Function block library

RadiolineBasic_1

for PLCnext Engineer

This documentation is available in English only.

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1 Installation hint

If you did not specify a different directory during **library** installation all data in the MSI file will be unpacked to

c:\Users\Public\Documents\Phoenix Contact Libraries\PLCnext Engineer (former: PC Worx Engineer)

Please copy the library data to your PLCnext Engineer (former: PC Worx Engineer) working library directory.

If you did not specify a different directory during **PLCnext Engineer** installation the default PLCnext Engineer working library directory is

c:\Users\Public\Documents\PLCnext Engineer\Libraries (former: PC Worx Engineer\Libraries)

2 General information

The RadiolineBasic library contains driver blocks for the currently available Radioline devices. The devices can be controlled and status information can be read out using these blocks.

The Modbus library is required for communication.

3 Change notes

Library version	Library build	PLCnext Engineer version	Change notes	Supported PLCs
1	20200423	>= 2020.0 LTS	Added the following startup examples: • RAD_1_EXA_IL_UNI.pcwex • RAD_1_EXA_AXL_UNI.pcwex Updated with new version of Modbus library	AXC F 1152 (1151412) AXC F 2152 (2404267) AXC F 3152 (1069208)
1	20191125	2019.0 LTS 2019.3 2019.6 2019.9	Converted from PC Worx 6	AXC F 2152 (2404267)

4 Function blocks

Function block	Description	Version	Supported articles	License
RAD_Search_IO	Detecting all the I/O modules in a Radioline network and entering the information in a structure.	1	RAD-2400-IFS (2901541) RAD-868-IFS (2904909) RAD-900-IFS (2901540) RAD-RS485-IFS (2702184)	none
RAD_DIAG	Function block for reading out diagnostic information.	1	RAD-2400-IFS (2901541) RAD-868-IFS (2904909) RAD-900-IFS (2901540) RAD-RS485-IFS (2702184)	none
RAD_DI4	Driver block for RAD-DI4-IFS.	1	RAD-DI4-IFS (2901535)	none
RAD_DI8_STAT	Driver block for RAD-DI8-IFS.	1	RAD-DI8-IFS (2901539)	none
RAD_DI8_CNT	Driver block for RAD-DI8-IFS.	1	RAD-DI8-IFS (2901539)	none
RAD_DOR4	Driver block for RAD-DOR4-IFS.	1	RAD-DOR4-IFS (2901536)	none
RAD_DO8	Driver block for RAD-DO8-IFS.	1	RAD-DO8-IFS (2902811)	none
RAD_AI4	Driver block for RAD-AI4-IFS.	1	RAD-AI4-IFS (2901537)	none
RAD_AI4_U	Driver block for RAD-AI4-IFS.	1	RAD-AI4-IFS (2901537)	none
RAD_AO4	Driver block for RAD-AO4-IFS.	1	RAD-AO4-IFS (2901538)	none
RAD_PT100_4	Driver block for RAD-PT100-4-IFS.	1	RAD-PT100-4-IFS (2904035)	none
RAD_DAIO6	Driver block for RAD-DAIO6-IFS.	1	RAD-DAIO6-IFS (2901533)	none
RAD_NAM4	Driver block for RAD-NAM4-IFS.	1	RAD-NAM4-IFS (2316275)	none

5 RAD_Search_IO

The block is used for detecting all the I/O modules in a Radioline network and entering the information in a structure. The function block requests all the available Modbus registers that may contain device information, one after the other. When receiving a response, the device parameters received, e.g., device ID, device designation, and I/O MAP address, are stored in a structure. In this way it can be checked in the driver blocks whether the correct driver has been selected for the device. However, this is not strictly necessary because each driver block, upon activation, reads its own configuration and writes it to the structure.

5.1 Function block call
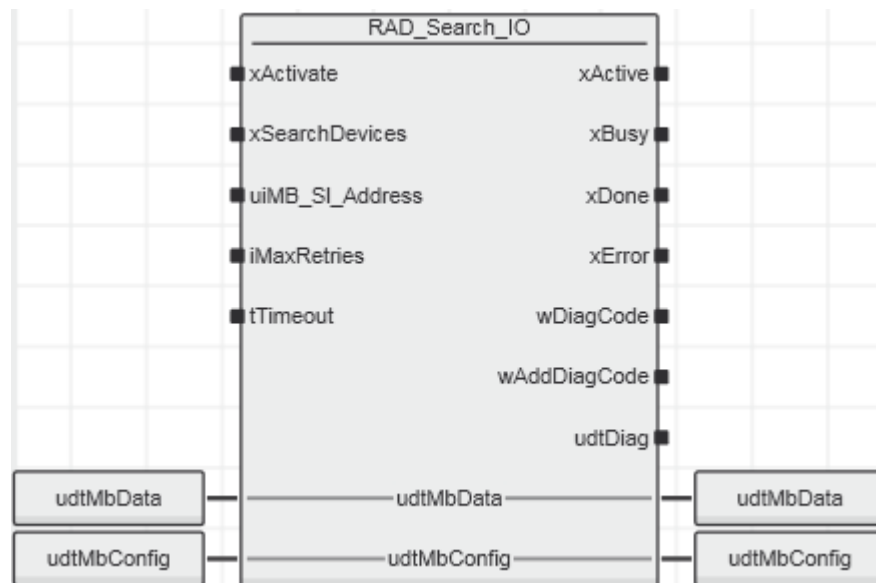
5.2 Input parameters

Name	Type	Description
xActivate	BOOL	Rising edge: Activates the function block. FALSE: Deactivates the function block.
xSearchDevices	BOOL	Starts a new read operation of the Radioline network.
uiMB_SI_Address	UINT	The Modbus slave address of the Radioline master module is specified at this parameter.
iMaxRetries	INT	This variable defines the number of connection attempts to a module if the Modbus function code block outputs an error.
tTimeout	TIME	The time a state machine of the FB is allowed to remain at one step before an error is detected is set here. The time must be longer than the Modbus timeout time.

5.3 Output parameters

Name	Type	Description
xActive	BOOL	FALSE: Function block is not active. TRUE: Function block is active.
xBusy	BOOL	TRUE: The block is busy with the service execution.
xDone	BOOL	TRUE: Request was sent and the response from communication partner received successfully.
xError	BOOL	TRUE: An error has occurred. For details refer to wDiagCode and wAddDiagCode.
wDiagCode	WORD	Diagnosis code. Refer to diagnostic table.
wAddDiagCode	WORD	Additional diagnosis code. Refer to diagnostic table.
udtDiag	RAD_UDT_SEARCH_IO_DIAG	Structure with internal variables for Diagnostic

5.4 Inout parameters

Name	Type	Description
udtMBData	udtModbus2_Data	Structure for communication with the Modbus function blocks.
udtMB_Config	UDT_RAD_CONFIG	At the end of a read operation, the structure contains the information about the Radioline network structure that is required by the driver blocks. The parameters of the Radioline device are then found in the structure in place of the entered IO-MAP address (parameter iIO_MAP).

5.5 Diagnosis

wDiagCode	wAddDiagCode	Description
16#0000	16#0000	Function block is deactivated.
16#8400	16#xxxx	The function block waits for the deactivation of the block with the IO-MAP address displayed under wAddDiagCode.
16#8000	16#0000	Function block is in regular operation.
16#C110	16#0001	Parameterization error: Parameter uiMB_SI_Address equal to 0 or greater than 255
16#C416	16#xxxx	Internal timeout: wAddDiagCode shows the position of the internal timeout (Support)
16#C520	16#0002	Error in the internally used block modbus FC4: For the diagnostic code of the internal block refer to output udtDiag.udtMB_RTU_FC4_Diag. For the description of the diagnostic code refer to the Modbus_RTU library documentation.
16#C520	16#0004	Error in the internally used block modbus FC3: For the diagnostic code of the internal block refer to output udtDiag.udtMB_RTU_FC3_Diag. For the description of the diagnostic code refer to the Modbus_RTU library documentation.

6 RAD_DIAG

Function block for reading the diagnostic information of the wireless transceivers that are present in the Radioline network. The block outputs output the signal strengths of the wireless communication and error messages.

6.1 Function block call
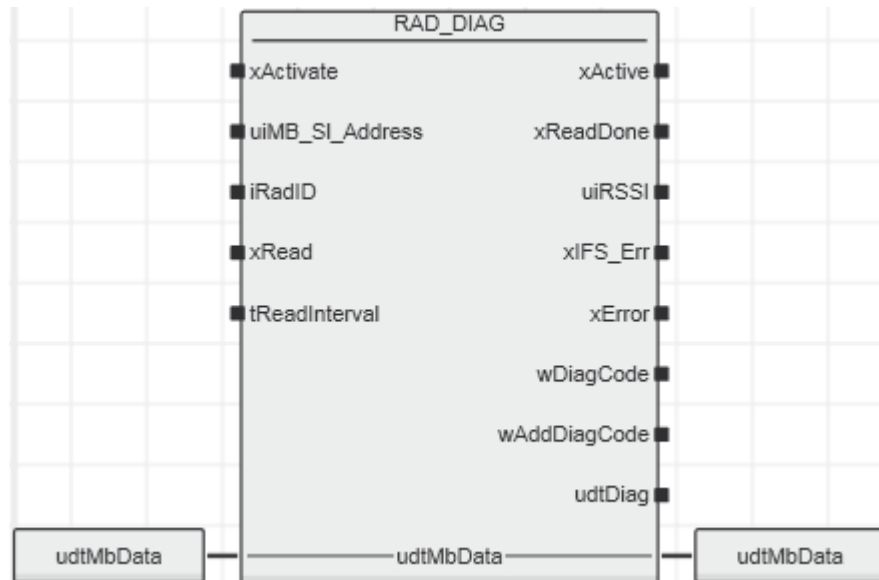
6.2 Input parameters

Name	Type	Description
xActivate	BOOL	Rising edge: Activates the function block. FALSE: Deactivates the function block.
uiMB_SI_Address	UINT	The Modbus slave address of the Radioline master module is specified at this parameter.
iRad_ID	INT	RAD ID of the wireless transceiver.
xRead	BOOL	These variables are used to start cyclic reading of the module process data via Modbus.
tReadInterval	TIME	The cyclic interval for reading the data is specified here.

6.3 Output parameters

Name	Type	Description
xActive	BOOL	FALSE: Function block is not active. TRUE: Function block is active.
xReadDone	BOOL	Modbus data received. TRUE for only one cycle.
uiRSSI	UINT	Received signal strength indicator of the wireless communication in –dBm.
xIFS_Err	BOOL	Error in the local bus of the wireless transceiver.
xError	BOOL	TRUE: An error has occurred. For details refer to wDiagCode and wAddDiagCode.
wDiagCode	WORD	Diagnosis code. Refer to diagnostic table.
wAddDiagCode	WORD	Additional diagnosis code. Refer to diagnostic table.
udtDiag	RAD_UDT_DIAG_DIAG	Structure with internal variables for Diagnostic

6.4 Inout parameters

Name	Type	Description
udtMBData	udtModbus2_Data	Structure for communication with the Modbus function blocks.

6.5 Diagnosis

wDiagCode	wAddDiagCode	Description
16#0000	16#0000	Function block is deactivated.
16#8000	16#0000	Function block is in regular operation.
16#C110	16#0001	Parameterization error: Parameter uiMB_Sl_Address equal to 0 or greater than 255
16#C110	16#0002	Parameterization error: Parameter iIO_MAP less than 0 or greater than 99.
16#C520	16#0002	Error in the internally used block modbus FC4: For the diagnostic code of the internal block refer to output udtDiag.udtMB_RTU_FC4_Diag. For the description of the diagnostic code refer to the Modbus_RTU library documentation.

7 RAD_DI4

Driver block for communication with a RAD-DI4-IFS (2901535) module.

The function block outputs the states of the digital module inputs at the block output. Each time the block is activated, or cyclically after a communication error, the data of the device associated with the block is read once via the iIO_MAP address and is entered in the structure udtMB_Config in place of the iIO_MAP. The cycle time is set at the input tScanCycle.

7.1 Function block call

7.2 Input parameters

Name	Type	Description
xActivate	BOOL	Rising edge: Activates the function block. FALSE: Deactivates the function block.
uiMB_SI_Address	UINT	The Modbus slave address of the Radioline master module is specified at this parameter.
iIO_MAP	INT	The point at which the I/O device is present in the udtMB_Config device structure is specified here.
xRead	BOOL	These variables are used to start cyclic reading of the module process data via Modbus.
tReadInterval	TIME	The cyclic interval for reading the data is specified here.
tScanCycle	TIME	Time interval in which the block reads its data again in the structure udtMB_Config in place of iIO_MAP. Once the set time has elapsed, the function is only executed when the up-to-date data bit is FALSE. The time is set to 60 seconds by default.

7.3 Output parameters

Name	Type	Description
xActive	BOOL	FALSE: Function block is not active. TRUE: Function block is active.
xReadDone	BOOL	Modbus data received. TRUE for only one cycle.
xMB_DataValid	BOOL	Message from the I/O device: the process data provided via Modbus is valid. Only valid if xReadDone is true.
bDI	BYTE	Bits 0 - 3 contain the states of the digital module inputs. Only valid if xMB_DataValid is true.
xError	BOOL	TRUE: An error has occurred. For details refer to wDiagCode and wAddDiagCode.
wDiagCode	WORD	Diagnosis code. Refer to diagnostic table.
wAddDiagCode	WORD	Additional diagnosis code. Refer to diagnostic table.
udtDiag	RAD_UDT_DI4_DIAG	Structure with internal variables for Diagnostic

7.4 Inout parameters

Name	Type	Description
udtMBData	udtModbus2_Data	Structure for communication with the Modbus function blocks.
udtMB_Config	UDT_RAD_CONFIG	At the end of a read operation, the structure contains the information about the Radioline network structure that is required by the driver blocks. The parameters of the Radioline device are then found in the structure in place of the entered IO-MAP address (parameter iIO_MAP).

7.5 Diagnosis

wDiagCode	wAddDiagCode	Description
16#0000	16#0000	Function block is deactivated.
16#8100	16#0000	The function block searches for the Radioline module at the IO-Map address.
16#8400	16#0000	The function block waits for the end of the search process of the RAD_Search_IO block.
16#8000	16#0000	Function block is in regular operation.
16#C110	16#0001	Parameterization error: Parameter uiMB_SI_Address equal to 0 or greater than 255
16#C110	16#0002	Parameterization error: Parameter iIO_MAP less than 0 or greater than 99.
16#C211	16#0002	Module type error: Wrong module type found at specified IO-MAP address.
16#C520	16#0001	Error in the internally used block RAD_Search_Module: For the diagnostic code of the internal block refer to output udtDiag.udtRAD_Search_Module_Diag.
16#C520	16#0002	Error in the internally used block modbus FC4: For the diagnostic code of the internal block refer to output udtDiag.udtMB_RTU_FC4_Diag. For the description of the diagnostic code refer to the Modbus_RTU library documentation.
16#C520	16#0004	Error in the internally used block modbus FC3: For the diagnostic code of the internal block refer to output udtDiag.udtMB_RTU_FC3_Diag. For the description of the diagnostic code refer to the Modbus_RTU library documentation.

8 RAD_DI8_STAT

Driver block for communication with a RAD-DI8-IFS (2901539) module in "static mode" operating mode.

The function block outputs the states of the digital module inputs at the block output. Each time the block is activated, or cyclically after a communication error, the data of the device associated with the block is read once via the iIO_MAP address and is entered in the structure udtMB_Config in place of the iIO_MAP. The cycle time is set at the input tScanCycle.

8.1 Function block call

8.2 Input parameters

Name	Type	Description
xActivate	BOOL	Rising edge: Activates the function block. FALSE: Deactivates the function block.
uiMB_SI_Address	UINT	The Modbus slave address of the Radioline master module is specified at this parameter.
iIO_MAP	INT	The point at which the I/O device is present in the udtMB_Config device structure is specified here.
xRead	BOOL	These variables are used to start cyclic reading of the module process data via Modbus.
tReadInterval	TIME	The cyclic interval for reading the data is specified here.
tScanCycle	TIME	Time interval in which the block reads its data again in the structure udtMB_Config in place of iIO_MAP. Once the set time has elapsed, the function is only executed when the up-to-date data bit is FALSE. The time is set to 60 seconds by default.

8.3 Output parameters

Name	Type	Description
xActive	BOOL	FALSE: Function block is not active. TRUE: Function block is active.
xReadDone	BOOL	Modbus data received. TRUE for only one cycle.
xMB_DataValid	BOOL	Message from the I/O device: the process data provided via Modbus is valid. Only valid if xReadDone is true.
bDI	BYTE	Bits 0 - 3 contain the states of the digital module inputs. Only valid if xMB_DataValid is true.
xError	BOOL	TRUE: An error has occurred. For details refer to wDiagCode and wAddDiagCode.
wDiagCode	WORD	Diagnosis code. Refer to diagnostic table.
wAddDiagCode	WORD	Additional diagnosis code. Refer to diagnostic table.
udtDiag	RAD_UDT_DI8_STAT_DIAG	Structure with internal variables for Diagnostic

8.4 Inout parameters

Name	Type	Description
udtMBData	udtModbus2_Data	Structure for communication with the Modbus function blocks.
udtMB_Config	UDT_RAD_CONFIG	At the end of a read operation, the structure contains the information about the Radioline network structure that is required by the driver blocks. The parameters of the Radioline device are then found in the structure in place of the entered IO-MAP address (parameter iIO_MAP).

8.5 Diagnosis

wDiagCode	wAddDiagCode	Description
16#0000	16#0000	Function block is deactivated.
16#8100	16#0000	The function block searches for the Radioline module at the IO-Map address.
16#8400	16#0000	The function block waits for the end of the search process of the RAD_Search_IO block.
16#8000	16#0000	Function block is in regular operation.
16#C110	16#0001	Parameterization error: Parameter uiMB_SI_Address equal to 0 or greater than 255
16#C110	16#0002	Parameterization error: Parameter iIO_MAP less than 0 or greater than 99.
16#C211	16#0002	Module type error: Wrong module type found at specified IO-MAP address.
16#C520	16#0001	Error in the internally used block RAD_Search_Module: For the diagnostic code of the internal block refer to output udtDiag.udtRAD_Search_Module_Diag.
16#C520	16#0002	Error in the internally used block modbus FC4: For the diagnostic code of the internal block refer to output udtDiag.udtMB_RTU_FC4_Diag. For the description of the diagnostic code refer to the Modbus_RTU library documentation.
16#C520	16#0004	Error in the internally used block modbus FC3: For the diagnostic code of the internal block refer to output udtDiag.udtMB_RTU_FC3_Diag. For the description of the diagnostic code refer to the Modbus_RTU library documentation.

9 RAD_DI8_CNT

Driver block for communication with a RAD-DI8-IFS (2901539) module in "pulse counter mode" operating mode.

The function block outputs the values of the two counters as block outputs. Two inputs can be used to reset the two counters. Each time the block is activated, or cyclically after a communication error, the data of the device associated with the block is read once via the iIO_MAP address and is entered in the structure udtMB_Config in place of the iIO_MAP. The cycle time is set at the input tScanCycle.

9.1 Function block call

9.2 Input parameters

Name	Type	Description
xActivate	BOOL	Rising edge: Activates the function block. FALSE: Deactivates the function block.
uiMB_SI_Address	UINT	The Modbus slave address of the Radioline master module is specified at this parameter.
iIO_MAP	INT	The point at which the I/O device is present in the udtMB_Config device structure is specified here.
xRead	BOOL	These variables are used to start cyclic reading of the module process data via Modbus.
tReadInterval	TIME	The cyclic interval for reading the data is specified here.
xWrite	BOOL	These variables are used to start cyclic writing of the module process data via Modbus.
tWriteInterval	TIME	The cyclic interval for writing the data is specified here.
xResetCounter1	BOOL	These variables are used to reset counter 1.
xResetCounter2	BOOL	These variables are used to reset counter 2.
tScanCycle	TIME	Time interval in which the block reads its data again in the structure udtMB_Config in place of iIO_MAP. Once the set time has elapsed, the function is only executed when the up-to-date data bit is FALSE. The time is set to 60 seconds by default.

9.3 Output parameters

Name	Type	Description
xActive	BOOL	FALSE: Function block is not active. TRUE: Function block is active.
xReadDone	BOOL	Modbus data received. TRUE for only one cycle.
xWriteDone	BOOL	Modbus data written. TRUE for only one cycle.
xMB_DataValid	BOOL	Message from the I/O device: the process data provided via Modbus is valid. Only valid if xReadDone is true.
udiCounter1	UDINT	Counter state of counter input 1. Only valid if xMB_DataValid is true.
udiCounter2	UDINT	Counter state of counter input 2. Only valid if xMB_DataValid is true.
xError	BOOL	TRUE: An error has occurred. For details refer to wDiagCode and wAddDiagCode.
wDiagCode	WORD	Diagnosis code. Refer to diagnostic table.
wAddDiagCode	WORD	Additional diagnosis code. Refer to diagnostic table.
udtDiag	RAD_UDT_DI8_CNT_DIAG	Structure with internal variables for Diagnostic

9.4 Inout parameters

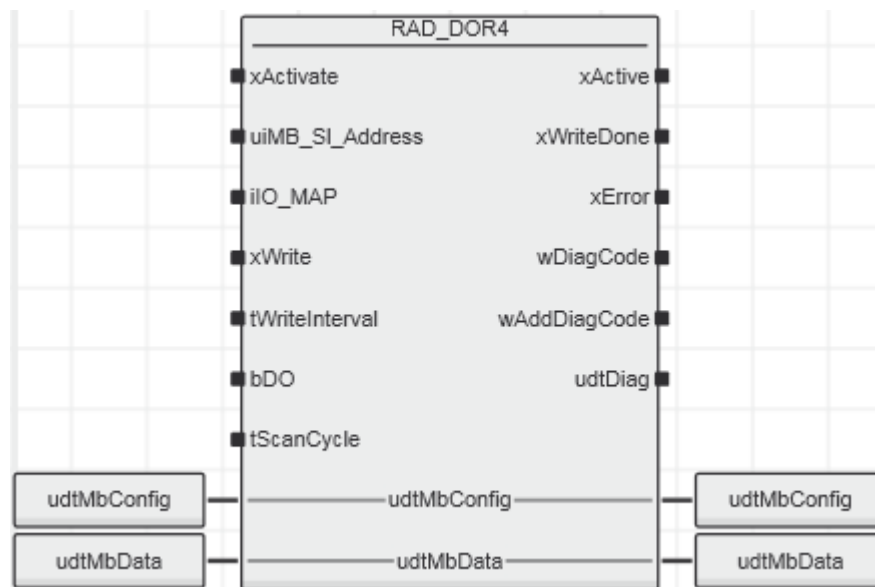| Name	Type	Description
udtMBData	udtModbus2_Data	Structure for communication with the Modbus function blocks.
udtMB_Config	UDT_RAD_CONFIG	At the end of a read operation, the structure contains the information about the Radioline network structure that is required by the driver blocks. The parameters of the Radioline device are then found in the structure in place of the entered IO-MAP address (parameter iIO_MAP).

9.5 Diagnosis

wDiagCode	wAddDiagCode	Description
16#0000	16#0000	Function block is deactivated.
16#8100	16#0000	The function block searches for the Radioline module at the IO-Map address.
16#8400	16#0000	The function block waits for the end of the search process of the RAD_Search_IO block.
16#8000	16#0000	Function block is in regular operation.
16#C110	16#0001	Parameterization error: Parameter uiMB_SI_Address equal to 0 or greater than 255
16#C110	16#0002	Parameterization error: Parameter iIO_MAP less than 0 or greater than 99.
16#C211	16#0002	Module type error: Wrong module type found at specified IO-MAP address.
16#C520	16#0001	Error in the internally used block RAD_Search_Module: For the diagnostic code of the internal block refer to output udtDiag.udtRAD_Search_Module_Diag.
16#C520	16#0002	Error in the internally used block modbus FC4: For the diagnostic code of the internal block refer to output udtDiag.udtMB_RTU_FC4_Diag. For the description of the diagnostic code refer to the Modbus_RTU library documentation.
16#C520	16#0003	Error in the internally used block modbus FC16: For the diagnostic code of the internal block refer to output udtDiag.udtMB_RTU_FC16_Diag. For the description of the diagnostic code refer to the Modbus_RTU library documentation.
16#C520	16#0004	Error in the internally used block modbus FC3: For the diagnostic code of the internal block refer to output udtDiag.udtMB_RTU_FC3_Diag. For the description of the diagnostic code refer to the Modbus_RTU library documentation.

10 RAD_DOR4

Driver block for communication with a RAD-DOR4-IFS (2901536) module.

The four digital module outputs can be controlled using one block input. Each time the block is activated, or cyclically after a communication error, the data of the device associated with the block is read once via the iIO_MAP address and is entered in the structure udtMB_Config in place of the iIO_MAP. The cycle time is set at the input tScanCycle.

10.1 Function block call

10.2 Input parameters

Name	Type	Description
xActivate	BOOL	Rising edge: Activates the function block. FALSE: Deactivates the function block.
uiMB_SI_Address	UINT	The Modbus slave address of the Radioline master module is specified at this parameter.
iIO_MAP	INT	The point at which the I/O device is present in the udtMB_Config device structure is specified here.
xWrite	BOOL	These variables are used to start cyclic writing of the module process data via Modbus.
tWriteInterval	TIME	The cyclic interval for writing the data is specified here.
bDO	BYTE	Bits 0 - 3 contain the states of the digital module outputs.
tScanCycle	TIME	Time interval in which the block reads its data again in the structure udtMB_Config in place of iIO_MAP. Once the set time has elapsed, the function is only executed when the up-to-date data bit is FALSE. The time is set to 60 seconds by default.

10.3 Output parameters

Name	Type	Description
xActive	BOOL	FALSE: Function block is not active. TRUE: Function block is active.
xWriteDone	BOOL	Modbus data written. TRUE for only one cycle.
xError	BOOL	TRUE: An error has occurred. For details refer to wDiagCode and wAddDiagCode.
wDiagCode	WORD	Diagnosis code. Refer to diagnostic table.
wAddDiagCode	WORD	Additional diagnosis code. Refer to diagnostic table.
udtDiag	RAD_UDT_DOR4_DIAG	Structure with internal variables for Diagnostic

10.4 Inout parameters

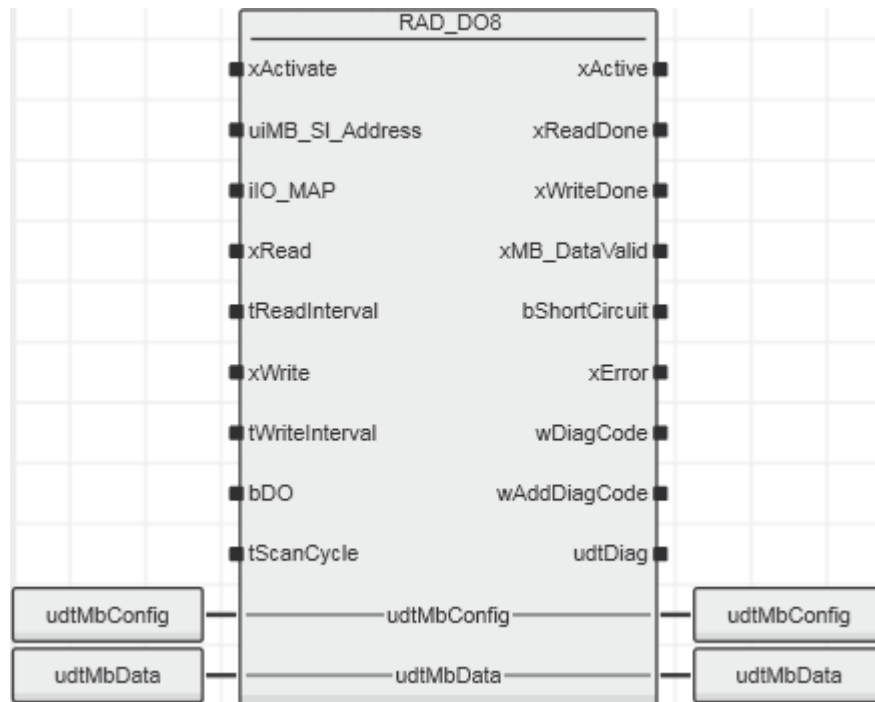| Name	Type	Description
udtMBData	udtModbus2_Data	Structure for communication with the Modbus function blocks.
udtMB_Config	UDT_RAD_CONFIG	At the end of a read operation, the structure contains the information about the Radioline network structure that is required by the driver blocks. The parameters of the Radioline device are then found in the structure in place of the entered IO-MAP address (parameter iIO_MAP).

10.5 Diagnosis

wDiagCode	wAddDiagCode	Description
16#0000	16#0000	Function block is deactivated.
16#8100	16#0000	The function block searches for the Radioline module at the IO-Map address.
16#8400	16#0000	The function block waits for the end of the search process of the RAD_Search_IO block.
16#8000	16#0000	Function block is in regular operation.
16#C110	16#0001	Parameterization error: Parameter uiMB_SI_Address equal to 0 or greater than 255
16#C110	16#0002	Parameterization error: Parameter iIO_MAP less than 0 or greater than 99.
16#C211	16#0002	Module type error: Wrong module type found at specified IO-MAP address.
16#C520	16#0001	Error in the internally used block RAD_Search_Module: For the diagnostic code of the internal block refer to output udtDiag.udtRAD_Search_Module_Diag.
16#C520	16#0002	Error in the internally used block modbus FC4: For the diagnostic code of the internal block refer to output udtDiag.udtMB_RTU_FC4_Diag. For the description of the diagnostic code refer to the Modbus_RTU library documentation.
16#C520	16#0003	Error in the internally used block modbus FC16: For the diagnostic code of the internal block refer to output udtDiag.udtMB_RTU_FC16_Diag. For the description of the diagnostic code refer to the Modbus_RTU library documentation.
16#C520	16#0004	Error in the internally used block modbus FC3: For the diagnostic code of the internal block refer to output udtDiag.udtMB_RTU_FC3_Diag. For the description of the diagnostic code refer to the Modbus_RTU library documentation.

11 RAD_DO8

Driver block for communication with a RAD-DO8-IFS (2902811) module.

The eight digital module outputs can be controlled using one block input. The warning about a short circuit on the digital outputs is output at one block input. Each time the block is activated, or cyclically after a communication error, the data of the device associated with the block is read once via the iIO_MAP address and is entered in the structure udtMB_Config in place of the iIO_MAP. The cycle time is set at the input tScanCycle.

11.1 Function block call

11.2 Input parameters

Name	Type	Description
xActivate	BOOL	Rising edge: Activates the function block. FALSE: Deactivates the function block.
uiMB_Sl_Address	UINT	The Modbus slave address of the Radioline master module is specified at this parameter.
iIO_MAP	INT	The point at which the I/O device is present in the udtMB_Config device structure is specified here.
xRead	BOOL	These variables are used to start cyclic reading of the module process data via Modbus.
tReadInterval	TIME	The cyclic interval for reading the data is specified here.
xWrite	BOOL	These variables are used to start cyclic writing of the module process data via Modbus.
tWriteInterval	TIME	The cyclic interval for writing the data is specified here.
bDO	BYTE	Bits 0 - 3 contain the states of the digital module outputs.
tScanCycle	TIME	Time interval in which the block reads its data again in the structure udtMB_Config in place of iIO_MAP. Once the set time has elapsed, the function is only executed when the up-to-date data bit is FALSE. The time is set to 60 seconds by default.

11.3 Output parameters

Name	Type	Description
xActive	BOOL	FALSE: Function block is not active. TRUE: Function block is active.
xReadDone	BOOL	Modbus data received. TRUE for only one cycle.
xWriteDone	BOOL	Modbus data written. TRUE for only one cycle.
xMB_DataValid	BOOL	Message from the I/O device: the process data provided via Modbus is valid. Only valid if xReadDone is true.
bShortCircuit	BYTE	Bits 0 - 7 indicate the states for short circuit detection on the digital outputs.
xError	BOOL	TRUE: An error has occurred. For details refer to wDiagCode and wAddDiagCode.
wDiagCode	WORD	Diagnosis code. Refer to diagnostic table.
wAddDiagCode	WORD	Additional diagnosis code. Refer to diagnostic table.
udtDiag	RAD_UDT_DO8_DIAG	Structure with internal variables for Diagnostic

11.4 Inout parameters

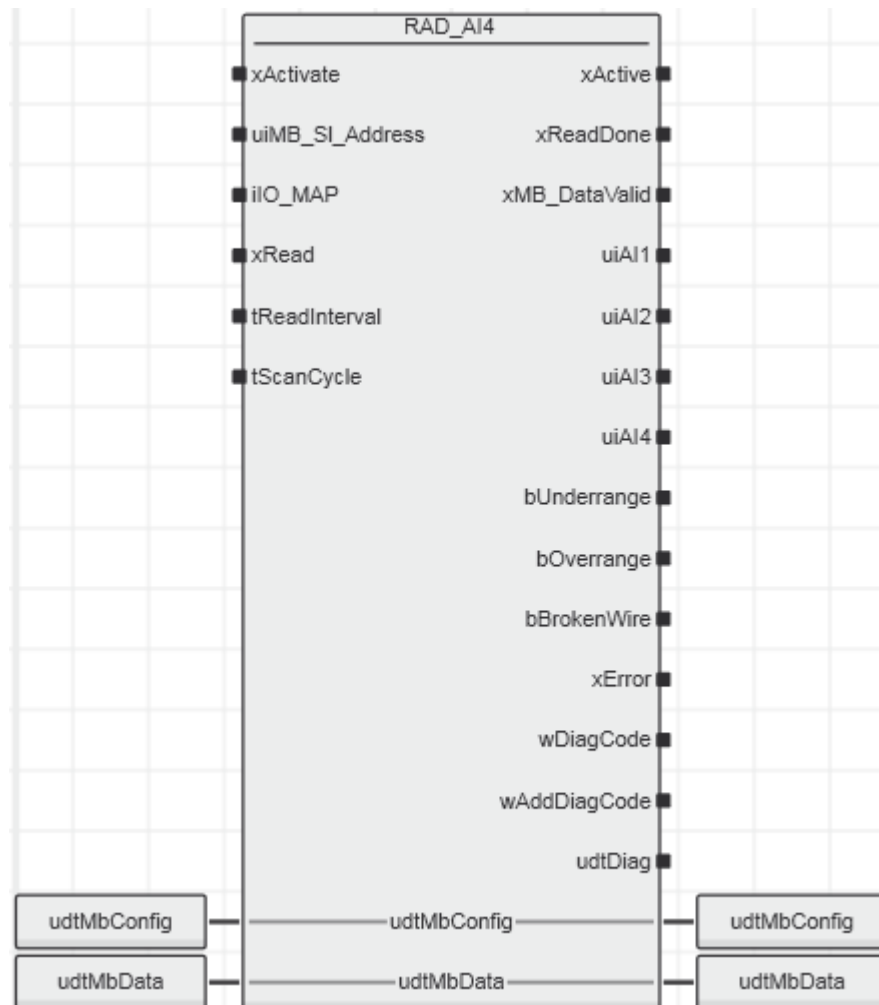| Name	Type	Description
udtMBData	udtModbus2_Data	Structure for communication with the Modbus function blocks.
udtMB_Config	UDT_RAD_CONFIG	At the end of a read operation, the structure contains the information about the Radioline network structure that is required by the driver blocks. The parameters of the Radioline device are then found in the structure in place of the entered IO-MAP address (parameter iIO_MAP).

11.5 Diagnosis

wDiagCode	wAddDiagCode	Description
16#0000	16#0000	Function block is deactivated.
16#8100	16#0000	The function block searches for the Radioline module at the IO-Map address.
16#8400	16#0000	The function block waits for the end of the search process of the RAD_Search_IO block.
16#8000	16#0000	Function block is in regular operation.
16#C110	16#0001	Parameterization error: Parameter uiMB_SI_Address equal to 0 or greater than 255
16#C110	16#0002	Parameterization error: Parameter iIO_MAP less than 0 or greater than 99.
16#C211	16#0002	Module type error: Wrong module type found at specified IO-MAP address.
16#C520	16#0001	Error in the internally used block RAD_Search_Module: For the diagnostic code of the internal block refer to output udtDiag.udtRAD_Search_Module_Diag.
16#C520	16#0002	Error in the internally used block modbus FC4: For the diagnostic code of the internal block refer to output udtDiag.udtMB_RTU_FC4_Diag. For the description of the diagnostic code refer to the Modbus_RTU library documentation.
16#C520	16#0003	Error in the internally used block modbus FC16: For the diagnostic code of the internal block refer to output udtDiag.udtMB_RTU_FC16_Diag. For the description of the diagnostic code refer to the Modbus_RTU library documentation.
16#C520	16#0004	Error in the internally used block modbus FC3: For the diagnostic code of the internal block refer to output udtDiag.udtMB_RTU_FC3_Diag. For the description of the diagnostic code refer to the Modbus_RTU library documentation.

12 RAD_AI4

Driver block for communication with a RAD-AI4-IFS (2901537) module.

The function block outputs the states of the analog inputs as block outputs. The states for value overrange, value underrange, and cable break are also output as block outputs. Each time the block is activated, or cyclically after a communication error, the data of the device associated with the block is read once via the iIO_MAP address and is entered in the structure udtMB_Config in place of the iIO_MAP. The cycle time is set at the input tScanCycle.

12.1 Function block call

12.2 Input parameters

Name	Type	Description
xActivate	BOOL	Rising edge: Activates the function block. FALSE: Deactivates the function block.
uiMB_SI_Address	UINT	The Modbus slave address of the Radioline master module is specified at this parameter.
iIO_MAP	INT	The point at which the I/O device is present in the udtMB_Config device structure is specified here.
xRead	BOOL	These variables are used to start cyclic reading of the module process data via Modbus.
tReadInterval	TIME	The cyclic interval for reading the data is specified here.
tScanCycle	TIME	Time interval in which the block reads its data again in the structure udtMB_Config in place of iIO_MAP. Once the set time has elapsed, the function is only executed when the up-to-date data bit is FALSE. The time is set to 60 seconds by default.

12.3 Output parameters

Name	Type	Description
xActive	BOOL	FALSE: Function block is not active. TRUE: Function block is active.
xReadDone	BOOL	Modbus data received. TRUE for only one cycle.
xMB_DataValid	BOOL	Message from the I/O device: the process data provided via Modbus is valid. Only valid if xReadDone is true.
uiAI1	UINT	This output indicates the value of analog input 1 in µA. Only valid if xMB_DataValid is true. In case of a channel error, the value is set to 0.
uiAI2	UINT	This output indicates the value of analog input 2 in µA. Only valid if xMB_DataValid is true. In case of a channel error, the value is set to 0.
uiAI3	UINT	This output indicates the value of analog input 3 in µA. Only valid if xMB_DataValid is true. In case of a channel error, the value is set to 0.
uiAI4	UINT	This output indicates the value of analog input 4 in µA. Only valid if xMB_DataValid is true. In case of a channel error, the value is set to 0.
bUnderrange	BYTE	Bits 0 - 3 change to TRUE for inputs 1 - 4 if value underrange is detected.
bOverrange	BYTE	Bits 0 - 3 change to TRUE for inputs 1 - 4 if value overrange is detected.
bBrokenWire	BYTE	Bits 0 - 3 change to TRUE for inputs 1 - 4 if value a broken wire is detected.
xError	BOOL	TRUE: An error has occurred. For details refer to wDiagCode and wAddDiagCode.
wDiagCode	WORD	Diagnosis code. Refer to diagnostic table.
wAddDiagCode	WORD	Additional diagnosis code. Refer to diagnostic table.
udtDiag	RAD_UDT_AI4_DIAG	Structure with internal variables for Diagnostic

12.4 Inout parameters

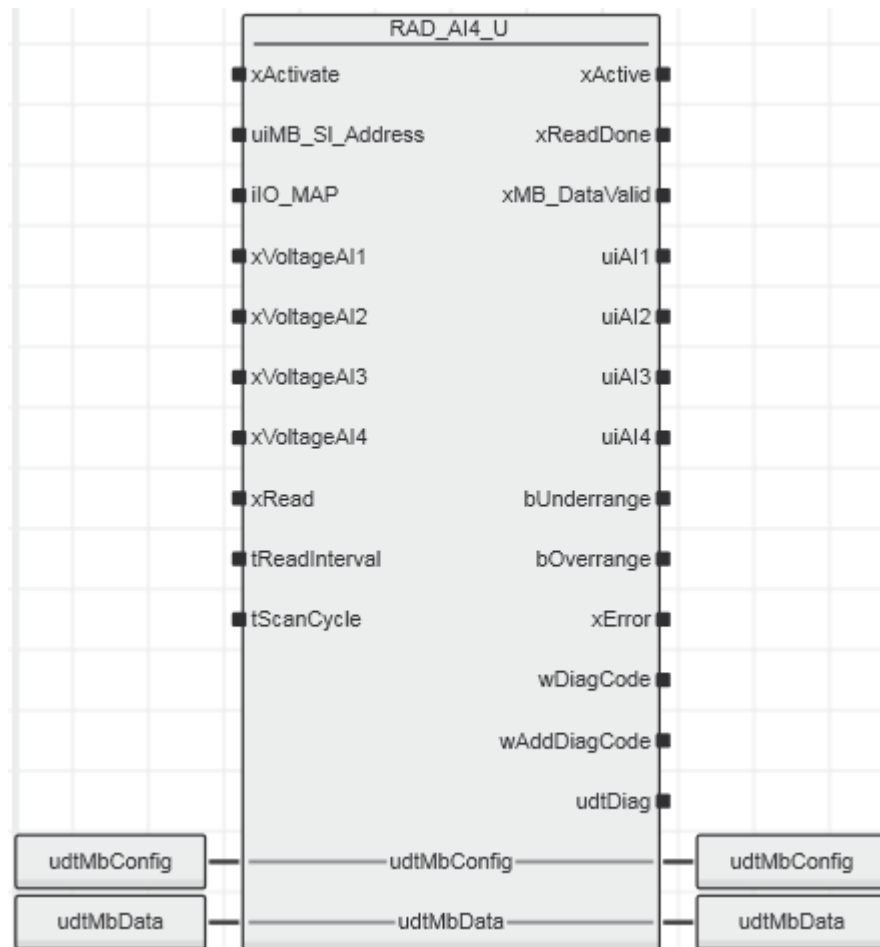| Name	Type	Description
udtMBData	udtModbus2_Data	Structure for communication with the Modbus function blocks.
udtMB_Config	UDT_RAD_CONFIG	At the end of a read operation, the structure contains the information about the Radioline network structure that is required by the driver blocks. The parameters of the Radioline device are then found in the structure in place of the entered IO-MAP address (parameter iIO_MAP).

12.5 Diagnosis

wDiagCode	wAddDiagCode	Description
16#0000	16#0000	Function block is deactivated.
16#8100	16#0000	The function block searches for the Radioline module at the IO-Map address.
16#8400	16#0000	The function block waits for the end of the search process of the RAD_Search_IO block.
16#8000	16#0000	Function block is in regular operation.
16#C110	16#0001	Parameterization error: Parameter uiMB_SI_Address equal to 0 or greater than 255
16#C110	16#0002	Parameterization error: Parameter iIO_MAP less than 0 or greater than 99.
16#C211	16#0002	Module type error: Wrong module type found at specified IO-MAP address.
16#C520	16#0001	Error in the internally used block RAD_Search_Module: For the diagnostic code of the internal block refer to output udtDiag.udtRAD_Search_Module_Diag.
16#C520	16#0002	Error in the internally used block modbus FC4: For the diagnostic code of the internal block refer to output udtDiag.udtMB_RTU_FC4_Diag. For the description of the diagnostic code refer to the Modbus_RTU library documentation.
16#C520	16#0004	Error in the internally used block modbus FC3: For the diagnostic code of the internal block refer to output udtDiag.udtMB_RTU_FC3_Diag. For the description of the diagnostic code refer to the Modbus_RTU library documentation.

13 RAD_AI4_U

Driver block for communication with a RAD-AI4-U-IFS (2702290) module.

The function block outputs the states of the analog inputs as block outputs. The states for value overrange and value underrange are also output as block outputs. Each time the block is activated, or cyclically after a communication error, the data of the device associated with the block is read once via the iIO_MAP address and is entered in the structure udtMB_Config in place of the iIO_MAP. The cycle time is set at the input tScanCycle.

13.1 Function block call

13.2 Input parameters

Name	Type	Description
xActivate	BOOL	Rising edge: Activates the function block. FALSE: Deactivates the function block.
uiMB_Sl_Address	UINT	The Modbus slave address of the Radioline master module is specified at this parameter.
iIO_MAP	INT	The point at which the I/O device is present in the udtMB_Config device structure is specified here.
xVoltageAI1	BOOL	Configure the input in the same way as the DIP switch on the front of the module. FALSE = 0 to 5 V TRUE = 0 to 10 V
xVoltageAI2	BOOL	Configure the input in the same way as the DIP switch on the front of the module. FALSE = 0 to 5 V TRUE = 0 to 10 V
xVoltageAI3	BOOL	Configure the input in the same way as the DIP switch on the front of the module. FALSE = 0 to 5 V TRUE = 0 to 10 V
xVoltageAI4	BOOL	Configure the input in the same way as the DIP switch on the front of the module. FALSE = 0 to 5 V TRUE = 0 to 10 V
xRead	BOOL	These variables are used to start cyclic reading of the module process data via Modbus.
tReadInterval	TIME	The cyclic interval for reading the data is specified here.
tScanCycle	TIME	Time interval in which the block reads its data again in the structure udtMB_Config in place of iIO_MAP. Once the set time has elapsed, the function is only executed when the up-to-date data bit is FALSE. The time is set to 60 seconds by default.

13.3 Output parameters

Name	Type	Description
xActive	BOOL	FALSE: Function block is not active. TRUE: Function block is active.
xReadDone	BOOL	Modbus data received. TRUE for only one cycle.
xMB_DataValid	BOOL	Message from the I/O device: the process data provided via Modbus is valid. Only valid if xReadDone is true.
uiAI1	UINT	This output indicates the value of analog input 1 in mV. Only valid if xMB_DataValid is true. In case of a channel error, the value is set to 0.
uiAI2	UINT	This output indicates the value of analog input 2 in mV. Only valid if xMB_DataValid is true. In case of a channel error, the value is set to 0.
uiAI3	UINT	This output indicates the value of analog input 3 in mV. Only valid if xMB_DataValid is true. In case of a channel error, the value is set to 0.
uiAI4	UINT	This output indicates the value of analog input 4 in mV. Only valid if xMB_DataValid is true. In case of a channel error, the value is set to 0.
bUnderrange	BYTE	Bits 0 - 3 change to TRUE for inputs 1 - 4 if value underrange is detected.
bOverrange	BYTE	Bits 0 - 3 change to TRUE for inputs 1 - 4 if value overrange is detected.
xError	BOOL	TRUE: An error has occurred. For details refer to wDiagCode and wAddDiagCode.
wDiagCode	WORD	Diagnosis code. Refer to diagnostic table.
wAddDiagCode	WORD	Additional diagnosis code. Refer to diagnostic table.
udtDiag	RAD_UDT_AI4_U_DIAG	Structure with internal variables for Diagnostic

13.4 Inout parameters

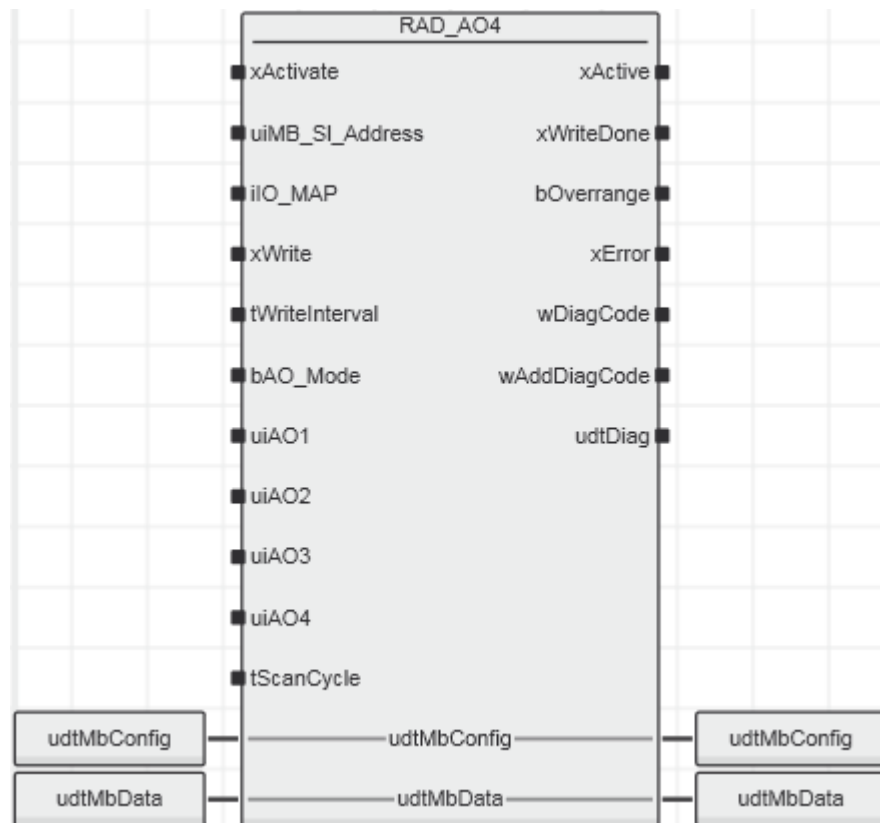| Name	Type	Description
udtMBData	udtModbus2_Data	Structure for communication with the Modbus function blocks.
udtMB_Config	UDT_RAD_CONFIG	At the end of a read operation, the structure contains the information about the Radioline network structure that is required by the driver blocks. The parameters of the Radioline device are then found in the structure in place of the entered IO-MAP address (parameter iIO_MAP).

13.5 Diagnosis

wDiagCode	wAddDiagCode	Description
16#0000	16#0000	Function block is deactivated.
16#8100	16#0000	The function block searches for the Radioline module at the IO-Map address.
16#8400	16#0000	The function block waits for the end of the search process of the RAD_Search_IO block.
16#8000	16#0000	Function block is in regular operation.
16#C110	16#0001	Parameterization error: Parameter uiMB_SI_Address equal to 0 or greater than 255
16#C110	16#0002	Parameterization error: Parameter iIO_MAP less than 0 or greater than 99.
16#C211	16#0002	Module type error: Wrong module type found at specified IO-MAP address.
16#C520	16#0001	Error in the internally used block RAD_Search_Module: For the diagnostic code of the internal block refer to output udtDiag.udtRAD_Search_Module_Diag.
16#C520	16#0002	Error in the internally used block modbus FC4: For the diagnostic code of the internal block refer to output udtDiag.udtMB_RTU_FC4_Diag. For the description of the diagnostic code refer to the Modbus_RTU library documentation.
16#C520	16#0004	Error in the internally used block modbus FC3: For the diagnostic code of the internal block refer to output udtDiag.udtMB_RTU_FC3_Diag. For the description of the diagnostic code refer to the Modbus_RTU library documentation.

14 RAD_AO4

Driver block for communication with a RAD-AO4-IFS (2901538) module.

The four analog module outputs can be controlled using four block inputs. Before applying the values, it is checked whether value overrange occurs. In this case, the block will generate a warning message. Each time the block is activated, or cyclically after a communication error, the data of the device associated with the block is read once via the iIO_MAP address and is entered in the structure udtMB_Config in place of the iIO_MAP. The cycle time is set at the input tScanCycle.

14.1 Function block call

14.2 Input parameters

Name	Type	Description
xActivate	BOOL	Rising edge: Activates the function block. FALSE: Deactivates the function block.
uiMB_SI_Address	UINT	The Modbus slave address of the Radioline master module is specified at this parameter.
iIO_MAP	INT	The point at which the I/O device is present in the udtMB_Config device structure is specified here.
xWrite	BOOL	These variables are used to start cyclic writing of the module process data via Modbus.
tWriteInterval	TIME	The cyclic interval for writing the data is specified here.
bAO_Mode	BYTE	The output variable for each analog output 1 - 4 can be selected using bits 0 - 3 of this parameter. FALSE – Current in μA TRUE – Voltage in mV.
uiAO1	UINT	This output indicates the value of analog output 1 in μA or mV.
uiAO2	UINT	This output indicates the value of analog output 2 in μA or mV.
uiAO3	UINT	This output indicates the value of analog output 3 in μA or mV.
uiAO4	UINT	This output indicates the value of analog output 4 in μA or mV.
tScanCycle	TIME	Time interval in which the block reads its data again in the structure udtMB_Config in place of iIO_MAP. Once the set time has elapsed, the function is only executed when the up-to-date data bit is FALSE. The time is set to 60 seconds by default.

14.3 Output parameters

Name	Type	Description
xActive	BOOL	FALSE: Function block is not active. TRUE: Function block is active.
xWriteDone	BOOL	Modbus data written. TRUE for only one cycle.
bOverrange	BYTE	Bits 0 - 3 change to TRUE for inputs 1 - 4 if value overrange is detected. The previous valid value is retained.
xError	BOOL	TRUE: An error has occurred. For details refer to wDiagCode and wAddDiagCode.
wDiagCode	WORD	Diagnosis code. Refer to diagnostic table.
wAddDiagCode	WORD	Additional diagnosis code. Refer to diagnostic table.
udtDiag	RAD_UDT_AO4_DIAG	Structure with internal variables for Diagnostic

14.4 Inout parameters

Name	Type	Description
udtMBData	udtModbus2_Data	Structure for communication with the Modbus function blocks.
udtMB_Config	UDT_RAD_CONFIG	At the end of a read operation, the structure contains the information about the Radioline network structure that is required by the driver blocks. The parameters of the Radioline device are then found in the structure in place of the entered IO-MAP address (parameter iIO_MAP).

14.5 Diagnosis

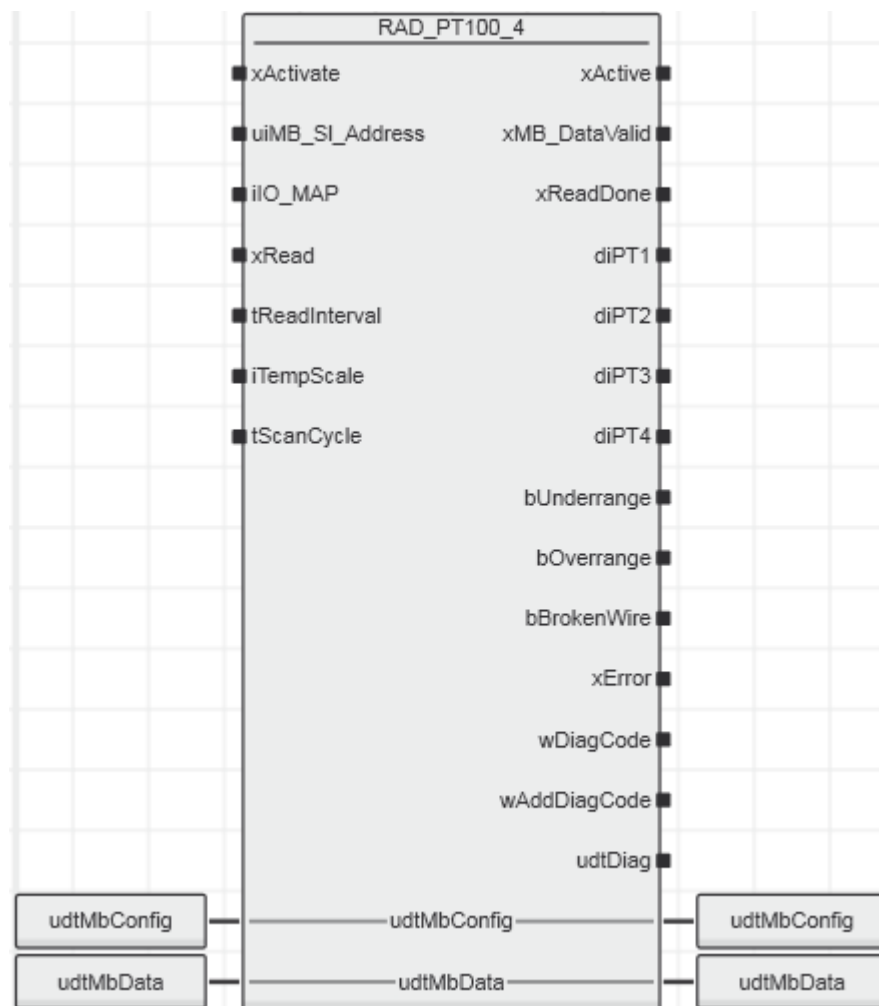| wDiagCode	wAddDiagCode	Description
16#0000	16#0000	Function block is deactivated.
16#8100	16#0000	The function block searches for the Radioline module at the IO-Map address.
16#8400	16#0000	The function block waits for the end of the search process of the RAD_Search_IO block.
16#8000	16#0000	Function block is in regular operation.
16#C110	16#0001	Parameterization error: Parameter uiMB_SI_Address equal to 0 or greater than 255
16#C110	16#0002	Parameterization error: Parameter iIO_MAP less than 0 or greater than 99.
16#C211	16#0002	Module type error: Wrong module type found at specified IO-MAP address.
16#C520	16#0001	Error in the internally used block RAD_Search_Module: For the diagnostic code of the internal block refer to output udtDiag.udtRAD_Search_Module_Diag.
16#C520	16#0002	Error in the internally used block modbus FC4: For the diagnostic code of the internal block refer to output udtDiag.udtMB_RTU_FC4_Diag. For the description of the diagnostic code refer to the Modbus_RTU library documentation.
16#C520	16#0003	Error in the internally used block modbus FC16: For the diagnostic code of the internal block refer to output udtDiag.udtMB_RTU_FC16_Diag. For the description of the diagnostic code refer to the Modbus_RTU library documentation.
16#C520	16#0004	Error in the internally used block modbus FC3: For the diagnostic code of the internal block refer to output udtDiag.udtMB_RTU_FC3_Diag. For the description of the diagnostic code refer to the Modbus_RTU library documentation.

15 RAD_PT100_4

Driver block for communication with a RAD-PT100-4-IFS (2904035) module.

The FB outputs the states of the temperature inputs as block outputs. The states for value overrange, value underrange, and cable break are also output as block outputs.

A temperature scale based on the °C, K or °F units can be selected. Each time the block is activated, or cyclically after a communication error, the data of the device associated with the block is read once via the iIO_MAP address and is entered in the structure udtMB_Config in place of the iIO_MAP. The cycle time is set at the input tScanCycle.

15.1 Function block call

15.2 Input parameters

Name	Type	Description
xActivate	BOOL	Rising edge: Activates the function block. FALSE: Deactivates the function block.
uiMB_Sl_Address	UINT	The Modbus slave address of the Radioline master module is specified at this parameter.
iIO_MAP	INT	The point at which the I/O device is present in the udtMB_Config device structure is specified here.
xRead	BOOL	These variables are used to start cyclic reading of the module process data via Modbus.
tReadInterval	TIME	The cyclic interval for reading the data is specified here.
tTempScale	TIME	This parameter provides the option to select the desired temperature scale 0 = °C/1000 1 = K/1000 2 = °F/1000.
tScanCycle	TIME	Time interval in which the block reads its data again in the structure udtMB_Config in place of iIO_MAP. Once the set time has elapsed, the function is only executed when the up-to-date data bit is FALSE. The time is set to 60 seconds by default.

15.3 Output parameters

Name	Type	Description
xActive	BOOL	FALSE: Function block is not active. TRUE: Function block is active.
xReadDone	BOOL	Modbus data received. TRUE for only one cycle.
xMB_DataValid	BOOL	Message from the I/O device: the process data provided via Modbus is valid. Only valid if xReadDone is true.
uiAl1	UINT	This output indicates the value of analog input 1 of the module. Only valid if xMB_DataValid is true. In case of a channel or scale error, the value is set to 0.
uiAl2	UINT	This output indicates the value of analog input 2 of the module. Only valid if xMB_DataValid is true. In case of a channel or scale error, the value is set to 0.
uiAl3	UINT	This output indicates the value of analog input 3 of the module. Only valid if xMB_DataValid is true. In case of a channel or scale error, the value is set to 0.
uiAl4	UINT	This output indicates the value of analog input 4 of the module. Only valid if xMB_DataValid is true. In case of a channel or scale error, the value is set to 0.
bUnderrange	BYTE	Bits 0 - 3 change to TRUE for inputs 1 - 4 if value underrange is detected.
bOverrange	BYTE	Bits 0 - 3 change to TRUE for inputs 1 - 4 if value overrange is detected.
bBrokenWire	BYTE	Bits 0 - 3 change to TRUE for inputs 1 - 4 if value a broken wire is detected.
xError	BOOL	TRUE: An error has occurred. For details refer to wDiagCode and wAddDiagCode.
wDiagCode	WORD	Diagnosis code. Refer to diagnostic table.
wAddDiagCode	WORD	Additional diagnosis code. Refer to diagnostic table.
udtDiag	RAD_UDT_PT100_4_DIAG	Structure with internal variables for Diagnostic

15.4 Inout parameters

Name	Type	Description
udtMBData	udtModbus2_Data	Structure for communication with the Modbus function blocks.
udtMB_Config	UDT_RAD_CONFIG	At the end of a read operation, the structure contains the information about the Radioline network structure that is required by the driver blocks. The parameters of the Radioline device are then found in the structure in place of the entered IO-MAP address (parameter iIO_MAP).

15.5 Diagnosis

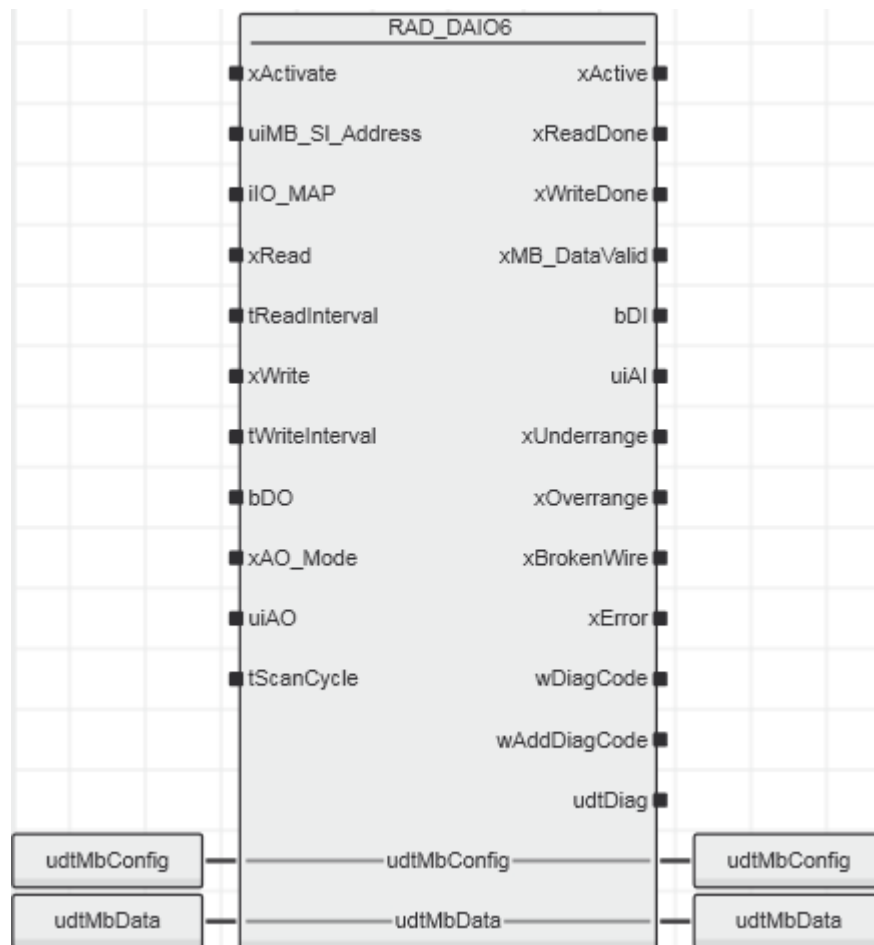| wDiagCode	wAddDiagCode	Description
16#0000	16#0000	Function block is deactivated.
16#8100	16#0000	The function block searches for the Radioline module at the IO-Map address.
16#8400	16#0000	The function block waits for the end of the search process of the RAD_Search_IO block.
16#8000	16#0000	Function block is in regular operation.
16#C110	16#0001	Parameterization error: Parameter uiMB_SI_Address equal to 0 or greater than 255
16#C110	16#0002	Parameterization error: Parameter iIO_MAP less than 0 or greater than 99.
16#C211	16#0001	Invalid scaling parameter on input iTempScale.
16#C211	16#0002	Module type error: Wrong module type found at specified IO-MAP address.
16#C520	16#0001	Error in the internally used block RAD_Search_Module: For the diagnostic code of the internal block refer to output udtDiag.udtRAD_Search_Module_Diag.
16#C520	16#0002	Error in the internally used block modbus FC4: For the diagnostic code of the internal block refer to output udtDiag.udtMB_RTU_FC4_Diag. For the description of the diagnostic code refer to the Modbus_RTU library documentation.
16#C520	16#0004	Error in the internally used block modbus FC3: For the diagnostic code of the internal block refer to output udtDiag.udtMB_RTU_FC3_Diag. For the description of the diagnostic code refer to the Modbus_RTU library documentation.

16 RAD_DAIO6

Driver block for communication with a RAD-DAIO6-IFS (2901533) module.

The function block outputs the states of the analog and digital module inputs as block outputs. The analog and digital module outputs can be controlled using block inputs. The states for value overrange, value underrange, and cable break are also output as block outputs. Each time the block is activated, or cyclically after a communication error, the data of the device associated with the block is read once via the iIO_MAP address and is entered in the structure udtMB_Config in place of the iIO_MAP. The cycle time is set at the input tScanCycle.

16.1 Function block call

16.2 Input parameters

Name	Type	Description
xActivate	BOOL	Rising edge: Activates the function block. FALSE: Deactivates the function block.
uiMB_SI_Address	UINT	The Modbus slave address of the Radioline master module is specified at this parameter.
iIO_MAP	INT	The point at which the I/O device is present in the udtMB_Config device structure is specified here.
xRead	BOOL	These variables are used to start cyclic reading of the module process data via Modbus.
tReadInterval	TIME	The cyclic interval for reading the data is specified here.
xWrite	BOOL	These variables are used to start cyclic writing of the module process data via Modbus.
tWriteInterval	TIME	The cyclic interval for writing the data is specified here.
bDO	BYTE	Bits 0 - 1 are used to control the digital module outputs.
xAO_Mode	BOOL	The output variable for the analog output can be selected using this parameter. FALSE: Current in µA TRUE: Voltage in mV.
uiAO	UINT	The desired value for the analog output of the module is assigned here. If the output range is exceeded, the past valid value is kept.
tScanCycle	TIME	Time interval in which the block reads its data again in the structure udtMB_Config in place of iIO_MAP. Once the set time has elapsed, the function is only executed when the up-to-date data bit is FALSE. The time is set to 60 seconds by default.

16.3 Output parameters

Name	Type	Description
xActive	BOOL	FALSE: Function block is not active. TRUE: Function block is active.
xReadDone	BOOL	Modbus data received. TRUE for only one cycle.
xWriteDone	BOOL	Modbus data written. TRUE for only one cycle.
xMB_DataValid	BOOL	Message from the I/O device: the process data provided via Modbus is valid. Only valid if xReadDone is true.
bDI	BYTE	Bits 0 - 1 contain the states of the digital module inputs. Only valid if xMB_DataValid is true.
uiAI	UINT	This output indicates the value of analog input in µA or mV. Only valid if xMB_DataValid is true. In case of a channel error, the value is set to 0.
bUnderrange	BYTE	Bits 0 - 3 change to TRUE for inputs 1 - 4 if value underrange is detected.
bOverrange	BYTE	Bits 0 - 3 change to TRUE for inputs 1 - 4 if value overrange is detected.
bBrokenWire	BYTE	Bits 0 - 3 change to TRUE for inputs 1 - 4 if value a broken wire is detected.
xError	BOOL	TRUE: An error has occurred. For details refer to wDiagCode and wAddDiagCode.
wDiagCode	WORD	Diagnosis code. Refer to diagnostic table.
wAddDiagCode	WORD	Additional diagnosis code. Refer to diagnostic table.
udtDiag	RAD_UDT_DAIO6_DIAG	Structure with internal variables for Diagnostic

16.4 Inout parameters

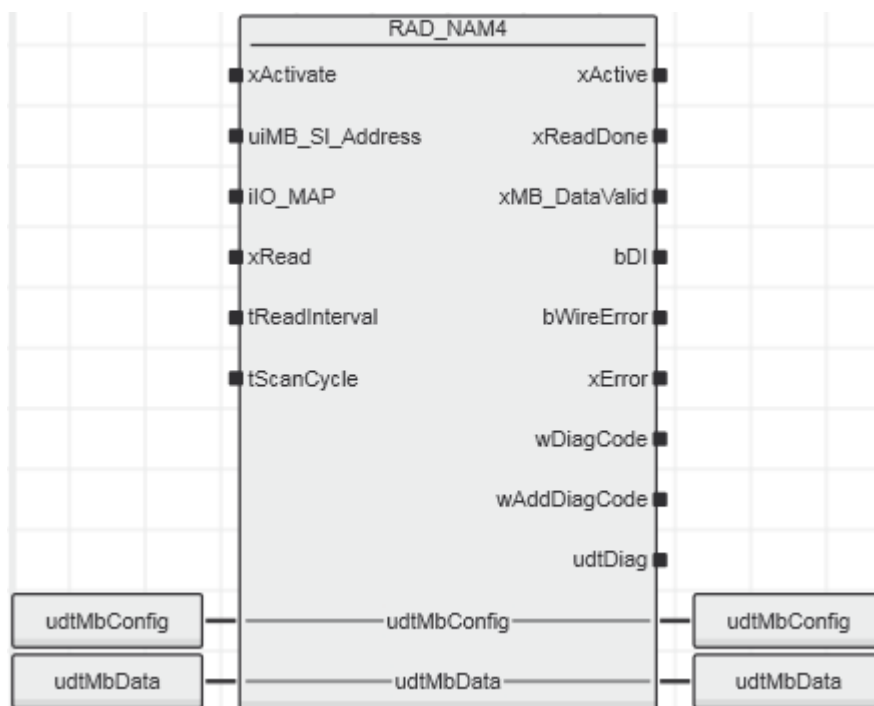| Name	Type	Description
udtMBData	udtModbus2_Data	Structure for communication with the Modbus function blocks.
udtMB_Config	UDT_RAD_CONFIG	At the end of a read operation, the structure contains the information about the Radioline network structure that is required by the driver blocks. The parameters of the Radioline device are then found in the structure in place of the entered IO-MAP address (parameter iIO_MAP).

16.5 Diagnosis

wDiagCode	wAddDiagCode	Description
16#0000	16#0000	Function block is deactivated.
16#8100	16#0000	The function block searches for the Radioline module at the IO-Map address.
16#8400	16#0000	The function block waits for the end of the search process of the RAD_Search_IO block.
16#8000	16#0000	Function block is in regular operation.
16#C110	16#0001	Parameterization error: Parameter uiMB_SI_Address equal to 0 or greater than 255
16#C110	16#0002	Parameterization error: Parameter iIO_MAP less than 0 or greater than 99.
16#C211	16#0002	Module type error: Wrong module type found at specified IO-MAP address.
16#C520	16#0001	Error in the internally used block RAD_Search_Module: For the diagnostic code of the internal block refer to output udtDiag.udtRAD_Search_Module_Diag.
16#C520	16#0002	Error in the internally used block modbus FC4: For the diagnostic code of the internal block refer to output udtDiag.udtMB_RTU_FC4_Diag. For the description of the diagnostic code refer to the Modbus_RTU library documentation.
16#C520	16#0003	Error in the internally used block modbus FC16: For the diagnostic code of the internal block refer to output udtDiag.udtMB_RTU_FC16_Diag. For the description of the diagnostic code refer to the Modbus_RTU library documentation.
16#C520	16#0004	Error in the internally used block modbus FC3: For the diagnostic code of the internal block refer to output udtDiag.udtMB_RTU_FC3_Diag. For the description of the diagnostic code refer to the Modbus_RTU library documentation.

17 RAD_NAM4

Driver block for communication with a RAD-NAM4-IFS (2316275) module.

The function block outputs the states of the Namur module inputs at the block output. Each time the block is activated, or cyclically after a communication error, the data of the device associated with the block is read once via the iIO_MAP address and is entered in the structure udtMB_Config in place of the iIO_MAP. The cycle time is set at the input tScanCycle.

17.1 Function block call

17.2 Input parameters

Name	Type	Description
xActivate	BOOL	Rising edge: Activates the function block. FALSE: Deactivates the function block.
uiMB_SI_Address	UINT	The Modbus slave address of the Radioline master module is specified at this parameter.
iIO_MAP	INT	The point at which the I/O device is present in the udtMB_Config device structure is specified here.
xRead	BOOL	These variables are used to start cyclic reading of the module process data via Modbus.
tReadInterval	TIME	The cyclic interval for reading the data is specified here.
tScanCycle	TIME	Time interval in which the block reads its data again in the structure udtMB_Config in place of iIO_MAP. Once the set time has elapsed, the function is only executed when the up-to-date data bit is FALSE. The time is set to 60 seconds by default.

17.3 Output parameters

Name	Type	Description
xActive	BOOL	FALSE: Function block is not active. TRUE: Function block is active.
xReadDone	BOOL	Modbus data received. TRUE for only one cycle.
xMB_DataValid	BOOL	Message from the I/O device: the process data provided via Modbus is valid. Only valid if xReadDone is true.
bDI	BYTE	Bits 0 - 3 contain the states of the digital module inputs. Only valid if xMB_DataValid is true.
bWireError	BYTE	Bits 0 - 3 are true in case of a wire error (short circuit or open circuit). Only valid if xMB_DataValid is true.
xError	BOOL	TRUE: An error has occurred. For details refer to wDiagCode and wAddDiagCode.
wDiagCode	WORD	Diagnosis code. Refer to diagnostic table.
wAddDiagCode	WORD	Additional diagnosis code. Refer to diagnostic table.
udtDiag	RAD_UDT_NAM4_DIAG	Structure with internal variables for Diagnostic

17.4 Inout parameters

Name	Type	Description
udtMBData	udtModbus2_Data	Structure for communication with the Modbus function blocks.
udtMB_Config	UDT_RAD_CONFIG	At the end of a read operation, the structure contains the information about the Radioline network structure that is required by the driver blocks. The parameters of the Radioline device are then found in the structure in place of the entered IO-MAP address (parameter iIO_MAP).

17.5 Diagnosis

wDiagCode	wAddDiagCode	Description
16#0000	16#0000	Function block is deactivated.
16#8100	16#0000	The function block searches for the Radioline module at the IO-Map address.
16#8400	16#0000	The function block waits for the end of the search process of the RAD_Search_IO block.
16#8000	16#0000	Function block is in regular operation.
16#C110	16#0001	Parameterization error: Parameter uiMB_SI_Address equal to 0 or greater than 255
16#C110	16#0002	Parameterization error: Parameter iIO_MAP less than 0 or greater than 99.
16#C211	16#0002	Module type error: Wrong module type found at specified IO-MAP address.
16#C520	16#0001	Error in the internally used block RAD_Search_Module: For the diagnostic code of the internal block refer to output udtDiag.udtRAD_Search_Module_Diag.
16#C520	16#0002	Error in the internally used block modbus FC4: For the diagnostic code of the internal block refer to output udtDiag.udtMB_RTU_FC4_Diag. For the description of the diagnostic code refer to the Modbus_RTU library documentation.
16#C520	16#0004	Error in the internally used block modbus FC3: For the diagnostic code of the internal block refer to output udtDiag.udtMB_RTU_FC3_Diag. For the description of the diagnostic code refer to the Modbus_RTU library documentation.

18 Startup examples

For the startup instruction of the RadiolineBasic function blocks please find the following examples:

- RAD_1_EXA_IL_UNI.pcwex
- RAD_1_EXA_AXL_UNI.pcwex

These examples are located in the "Examples" folder of the unzipped msi file of the library.

They describe the use of the IB IL RS UNI-PAC (2700893) and AXL F RS UNI 1H (2688666) modules with RadiolineBasic function blocks via the Modbus RTU protocol.

To use the RadiolineBasic function blocks, the Modbus_RTU library for communication is always required.

For these examples the PSI-CONF software was used to parameterize the Radioline modules.

Please find the PSI-CONF project RadiolineBasic_1_EXA_PSI_CONF.dat in the "Examples" folder of the unzipped msi file of the library, too.
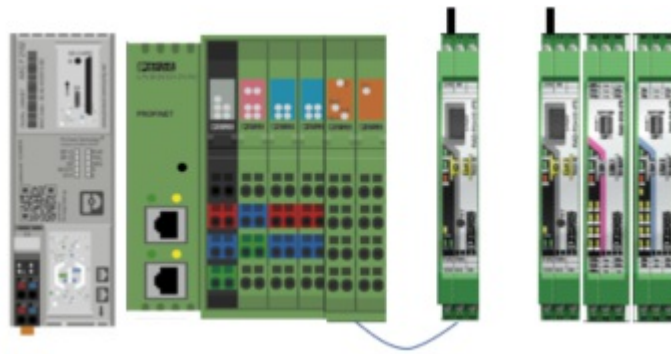
18.1 RAD_2_EXA_IL_UNI

For this example, the following hardware is used:

- AXC F 2152 (2404267)
- IL PN BK DI8 DO4 2TX-PAC (2703994)
- IB IL RS UNI-PAC (2700893)
- RAD-2400-IFS (2901541)
- RAD-2400-IFS (2901541)
- RAD-DI8-IFS (2901539)
- RAD-DO8-IFS (2902811)

18.1.1 Bus structure
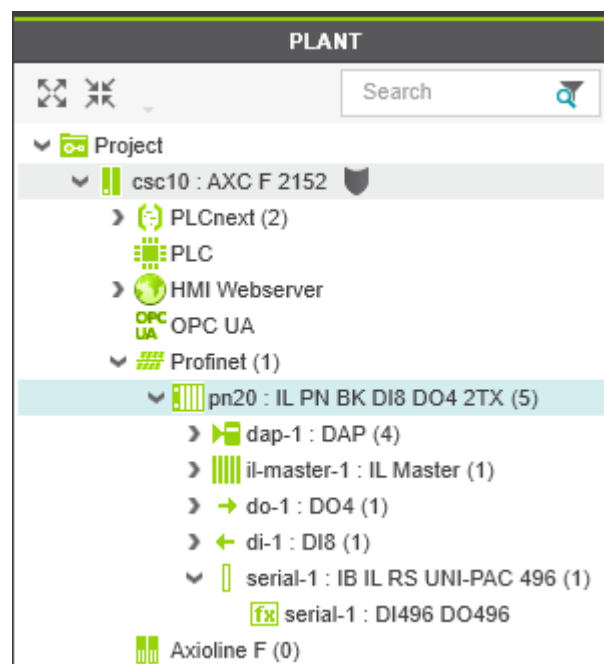
18.1.2 Hardware structure

For wiring the modules please refer to the individual data sheets. Please note that in this example channel 1 is used for the transmission of the digital signals. Therefore DO1 is wired to DI1.

18.1.3 Example description

For this example the IB IL RS UNI-PAC (2700893) module is used with a process data width of 31 words.
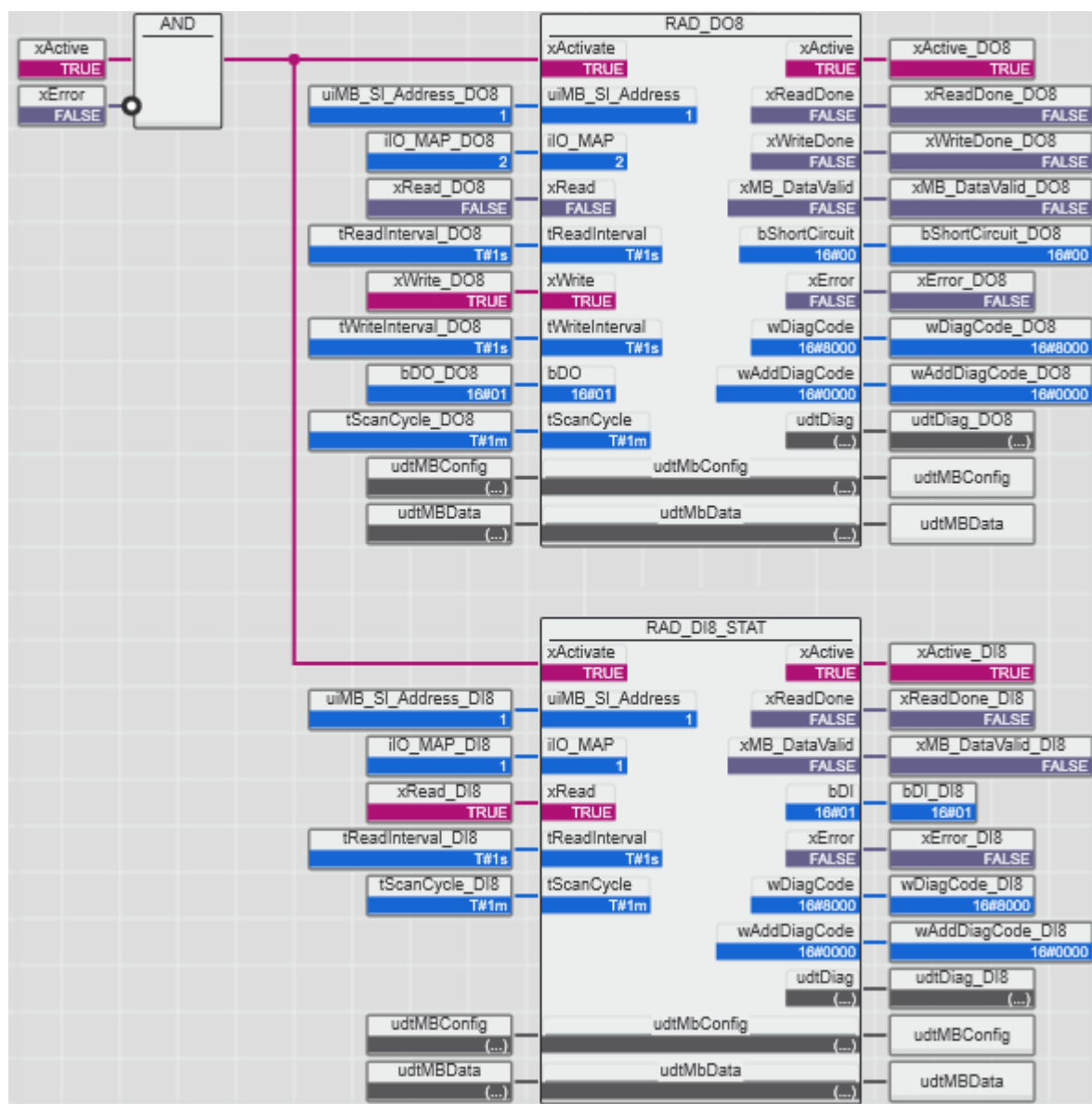
The module is also configured as follows:

- Baudrate = 19200
- Data width = 8 data bits, none, 1 stop bit
- Mode = RS-485

MB_IL_UNI_Master worksheet:

In addition the Modbus function block MB_IL_UNI31_Master must be called for communication between the IB IL RS UNI-PAC (2700893) module and Radioline transceiver RAD-2400-IFS (2901541) first. It must also be parameterized with the corresponding communication parameters (baud rate, data width etc.). After sucessful activation of the function block Modbus communication can be started.

For communication with the RAD-DI8-IFS and RAD-DO8-IFS modules the driver blocks RAD_DI8_STAT and RAD_DO8 are required. These function blocks are parameterized as shown in the following figures.
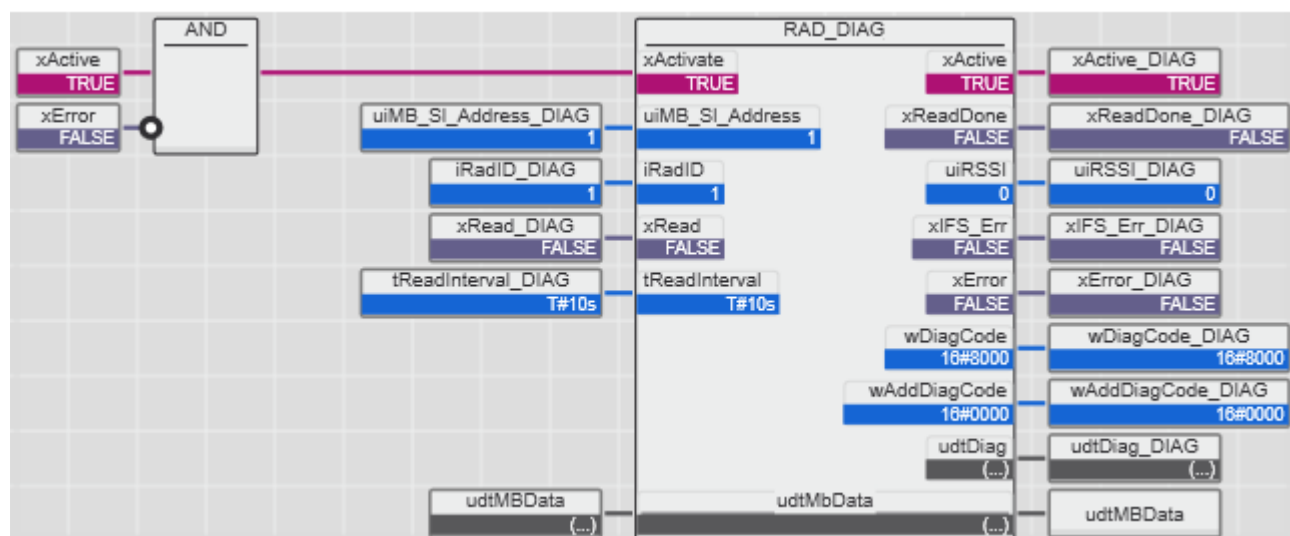

After sucessful activation of both driver function blocks RAD_DI8_STAT and RAD_DO8, the output parameter xActive is TRUE. Now the xWrite input parameter at RAD_DO8 function block has to be activated at first. The xWriteInterval input parameter for the cyclic writing of the data is specified here with one second. If Modbus data is written sucessfully, the xWriteDone and xMB_DataValid output parameters are TRUE for only one cycle.

In the next step, the input parameter xRead at the RAD_DI8_STAT function block is set to TRUE. Again, the outputs xReadDone and xMB_DataValid are TRUE for only one cycle if the Modbus data has been successfully sent. The status of the digital input module is specified at the output parameter bDI of the function block RAD_DI8_STAT after reading. This status is previously transferred to the function block RAD_DO8 for the digital output module at the input parameter bDO.

RAD_DIAG worksheet:

With the RAD_DIAG function block you can read additionally the diagnostic information of the wireless transceivers that are present in the Radioline network. The function block outputs provide wireless communication signal strength and error messages. The RAD_DIAG function block is parameterized as shown below.
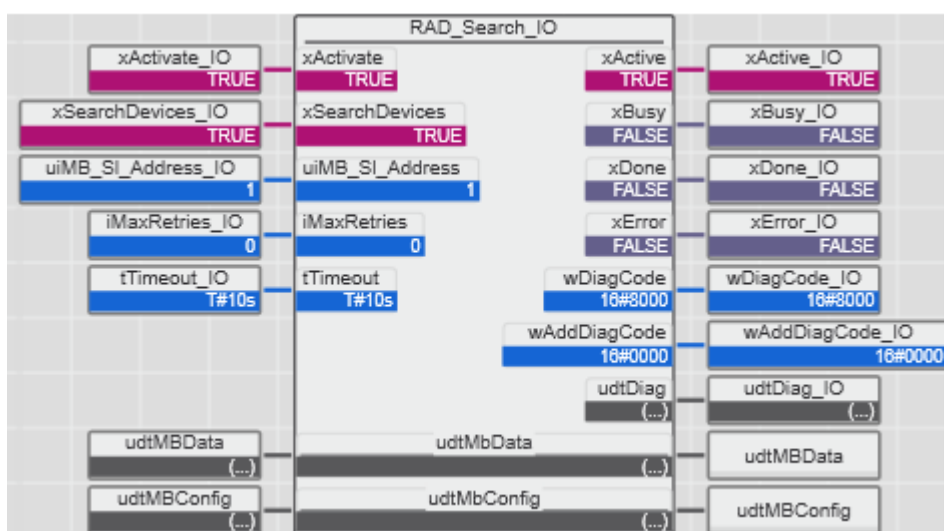

After activation of the function block and the xRead input parameter the RAD_DIAG function block starts with diagnosis.

RAD_Search_IO worksheet:

The function block Rad_Search_IO can be used for detecting all the I/O modules in a Radioline network and entering the information in the udtMB_Config structure.

To use the RAD_Search_IO function block, RAD_DI8_STAT and RAD_DO8 function blocks must be deactivated in MB_IL_UNI_Master worksheet.

The function block is parameterized as shown below.

After sucessful activation, the xRead input parameter is set to TRUE. If the xBusy output parameter is set from TRUE to FALSE the service execution is ready. Depending on the PLC cycle time, the search process can take several seconds to a few minutes! The devices found in the Radioline network are mapped in the udtMB_Config structure.

| Name	Value
udtMBConfig	(...)
xSearchRequest	TRUE
iCntDevices	2
uiMB_SI_Address	1
[ ] arrConf	[...]
arrConf[1]	(...)
xBusy	TRUE
bDeviceID	16#02
uiIO_MapAddr	1
uiStartAddress	9
strDeviceName	'RAD-DI8-IFS'
arrConf[2]	(...)
xBusy	TRUE
bDeviceID	16#11
uiIO_MapAddr	2
uiStartAddress	19
strDeviceName	'RAD-DO8-IFS'

18.2 RAD_2_EXA_AXL_UNI

For this example, the following hardware is used:

- AXC F 2152 (2404267)
- AXL F BK PN (2701815)
- AXL F RS UNI 1H (2688666)
- RAD-2400-IFS (2901541)
- RAD-2400-IFS (2901541)
- RAD-DI8-IFS (2901539)
- RAD-DO8-IFS (2902811)

18.2.1 Bus structure

18.2.2 Hardware structure
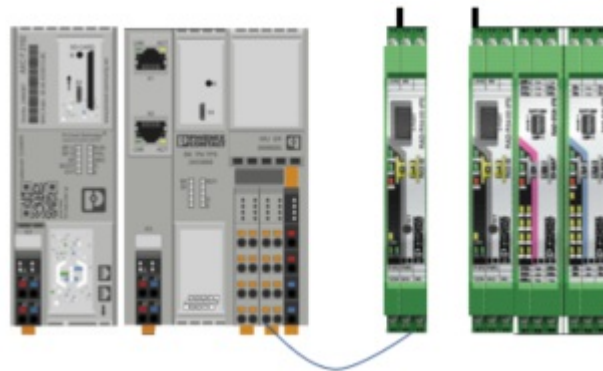
For wiring the modules please refer to the individual data sheets. Please note that in this example channel 1 is used for the transmission of the digital signals. Therefore DO1 is wired to DI1.

18.2.3 Example description

The configuration for the AXL F RS UNI 1H (2688666) module like baud rate, data width etc. can be set under AXL F RS UNI 1H/serial-1/Parameters.

In this example the AXL F RS UNI 1H (2688666) module has been parameterized as follows:
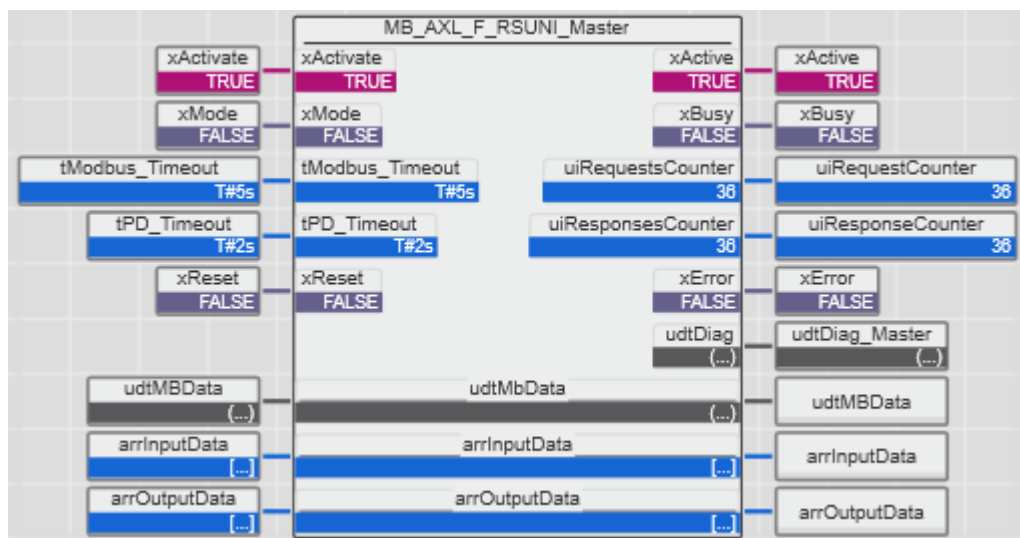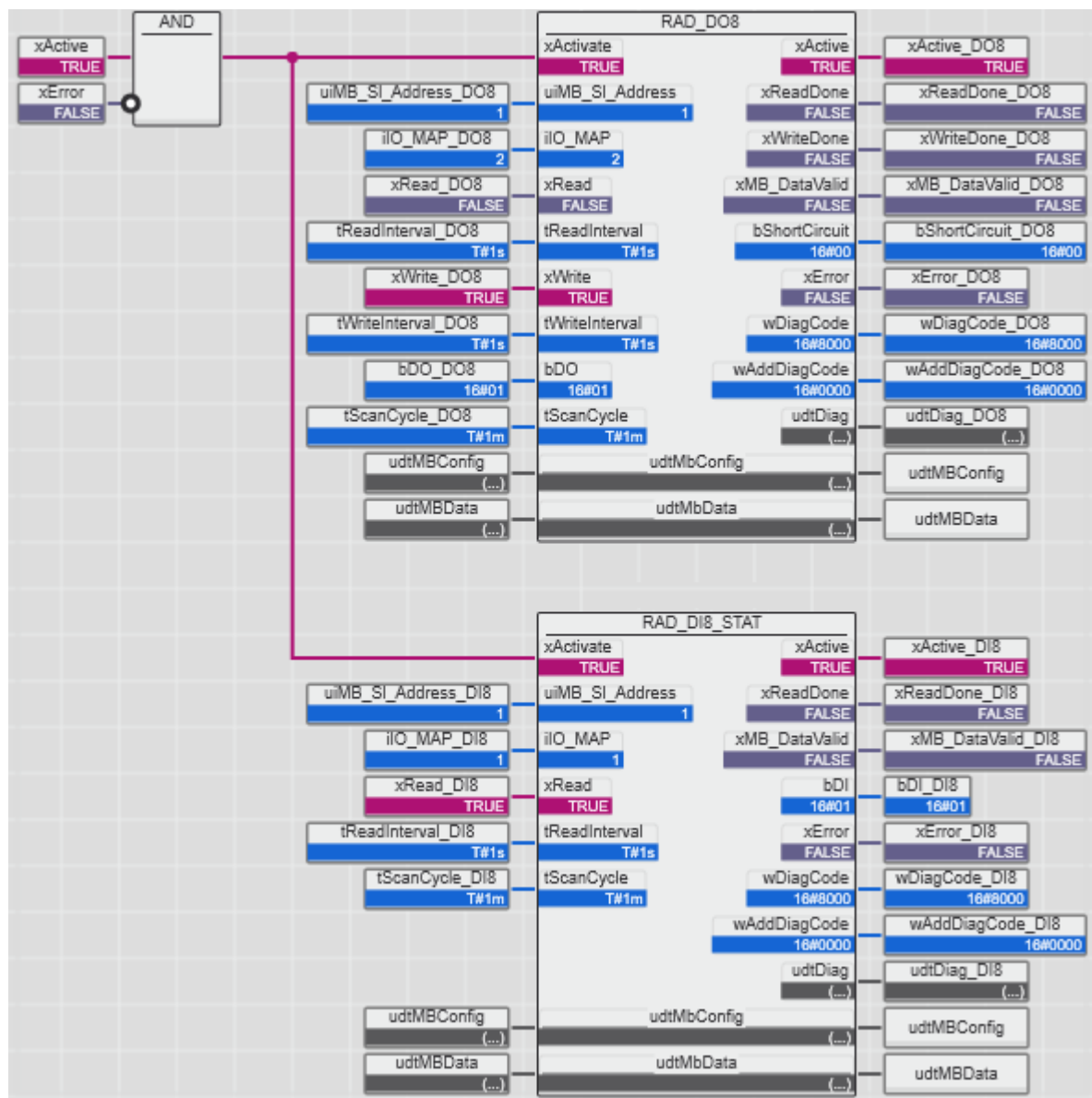
MB_AXL_F_RSUNI_Master worksheet:

In addition the Modbus function blocks MB_AXL_F_RSUNI must be called for communication between the AXL F RS UNI 1H (2688666) module and Radioline transceiver RAD-2400-IFS (2901541) first. This function block is parameterized as follows. After sucessful activation of the function blocks Modbus communication can be started.

For communication with the RAD-DI8-IFS and RAD-DO8-IFS modules the driver blocks RAD_DI8_STAT and RAD_DO8 are required. These function blocks are parameterized as shown in the following figures.
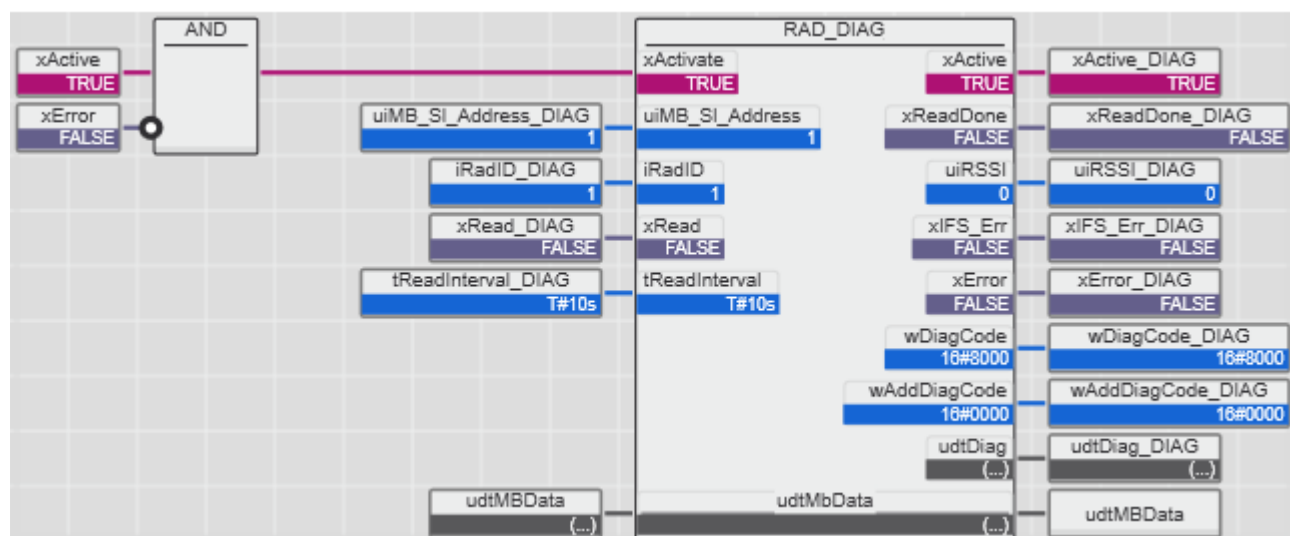

After sucessful activation of both driver function blocks RAD_DI8_STAT and RAD_DO8, the output parameter xActive is TRUE. Now the xWrite input parameter at RAD_DO8 function block has to be activated at first. The xWriteInterval input parameter for the cyclic writing of the data is specified here with one second. If Modbus data is written sucessfully, the xWriteDone and xMB_DataValid output parameters are TRUE for only one cycle.

In the next step, the input parameter xRead at the RAD_DI8_STAT function block is set to TRUE. Again, the outputs xReadDone and xMB_DataValid are TRUE for only one cycle if the Modbus data has been successfully sent. The status of the digital input module is specified at the output parameter bDI of the function block RAD_DI8_STAT after reading. This status is previously transferred to the function block RAD_DO8 for the digital output module at the input parameter bDO.

RAD_DIAG worksheet:

With the RAD_DIAG function block you can read additionally the diagnostic information of the wireless transceivers that are present in the Radioline network. The function block outputs provide wireless communication signal strength and error messages. The RAD_DIAG function block is parameterized as shown below.

After activation of the function block and the xRead input parameter the RAD_DIAG function block starts with diagnosis.

RAD_Search_IO worksheet:

The function block Rad_Search_IO can be used for detecting all the I/O modules in a Radioline network and entering the information in the udtMB_Config structure.

To use the RAD_Search_IO function block, RAD_DI8_STAT and RAD_DO8 function blocks must be deactivated in MB_IL_UNI_Master worksheet.

The function block is parameterized as shown below.

After sucessful activation, the xRead input parameter is set to TRUE. If the xBusy output parameter is set from TRUE to FALSE the service execution is ready. Depending on the PLC cycle time, the search process can take several seconds to a few minutes! The devices found in the Radioline network are mapped in the udtMB_Config structure.

Name	Value
⌄ udtMBConfig	(...)
● xSearchRequest	TRUE
E iCntDevices	2
E uiMB_SI_Address	1
⌄ [ ] arrConf	[...]
⌄ arrConf[1]	(...)
● xBusy	TRUE
E bDeviceID	16#02
E uiIO_MapAddr	1
E uiStartAddress	9
abc strDeviceName	'RAD-DI8-IFS'
⌄ arrConf[2]	(...)
● xBusy	TRUE
E bDeviceID	16#11
E uiIO_MapAddr	2
E uiStartAddress	19
abc strDeviceName	'RAD-DO8-IFS'

19 Appendix

19.1 Data types

```
(* Types for radioline device info and configuration *)
TYPE
    UDT_RAD_DEVICE :
    STRUCT
        xBusy           : BOOL;     (* initialization ready, processdata exchange *)
        bDeviceID       : BYTE;     (* id code of radioline device *)
        uiIO_MapAddr    : UINT;     (* io device number in radioline network *)
        uiStartAddress  : UINT;     (* address of first register *)
        strDeviceName   : STRING;   (* name of radioline device *)
    END_STRUCT;

    ARR_RAD_Conf : ARRAY [1..99] OF UDT_RAD_DEVICE;

    UDT_RAD_Config :
    STRUCT
        xSearchRequest  : BOOL;         (* request for search modules in the RAD network *)
        iCntDevices     : INT;          (* number of found modbus devices *)
        uiMB_Sl_Address : UINT;         (* address of modbus slave *)
        arrConf         : ARR_RAD_Conf; (* detected configuration of all connected MB devices *)
    END_STRUCT;
END_TYPE

(* Types for extended functionblock diagnostic *)
TYPE
    RAD_UDT_SEARCH_IO_DIAG :
    STRUCT
        iState              : INT;                  (* internal fb state *)
        wDiagCode           : WORD;                 (* diagnostic code of the fb *)
        wAddDiagCode        : WORD;                 (* additional diagnostic code *)
        udtMB_RTU_FC3_Diag  : MB_UDT_RTU_FC_DIAG;   (* diagnostic structure of FC3 fb *)
        udtMB_RTU_FC4_Diag  : MB_UDT_RTU_FC_DIAG;   (* diagnostic structure of FC4 fb *)
    END_STRUCT;

    RAD_UDT_SEARCH_MODULE_DIAG :
    STRUCT
        iState              : INT;                  (* internal fb state *)
        wDiagCode           : WORD;                 (* diagnostic code of the fb *)
        wAddDiagCode        : WORD;                 (* additional diagnostic code *)
        udtMB_RTU_FC3_Diag  : MB_UDT_RTU_FC_DIAG;   (* diagnostic structure of FC3 fb *)
        udtMB_RTU_FC4_Diag  : MB_UDT_RTU_FC_DIAG;   (* diagnostic structure of FC4 fb *)
    END_STRUCT;

    RAD_UDT_DIAG_DIAG :
    STRUCT
        iState              : INT;                  (* internal fb state *)
        wDiagCode           : WORD;                 (* diagnostic code of the fb *)
        wAddDiagCode        : WORD;                 (* additional diagnostic code *)
        udtMB_RTU_FC4_Diag  : MB_UDT_RTU_FC_DIAG;   (* diagnostic structure of FC4 fb *)
    END_STRUCT;

    RAD_UDT_AI4_DIAG :
    STRUCT
        iState              : INT;                  (* internal fb state *)
        wDiagCode           : WORD;                 (* diagnostic code of the fb *)
        wAddDiagCode        : WORD;                 (* additional diagnostic code *)
        udtMB_RTU_FC4_Diag  : MB_UDT_RTU_FC_DIAG;   (* diagnostic structure of FC4 fb *)
        (* diagnostic structure of internal Search Module fb *)
        udtRAD_Search_Module_Diag : RAD_UDT_SEARCH_MODULE_DIAG;
```

```
    END_STRUCT;

    RAD_UDT_AI4_U_DIAG :
    STRUCT
        iState              : INT;                  (* internal fb state *)
        wDiagCode           : WORD;                 (* diagnostic code of the fb *)
        wAddDiagCode        : WORD;                 (* additional diagnostic code *)
        udtMB_RTU_FC4_Diag  : MB_UDT_RTU_FC_DIAG; (* diagnostic structure of FC4 fb *)
        (* diagnostic structure of internal Search Module fb *)
        udtRAD_Search_Module_Diag : RAD_UDT_SEARCH_MODULE_DIAG;
    END_STRUCT;

    RAD_UDT_AO4_DIAG :
    STRUCT
        iState              : INT;                  (* internal fb state *)
        wDiagCode           : WORD;                 (* diagnostic code of the fb *)
        wAddDiagCode        : WORD;                 (* additional diagnostic code *)
        udtMB_RTU_FC16_Diag : MB_UDT_RTU_FC_DIAG; (* diagnostic structure of FC16 fb *)
        (* diagnostic structure of internal Search Module fb *)
        udtRAD_Search_Module_Diag : RAD_UDT_SEARCH_MODULE_DIAG;
    END_STRUCT;

    RAD_UDT_DAIO6_DIAG :
    STRUCT
        iState              : INT;                  (* internal fb state *)
        wDiagCode           : WORD;                 (* diagnostic code of the fb *)
        wAddDiagCode        : WORD;                 (* additional diagnostic code *)
        udtMB_RTU_FC4_Diag  : MB_UDT_RTU_FC_DIAG; (* diagnostic structure of FC4 fb *)
        udtMB_RTU_FC16_Diag : MB_UDT_RTU_FC_DIAG; (* diagnostic structure of FC16 fb *)
        (* diagnostic structure of internal Search Module fb *)
        udtRAD_Search_Module_Diag : RAD_UDT_SEARCH_MODULE_DIAG;
    END_STRUCT;

    RAD_UDT_DI4_DIAG :
    STRUCT
        iState              : INT;                  (* internal fb state *)
        wDiagCode           : WORD;                 (* diagnostic code of the fb *)
        wAddDiagCode        : WORD;                 (* additional diagnostic code *)
        udtMB_RTU_FC4_Diag  : MB_UDT_RTU_FC_DIAG; (* diagnostic structure of FC4 fb *)
        (* diagnostic structure of internal Search Module fb *)
        udtRAD_Search_Module_Diag : RAD_UDT_SEARCH_MODULE_DIAG;
    END_STRUCT;

    RAD_UDT_NAM4_DIAG :
    STRUCT
        iState              : INT;                  (* internal fb state *)
        wDiagCode           : WORD;                 (* diagnostic code of the fb *)
        wAddDiagCode        : WORD;                 (* additional diagnostic code *)
        udtMB_RTU_FC4_Diag  : MB_UDT_RTU_FC_DIAG; (* diagnostic structure of FC4 fb *)
        (* diagnostic structure of internal Search Module fb *)
        udtRAD_Search_Module_Diag : RAD_UDT_SEARCH_MODULE_DIAG;
    END_STRUCT;

    RAD_UDT_DI8_CNT_DIAG :
    STRUCT
        iState              : INT;                  (* internal fb state *)
        wDiagCode           : WORD;                 (* diagnostic code of the fb *)
        wAddDiagCode        : WORD;                 (* additional diagnostic code *)
        udtMB_RTU_FC4_Diag  : MB_UDT_RTU_FC_DIAG; (* diagnostic structure of FC4 fb *)
        udtMB_RTU_FC16_Diag : MB_UDT_RTU_FC_DIAG; (* diagnostic structure of FC16 fb *)
        (* diagnostic structure of internal Search Module fb *)
        udtRAD_Search_Module_Diag : RAD_UDT_SEARCH_MODULE_DIAG;
    END_STRUCT;
```

```
    RAD_UDT_DI8_STAT_DIAG :
    STRUCT
        iState                 : INT;                (* internal fb state *)
        wDiagCode              : WORD;               (* diagnostic code of the fb *)
        wAddDiagCode           : WORD;               (* additional diagnostic code *)
        udtMB_RTU_FC4_Diag  : MB_UDT_RTU_FC_DIAG; (* diagnostic structure of FC4 fb *)
        (* diagnostic structure of internal Search Module fb *)
        udtRAD_Search_Module_Diag : RAD_UDT_SEARCH_MODULE_DIAG;
    END_STRUCT;

    RAD_UDT_DO8_DIAG :
    STRUCT
        iState                 : INT;                (* internal fb state *)
        wDiagCode              : WORD;               (* diagnostic code of the fb *)
        wAddDiagCode           : WORD;               (* additional diagnostic code *)
        udtMB_RTU_FC4_Diag  : MB_UDT_RTU_FC_DIAG; (* diagnostic structure of FC4 fb *)
        udtMB_RTU_FC16_Diag : MB_UDT_RTU_FC_DIAG; (* diagnostic structure of FC16 fb *)
        (* diagnostic structure of internal Search Module fb *)
        udtRAD_Search_Module_Diag : RAD_UDT_SEARCH_MODULE_DIAG;
    END_STRUCT;

    RAD_UDT_DOR4_DIAG :
    STRUCT
        iState                 : INT;                (* internal fb state *)
        wDiagCode              : WORD;               (* diagnostic code of the fb *)
        wAddDiagCode           : WORD;               (* additional diagnostic code *)
        udtMB_RTU_FC16_Diag : MB_UDT_RTU_FC_DIAG; (* diagnostic structure of FC16 fb *)
        (* diagnostic structure of internal Search Module fb *)
        udtRAD_Search_Module_Diag : RAD_UDT_SEARCH_MODULE_DIAG;
    END_STRUCT;

    RAD_UDT_PT100_4_DIAG :
    STRUCT
        iState                 : INT;                (* internal fb state *)
        wDiagCode              : WORD;               (* diagnostic code of the fb *)
        wAddDiagCode           : WORD;               (* additional diagnostic code *)
        udtMB_RTU_FC4_Diag  : MB_UDT_RTU_FC_DIAG; (* diagnostic structure of FC4 fb *)
        (* diagnostic structure of internal Search Module fb *)
        udtRAD_Search_Module_Diag : RAD_UDT_SEARCH_MODULE_DIAG;
    END_STRUCT;
END_TYPE
```

20 Support

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