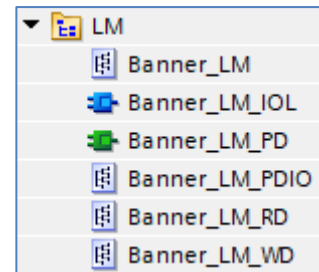
Name	Data type	Start value	Monitor value
▼ Static			
■ ▼ LE IOLM1 01 PD	"Banner_LM_PDIO"		
■ Channel 1 Output State	Bool	false	FALSE
■ Analog State	Bool	false	FALSE
■ Stability	Bool	false	FALSE
■ Measurement Value 1	Real	0.0	95.21
■ Measurement Value 2	Real	0.0	170.0
■ Laser Transducer	SInt	0	0

### **Setup of LM with other IO-Link Masters**

1. The Banner LM Library will now be in the Global Library List. Expand the Master copies section. The LM folder contains elements for both Process Data and Parameter Data connections to an LM sensor. As Process Data is the focus of this paper, we will concern ourselves with these two items: Banner\_LM\_PD and Banner\_LM\_PDIO.
2. Drag Banner\_LM\_PD to the Program Blocks area under your PLC.
3. Drag the Banner\_LM\_PDIO to the PLC Data Types area under your PLC



4. Go to Devices and networks to configure the system as necessary. Below is an example of what a configuration might look like. This example shows 5 different IO-Link Masters connected to the same PLC.



5. Click on the relevant device and configure the IO-Link Master as necessary. Refer to the documentation for the IO-Link Master. Recall that an LM requires 4 bytes of space for the Process Data In and 1 byte for the Process Data Out.
6. Record the "I" address where this LM Process Data In is to be stored, as the address will be required in the next step. In this example, 4 bytes of Process Data In for port 7 on the IO-Link Master will be stored in I101 through I104. The one byte of Process Data Out will be in Q98.

7. Go to PLC Tags. Add a new tag table, then create a new tag to represent the raw Process Data from the IO-Link Master. In this example, Tag tabLM\_1 was created, then the tag “LM IOLM3 07 PDI” was created using a Data Type of “DWord”. This naming convention calls out the type of sensor in question as well as the specific IO-Link Master and port number where the sensor is connected. A different IO-Link Master might be named IOLM1 or IOLM2, for instance, and other specific sensors may be connected to different port numbers. The “I” address found in step 9 is tied to this new tag. Another tag is created for the LM Process Data Out. This one is a Byte data type and is linked to the memory address found in step 9.

	Name	Data type	Address	Retain	Acces...	Writa...	Visibl...	Sup
1	LM IOLM3 07 PDI	DWord	%ID101	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
2	LM IOLM3 07 PDO	Byte	%QB98	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	

8. Go to Program blocks. Add a new Data block if necessary. In this example the new data block is named “Banner IO-Link Data”.

**Add new block**

Name: Banner IO-Link Data

Organization block

Function block

Function

Data block

Type: Global DB

Language: DB

Number: 1

Manual

Automatic

Description: Data blocks (DBs) save program data. [more...](#)

Additional information

☒ Add new and open

OK Cancel



9. In the new data block, create a new tag to represent the parsed Process Data for our LM. The tag name again calls out the type of sensor, the IO-Link Master, and the port number. Use the data type “Banner\_LM\_PDIO” for the new tag.

	Name	Data type	Start value	Retain	Accessible f...	Writa...	Visible in ... S
1	Static			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2	LM IOLM3 Port 7	*Banner_LM_PDIO*		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

10. Add the “Banner\_LM\_PD” function to an OB ladder. Link the “Process Data In” and “Process Data Out” to the raw Process Data variables from step 10. Link the “LM Process Data” to the parsed Process Data variable from step 12.

The last two variables, “Include Binary” and “Process Measurement 1”, allow the function to correctly interpret the Process Data In. In the case of the LM, there are two user-defined measurements in the Process Data, and there can be some extra bits included to tell the state of the discrete and analog outputs as well as the stability indicator. This function needs to know what choices have been made in the sensor for these three options.

There are two ways to achieve this goal. We can simply type in the correct number for each of these selections (see Fig. 1), or we can link this LM Process Data Function to the LM Parameter Data Function Block (see Fig. 2). See Appendix A for more information about LM Process Data In.

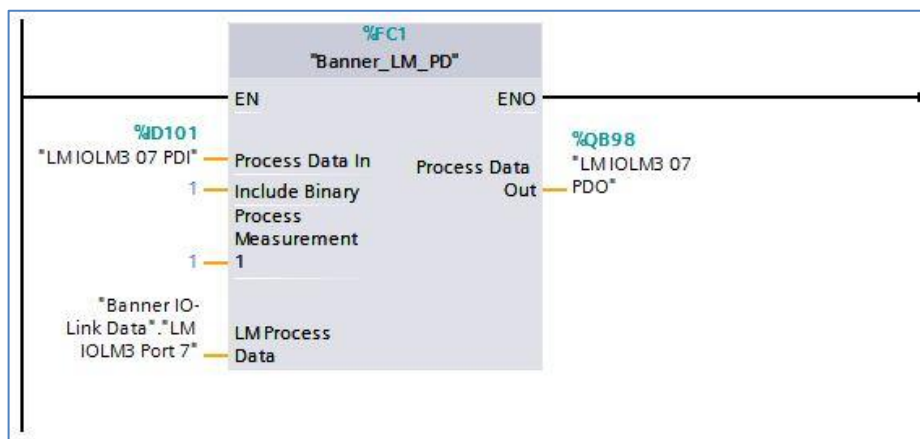


Figure 3: Typing in values for Include Binary and Process Measurement 1

**NOTE:** if you type in the incorrect number (i.e. it does not match the sensor’s current configuration) you will get incorrectly displayed Process Data In information.

**Include Binary:** the options here are “0” (don’t include output 1 state, analog output state, and stability indicator state in Process Data In) and “1” (do included those bits). The default is “1”.

**Process Measurement 1:** the options here are “0” (Disabled), “1” (Distance Measurement Value), “2” (Displayed Distance Measurement Value), “3” (Analog Output Value), and “4” (BDC1 Dual Mode Percent). The default is “1”.

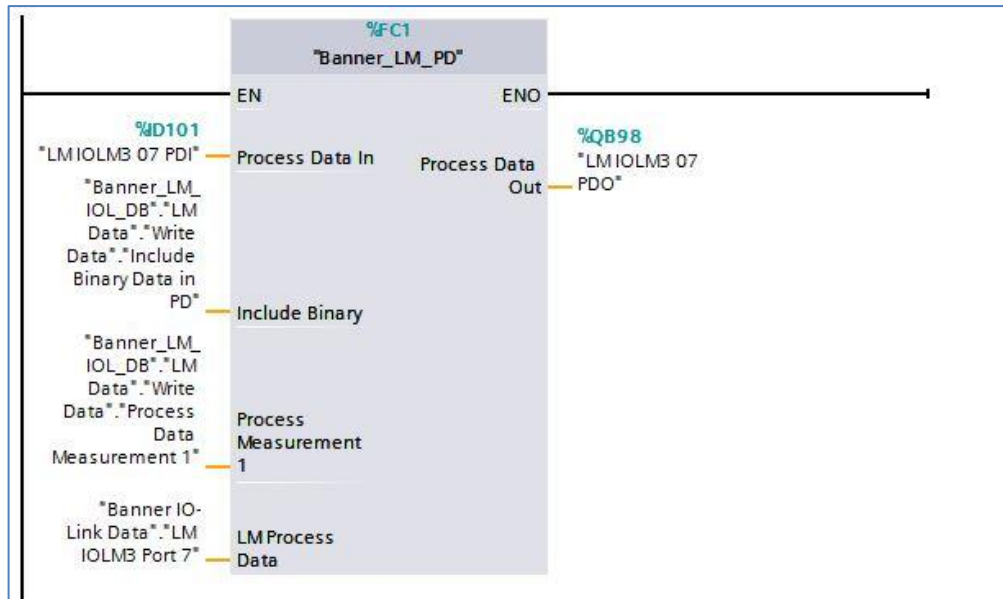


Figure 4: Linking Include Binary and Process Measurement 1 to LM Parameter Data Function Block

11. Process Data setup is complete.

12. Compile and download the configuration to the PLC, then go online. Open the “Banner IO-Link Data” data block and click Monitor all. You should see parsed LM Process Data In, like that shown below.

Banner IO-Link Data				
	Name	Data type	Start value	Monitor value
1	Static			
2	LM IOLM3 Port 7	"Banner_LM_PDIO"		
3	Channel 1 Output State	Bool	false	TRUE
4	Analog State	Bool	false	TRUE
5	Stability	Bool	false	TRUE
6	Measurement Value 1	Real	0.0	148.175
7	Measurement Value 2	Real	0.0	0.0
8	Laser Transducer	SInt	0	0

## Appendix A

## LM Process Data

The LM has 4 bytes of Process Data In. There are two modes for displaying this data, as shown below. The first is mode 1.

ProcessDataIn "Process Data Input" id=PD_ProcessDataIn									
bit length: 32 data type: 32-bit Record (subindex access not supported)									
subindex	bit offset	data type	allowed values	default value	acc. restr.	mod. other var.	excl. from DS	name	description
1	0	Boolean	false = Inactive, true = Active					Channel 1 Output State	Channel 1 Output State
2	1	Boolean	false = Inactive, true = Active					Analog State	Determine whether the measured process data distance is within the analog window.
3	2	Boolean	false = No target or Marginal, true = Stable					Stability	Stability state
4	3	19-bit Integer						Measurement 1 Value	The selected process data measurement 1 value.
5	22	10-bit UInteger						Measurement 2 Value	The selected process data measurement 2 value.

This Process Data is mapped to a specific group of PROFINET addresses. The 32-bits of Process Data encode five separate pieces of information. Bit 0 is the state of BDC1 (Binary Data Channel 1, also known simply as Output Channel 1). Bit 1 is the analog state indicator and bit 2 is the stability indicator. The remaining 29 bits are used to communicate the LM Measurement 1 and Measurement 2 values.

This function intelligently parses this Process Data into its component pieces.

In mode 0 only the measurement value is provided with no binary status bits (no Output 1, Analog, or Stability).

ProcessDataIn "Process Data Input" id=PD_ProcessDataInWithoutBinary									
bit length: 32 data type: 32-bit Record (subindex access not supported)									
subindex	bit offset	data type	allowed values	default value	acc. restr.	mod. other var.	excl. from DS	name	description
1	0	19-bit UInteger						Measurement 1 Value	The selected process data measurement 1 value.
2	19	13-bit UInteger						Measurement 2 Value	The selected process data measurement 2 value.

The LM has 1 byte of Process Data Out. The value controls whether the laser is disabled.

ProcessDataOut "Process Data Output" id=PD_ProcessDataOut									
bit length: 8 data type: 8-bit Record (subindex access not supported)									
subindex	bit offset	data type	allowed values	default value	acc. restr.	mod. other var.	excl. from DS	name	description
1	0	Boolean	false = Active, true = Inactive					Transducer Disable	