

# Technical Manual

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Sigma-5 EtherCAT Function Blocks for TwinCAT

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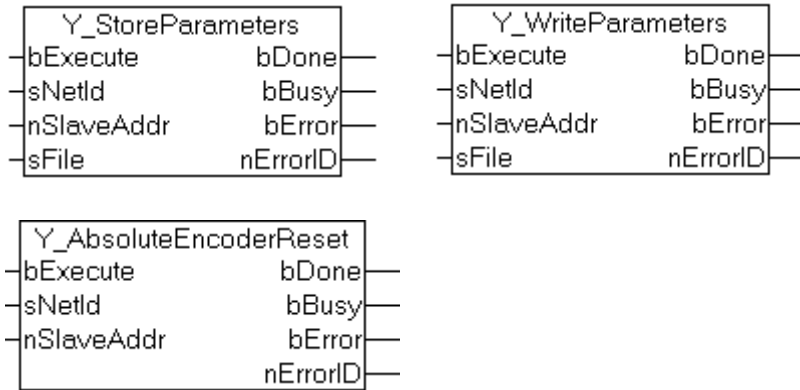
**Applicable Products: TwinCAT,  
Sigma-5 with CANopen over EtherCAT option**



<b>Product:</b> TwinCAT, Sigma-5 with CANopen over EtherCAT option	<b>Doc#:</b> TM.SGDV.01
<b>Title:</b> Sigma-5 EtherCAT Function Blocks for TwinCAT	

## About This Document

This document provides details about the Yaskawa Function Blocks found in the TwinCAT library “YaskawaFunctions.lib” created by Yaskawa.





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## 1. Summary of Function Block Usage

(See section “Function Blocks – Required Objects” of this document for information about objects which these function blocks utilize.)

### A. Y\_StoreParameters & Y\_WriteParameters:

- The purpose of these function blocks is to copy & store the parameters that are on an amplifier, to the computer.
- These function blocks can also copy the parameters from a computer onto an amplifier.
- Y\_StoreParameters will output a data file that can only be read by Y\_WriteParameters.
- In order for Y\_WriteParameters to execute completely, the following must be true:
  1. The drive’s FSA state must be set to “Switch On Disabled” (Statusword x1xx\_0000). See ErrorID 4107 of this document for an example of how to make this setting. Reference Sigma-5 EtherCAT User’s Manual (SIEP C720829 04A) Section 8.5 subsection (2), and Section 8.2 subsection (5) for more details.
  2. The drive’s EtherCAT Device State must be set to PRE-OP Device State. See ErrorID 4108 of this document for an example of how to make this setting. Reference Sigma-5 EtherCAT User’s Manual (SIEP C720829 04A) Section 8.3, and Section 8.4 subsection (2) for more details.

### B. Y\_AbsoluteEncoderReset:

- The purpose of this function block is to perform Fn008: Absolute encoder reset. For functionality details of Fn008, please see the Sigma-5 Series User’s Manual for Command Option Attachable Type (Manual No. SIEP S800000 60A) Section 4.5.4: Absolute Encoder Setup.
- This function block does not perform a soft reset, which is required to clear the A.810 alarm.



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## 2. Version Notes

The current Function Block library supports the following Sigma-5 EtherCAT Revisions:

(see value in object 1018:03):

	0x00010000 (Version 1.00)	0x00020000 (Version 2.00)	0x00030001 (Version 3.01)
Y_StoreParameters & Y_WriteParameters	OK	OK	Not developed*
Y_AbsoluteEncoderReset	OK	OK	OK

\*This function block does not support this EtherCAT revision. The function block can be modified to utilize some features. See Section 9, "Modifying Function Blocks" for details.

### Note:

For Version 2.00, there are 3 new objects compared to Version 1.00:

- 10F1:0 (Sync Error Settings)
- 10F1:01 (Reserved)
- 10F1:02 (Sync Error Count Limit)

These 3 objects are coupled to the objects 1F01:0, 1F01:01, 1F01:02, respectively.

If one object changes, the object that it is coupled to will also change.

Since these objects operate in this manner, the function block does not store values of the following objects for Version 2.00: 10F1:0, 10F1:01, 10F1:02.



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### 3. Version Compatibility

Storing and Writing parameters (Y\_StoreParameters & Y\_WriteParameters) are possible between versions detailed in the table below:

		1. Storing		
		Version 1.00	Version 2.00	Version 3.01
2. Writing	Version 1.00	OK	OK	Not developed*
	Version 2.00	OK	OK	Not developed*
	Version 3.01	Not developed*	Not developed*	Not developed*

\*This function block does not support this EtherCAT revision. The function block can be modified to utilize some features. See Section 9, “Modifying Function Blocks” for details.

Example: Storing from Version 1.00, then Writing to Version 2.00 is possible.

Y\_WriteParameters can read data files created with previous versions of YaskawaFunctions.lib.



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## 4. Inputs

### *Inputs for Y\_StoreParameters, Y\_WriteParameters, and Y\_AbsoluteEncoderReset*

Variable Name	Data Type	Default Value	Function
bExecute	BOOL	False	Upon the rising edge, all other function block inputs are read and the function is initiated. To modify an input, change the value and re-trigger the execute input.
sNetId	T_AmsNetId	<empty string>	A string containing the AMS network identifier of the EtherCAT master device to which the ADS commands within this Function Block are directed. See notes for usage.
nSlaveAddr	UINT	0	Fixed address of the EtherCAT slave to which the commands within this function block should be sent. See notes for usage.
sFile	T_MaxString	'C:\YaskawaPrm.dat'	Contains the path and filename for the file to be created (Y_StoreParameters) or read (Y_WriteParameters) on the local machine. Note: Network paths cannot be used. Note: For Y_StoreParameters, if the file exists, it will be overwritten.





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## 5. Outputs

### *Outputs for Y\_StoreParameters, Y\_WriteParameters, and Y\_AbsoluteEncoderReset*

Variable Name	Data Type	Default Value	Function
bDone	BOOL	False	Set high when the commanded action has been completed successfully. This output is reset when bExecute goes low.
bBusy	BOOL	False	Set high upon the rising edge of bExecute, and reset if bDone or bError is true.
bError	BOOL	False	Set high if an error has occurred during the execution of the function block. This output is cleared when bExecute goes low.
nErrorID	UDINT	0	If bError is true, this output provides the Error ID. This output is reset when bExecute goes low. 41xx errors are in this documentation. All other errors are from TwinCAT function blocks and can be found in TwinCAT documentation.





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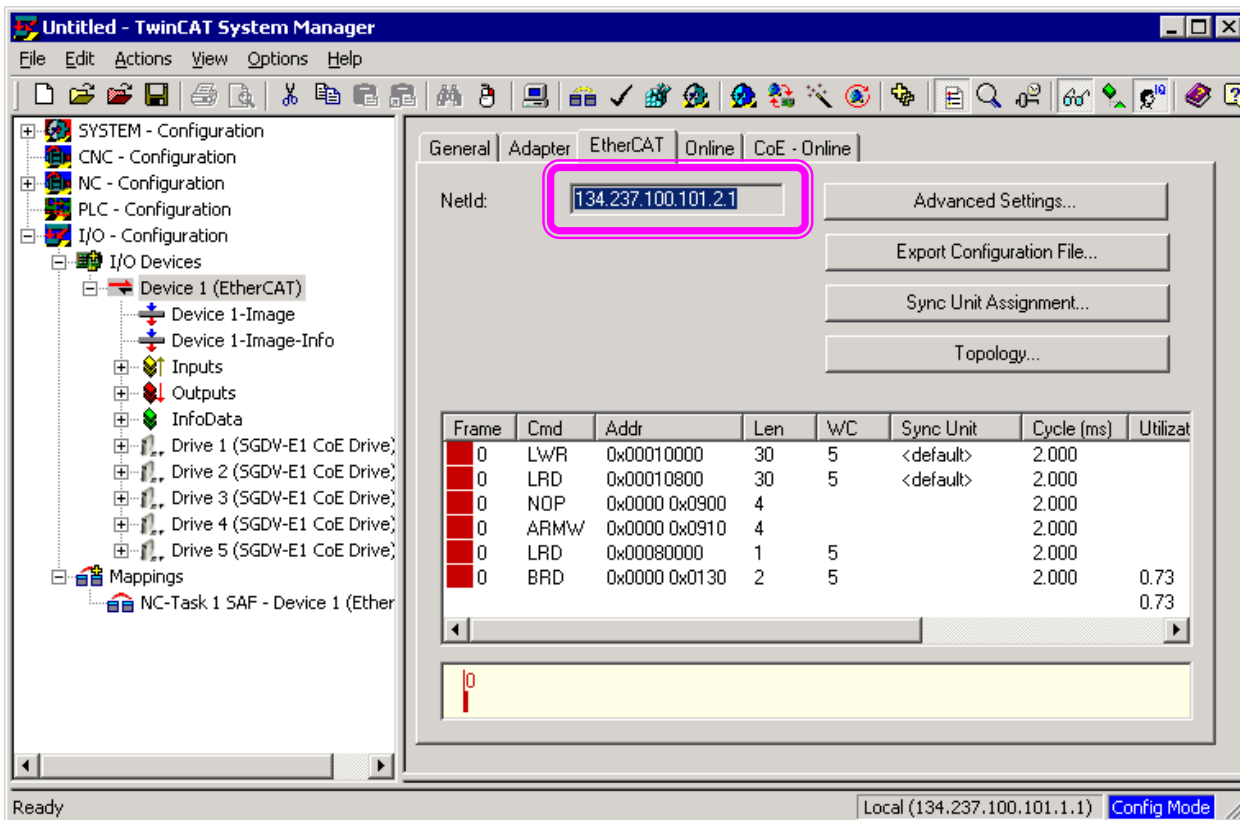
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## 6. Notes for Inputs and Outputs

### T\_AmsNetId: STRING(23)

The variable contains the AMS network identifier of the target device to which the ADS command is directed. The string consists of six numerical fields, separated by dots. Each numerical field contains a number between 1 and 254. Valid AMS network addresses are, for example, “1.1.1.2.7.1” or “200.5.7.170.1.7”. See following image for the location of the NetId of an example system. If an **empty string** is passed, the AMS network identifier of the local device will be *attempted* to be automatically assumed. In most cases, an empty string will not allow the function block to operate properly.



Frame	Cmd	Addr	Len	WC	Sync Unit	Cycle (ms)	Utilizat
0	LWR	0x00010000	30	5	<default>	2.000	
0	LRD	0x00010800	30	5	<default>	2.000	
0	NOP	0x0000 0x0900	4			2.000	
0	ARMW	0x0000 0x0910	4			2.000	
0	LRD	0x00080000	1	5		2.000	
0	BRD	0x0000 0x0130	2	5		2.000	0.73
							0.73

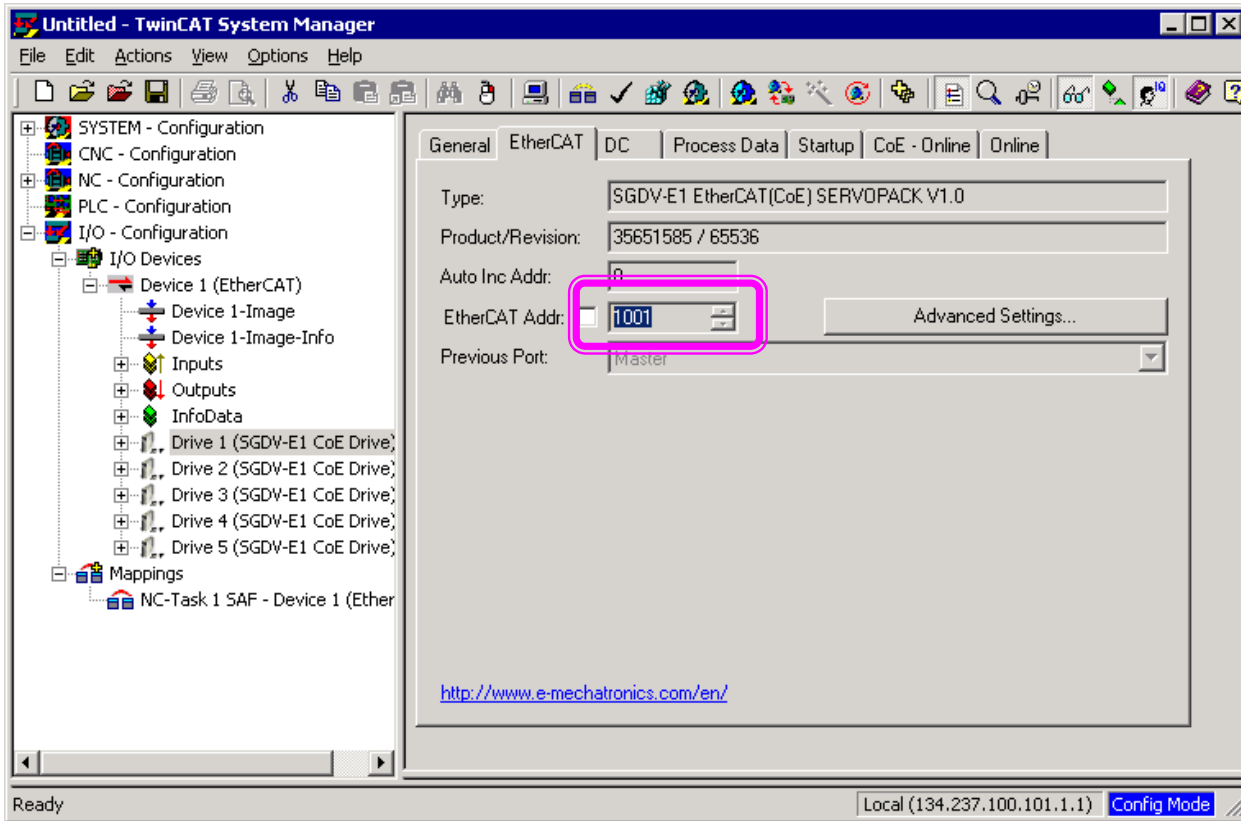
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**nSlaveAddr:**

See following image for the location of the nSlaveAddr of an example system.



**T\_MaxString:**

The variable of this type is the PLC string with the maximal length of 255 characters.



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## 7. ErrorID's

ErrorID	Description	Details
0-4099 5000+	[TwinCAT-specific]	See the Beckhoff Information System, section "ADS Return Codes" for details.
4100	Vendor ID mismatch	Product not compatible. This FB is only for Vendor ID 0x00000539 (Yaskawa).
4101	Product Code mismatch	Product not compatible. This FB is only for Product codes 0x02200001 (Sigma-5 Rotary) and 0x02200002 (Sigma-5 Linear). If using Sigma-5 CoE Drive, get latest FB from Yaskawa.com.
4102	Version mismatch	Product not compatible. This FB is only for certain EtherCAT revisions. If using Sigma-5 CoE Drive, get latest FB from Yaskawa.com, or, see Section 9, "Modifying Function Blocks."
4103	Object not found	Error reading object data type or data type not supported.
4104	File corrupt	File is corrupt. Store the parameters again.
4105	File ID is 0	No version of the ID of file was read. Possibly incorrect file, or FB has an error.
4106	File ID mismatch	This file was made with a different version than this Function Block. Obtain the latest FB from Yaskawa.com
4107	Incorrect FSA state	Not in FSA state "Switch On Disabled". StatusWord expected as x1xx_0000 (bin). See following notes.
4108	Incorrect Device state	Drive not set to PRE-OP mode. Set the drive to PRE-OP mode before using this FB. See following notes.
4109	File exists already	When trying to store parameters to a file, that file currently exists. A new file name or location must be provided.
4110	Servo state incorrect	Servo must be off. StatusWord cannot be x00x_0111, xx1x_x011_0111, or x0xx_1111 (bin).
4111	Adjusting Status incorrect	Adjusting status must be 1, 2, 3, or 255, but read as a different value.
4112	Internal Function Block Error	Function block internal programming error - Function Block State Not Found.
4113	Adjusting & Abort commands failed	Adjusting command failed, so Abort (Step 4) was performed. But Abort also failed (Status of Adjusting = 2).
4114	Adjusting & Abort commands failed	Adjusting command failed, so Abort (Step 4) was performed. But Abort also failed (Status of Adjusting = 2). Reply data for the Adjusting command failure exists in object 0x2710:03.
4115	Send Request 1008 failed	Error occurred (Status of Adjusting = 2) while performing Send Request 1008 (Step 1). No reply exists.
4116	Send Request 1008 failed	Error occurred (Status of Adjusting = 3) while performing Send Request 1008 (Step 1). Reply exists in object 0x2710:03.
4117	Send Preparation failed	Error occurred (Status of Adjusting = 2) while performing Send Preparation (Step 2). No reply exists.
4118	Send Preparation failed	Error occurred (Status of Adjusting = 3) while performing Send Preparation (Step 2). Reply exists in object 0x2710:03.





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ErrorID	Description	Details
4119	Send Execute failed	Error occurred (Status of Adjusting = 2) while performing Send Preparation (Step 3). No reply exists.
4120	Send Execute failed	Error occurred (Status of Adjusting = 3) while performing Send Preparation (Step 3). Reply exists in object 0x2710:03.



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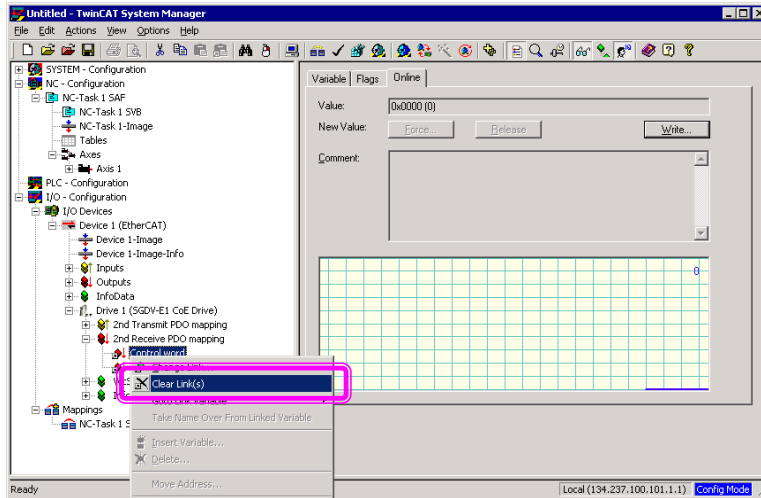
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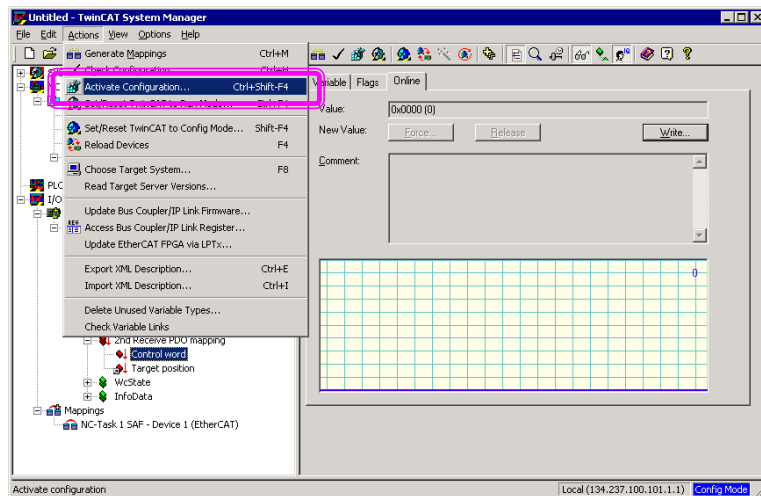
### 4107 ErrorID Notes: Incorrect FSA state

To change the FSA state to the correct FSA state for certain Function Blocks to be used, the following instructions may be used. Additional steps may need to be taken.

1. Clear link to Control word so that Control word can be set manually. This can be done by right-clicking the Control word.



2. Activate and Run.

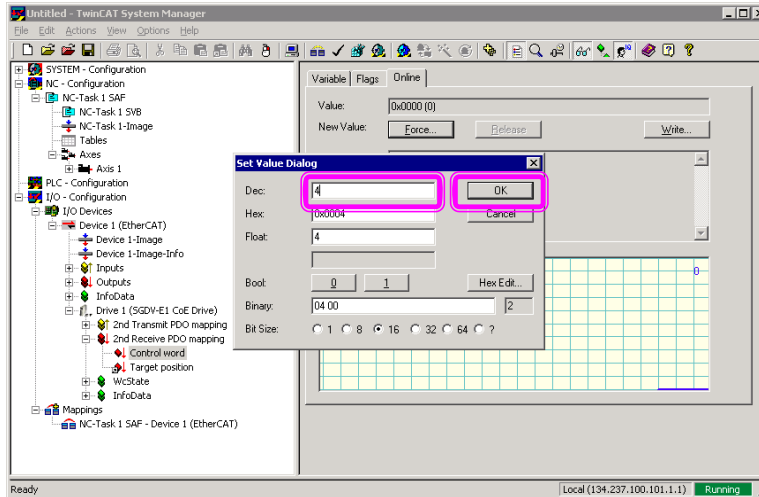


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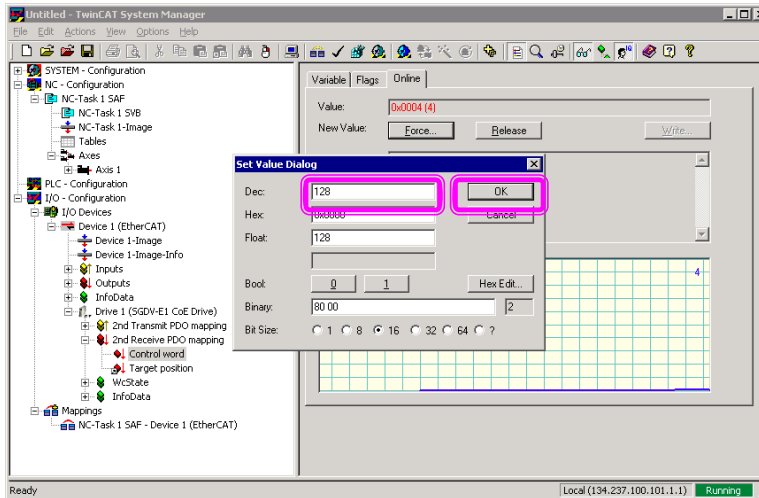
**Doc#:** TM.SGDV.01

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### 3. Force Quick Stop (4 dec for Control word).



### 4. Force Fault Reset (128 dec for Control word).



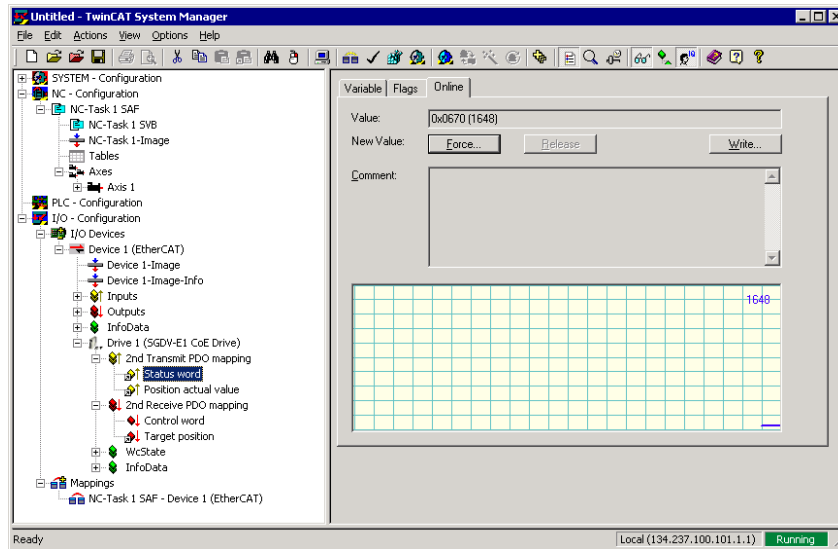


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- Status Word is now x1xx\_0000 (1648 decimal = 110 0111 0000 binary), which is the correct FSA state for the applicable Function Blocks to be used.



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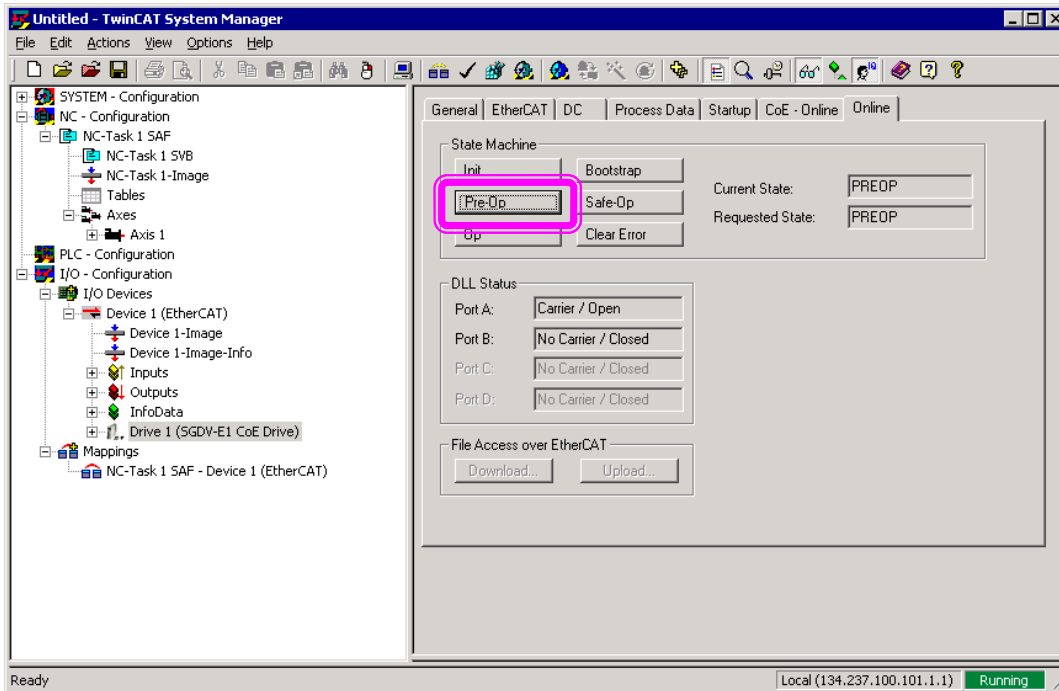
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## 4108 ErrorID Notes: Incorrect Device State

To change the Device state to the correct Device state for certain Function Blocks to be used, the following instructions may be used. Additional steps may need to be taken.

1. Change to Pre-Op. The Device is now in the correct state for the applicable Function Blocks to be used.







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## 8. Function Blocks – Required Objects

This section exists in order to inform the user about objects which function blocks depend on in order to operate.

For example, Y\_AbsoluteEncoderReset depends on object 0x2710. So if the user has object 0x2710 as a PDO in cyclic data, then the Y\_AbsoluteEncoderReset might not operate properly. This improper operation may be due to the data for object 0x2710 being sent by the Function Block, but the PDO cyclic data is writing over the data, so the EtherCAT option amplifier never receives the data from the Function Block.

- Y\_StoreParameters: Does not depend on any object
- Y\_WriteParameters: Depends on every RW object. If an RW object is in PDO cyclic data, then the Function Block might not be able to write to that object.
- Y\_AbsoluteEncoderReset: Depends on object 0x2710. Do not use object 0x2710 in PDO cyclic data.



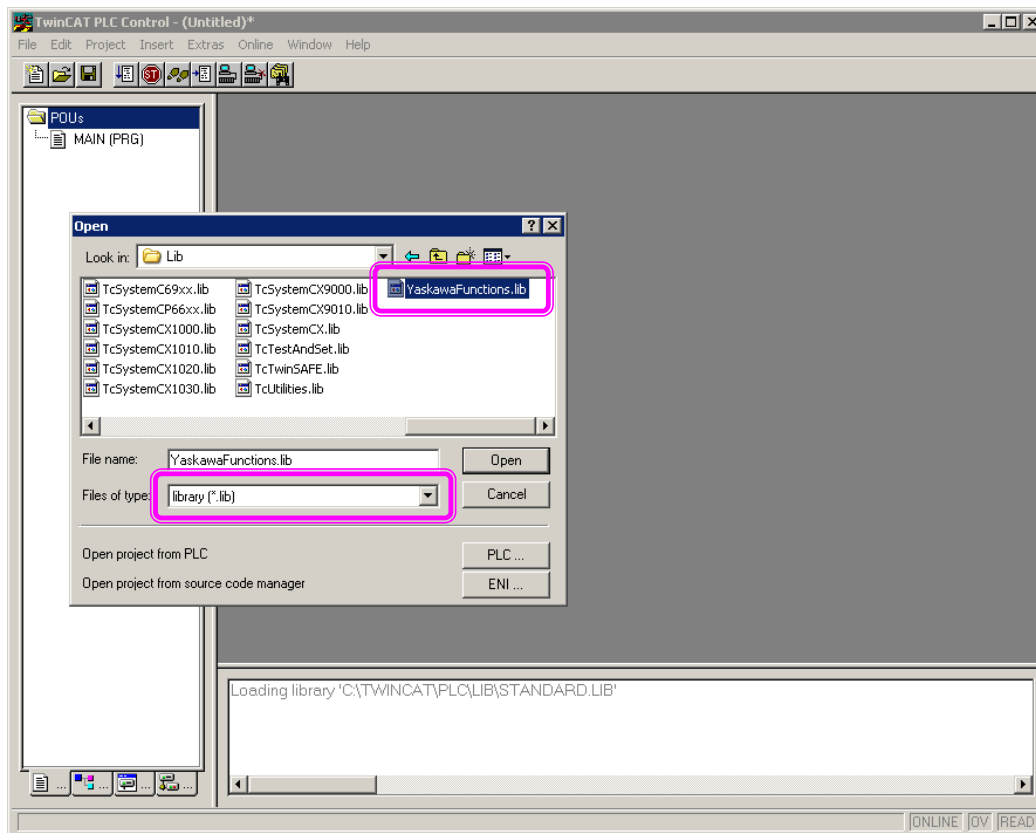
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## 9. Modifying Function Blocks

To use Y\_StoreParameters and Y\_WriteParameters to use with any version of the drive, the below procedure can be used..

Note that the entire YaskawaFunctions.lib library is available to be edited according to the user’s needs. In addition, by ignoring the version checking, additional or changed parameters for the unsupported drive versions (See Section 2, “Version Notes”) will not be handled correctly by the function blocks. The function blocks have a hardcoded database of supported parameters, which might not have been updated for unsupported drive versions.

1. In TwinCAT PLC Control, Open the YaskawaFunctions.lib file. Note: Select “library” as the “Files of type” in order to view \*.lib files.

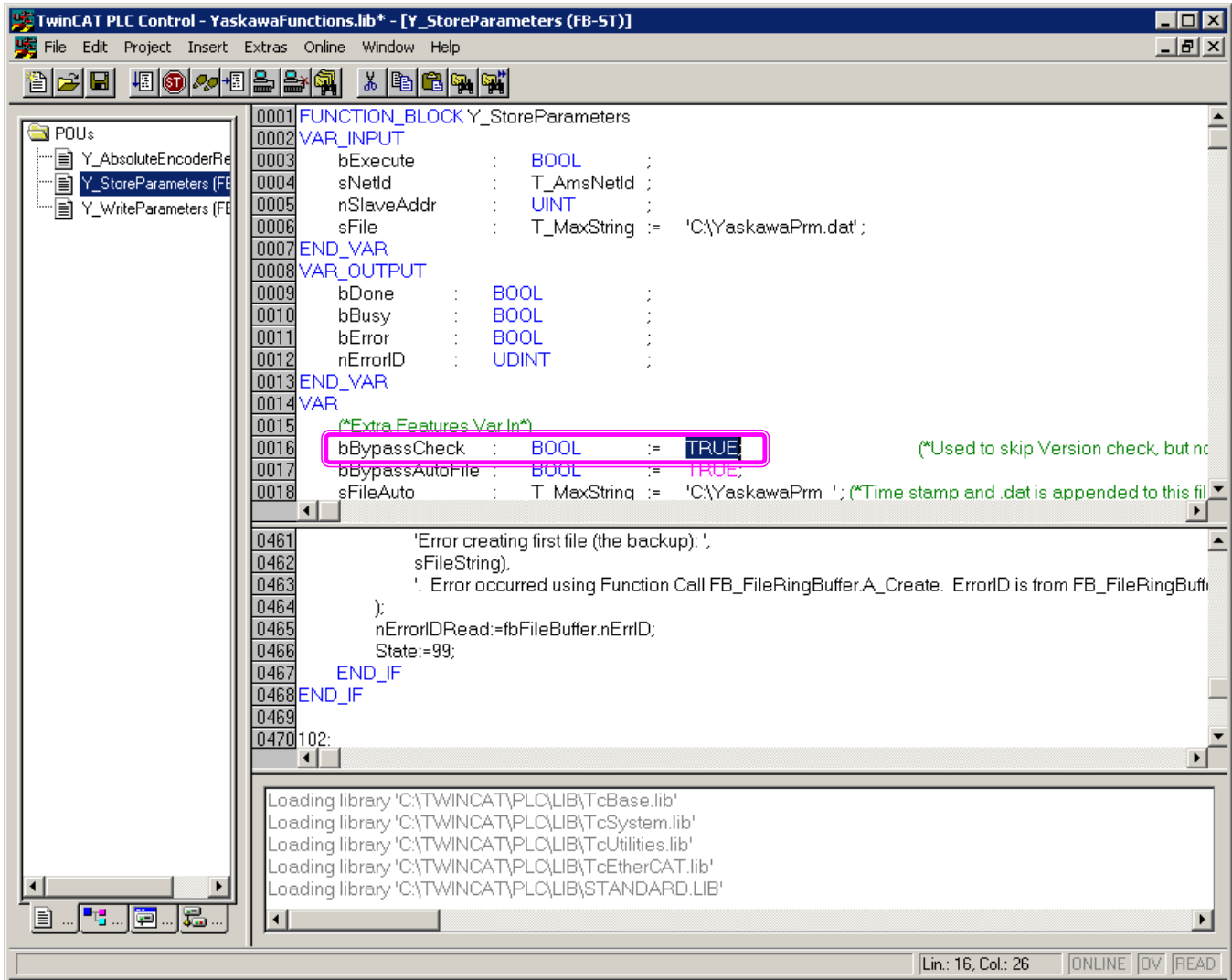


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2. In the Y\_StoreParameters POU, under the VAR section, set the bBypassCheck to TRUE.



The screenshot shows the TwinCAT PLC Control interface for the Y\_StoreParameters POU. The main window displays the ladder logic code for the function block. The following table represents the code content:

Line	Code
0001	FUNCTION_BLOCK Y_StoreParameters
0002	VAR_INPUT
0003	bExecute : BOOL ;
0004	sNetId : T_AmsNetId ;
0005	nSlaveAddr : UINT ;
0006	sFile : T_MaxString := 'C:\YaskawaPrm.dat';
0007	END_VAR
0008	VAR_OUTPUT
0009	bDone : BOOL ;
0010	bBusy : BOOL ;
0011	bError : BOOL ;
0012	nErrorID : UDINT ;
0013	END_VAR
0014	VAR
0015	(*Extra Features Var In*)
0016	bBypassCheck : BOOL := TRUE; (*Used to skip Version check, but no
0017	bBypassAutoFile : BOOL := TRUE;
0018	sFileAuto : T_MaxString := 'C:\YaskawaPrm '; (*Time stamp and .dat is appended to this fi
0461	'Error creating first file (the backup): ';
0462	sFileString);
0463	'! Error occurred using Function Call FB_FileRingBuffer.A_Create. ErrorID is from FB_FileRingBuff
0464	);
0465	nErrorIDRead:=fbFileBuffer.nErrID;
0466	State:=99;
0467	END_IF
0468	END_IF
0469	
0470	102:

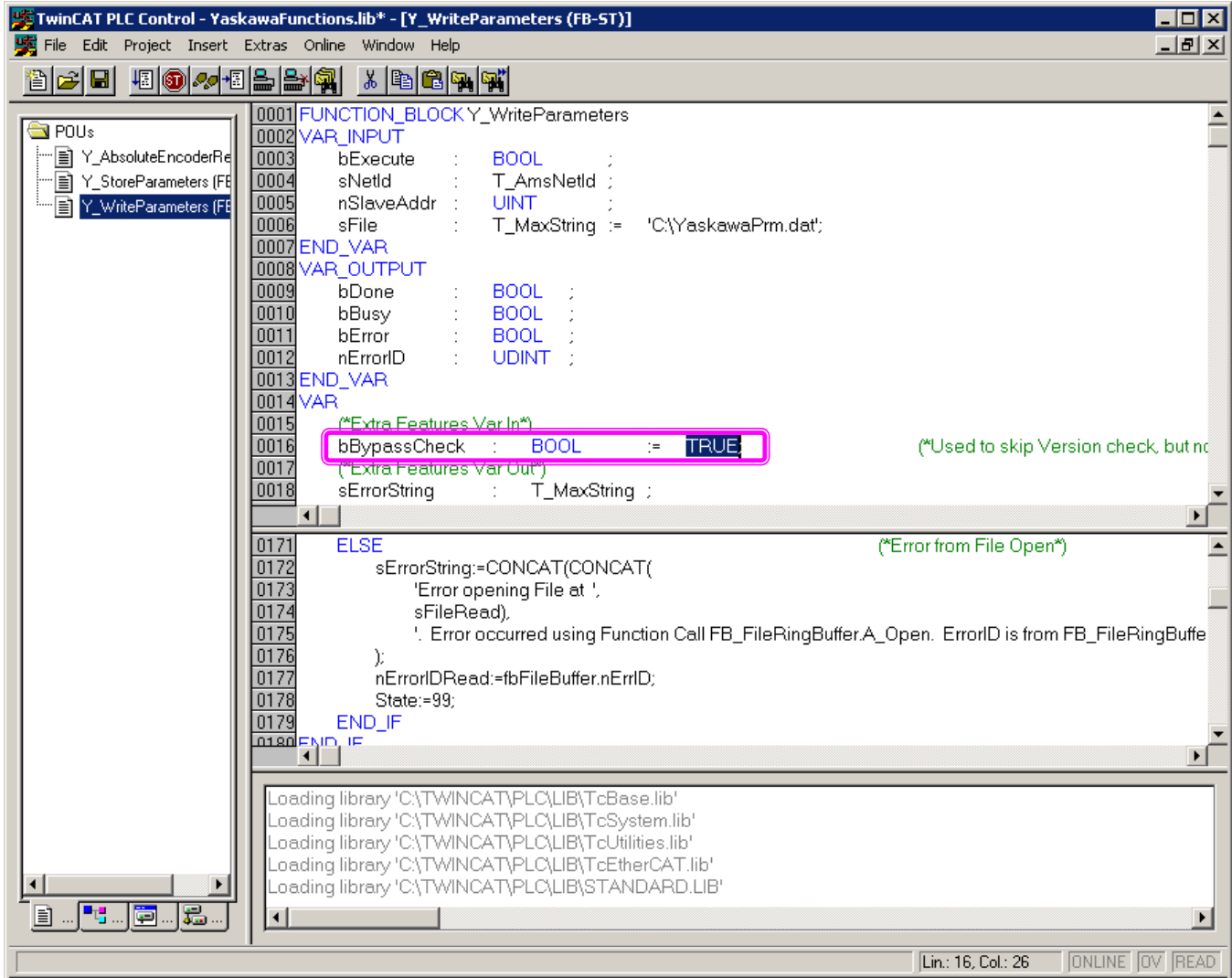
The status bar at the bottom of the window shows 'Lin.: 16, Col.: 26' and 'ONLINE OV READ'.

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3. In the Y\_WriteParameters POU, under the VAR section, set the bBypassCheck to TRUE.



The screenshot shows the TwinCAT PLC Control interface for the Y\_WriteParameters POU. The code is as follows:

```

0001 FUNCTION_BLOCK Y_WriteParameters
0002 VAR_INPUT
0003     bExecute      :   BOOL      ;
0004     sNetId        :   T_AmsNetId ;
0005     nSlaveAddr    :   UINT       ;
0006     sFile         :   T_MaxString := 'C:\YaskawaPrm.dat';
0007 END_VAR
0008 VAR_OUTPUT
0009     bDone          :   BOOL      ;
0010     bBusy          :   BOOL      ;
0011     bError         :   BOOL      ;
0012     nErrorID      :   UDINT     ;
0013 END_VAR
0014 VAR
0015     (*Extra Features Var In*)
0016     bBypassCheck  :   BOOL      := TRUE; (*Used to skip Version check, but no
0017     (*Extra Features Var Out*)
0018     sErrorString  :   T_MaxString ;
0019
0171 ELSE (*Error from File Open*)
0172     sErrorString:=CONCAT(CONCAT(
0173         'Error opening File at ',
0174         sFileRead),
0175         '! Error occurred using Function Call FB_FileRingBuffer.A_Open. ErrorID is from FB_FileRingBuffer
0176     );
0177     nErrorIDRead:=fbFileBuffer.nErrID;
0178     State:=99;
0179 END_IF
0180 END_IF
    
```

The variable `bBypassCheck` is highlighted with a pink box, and its value is set to `TRUE`. The status bar at the bottom right indicates "Lin.: 16, Col.: 26" and "ONLINE OV READ".

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## 4. Build the library.

The screenshot shows the TwinCAT PLC Control software interface. The 'Build' menu option is highlighted in a pink box. The main window displays the code for the 'Y\_WriteParameters' function block. The code includes variable declarations and comments. A status bar at the bottom indicates 'Compiles the changed POU's'.

```

Y_WriteParameters
  BOOL ;
  T_AmsNetId ;
  UINT ;
  T_MaxString := 'C:\YaskawaPrm.dat';

  BOOL ;
  BOOL ;
  BOOL ;
  UDINT ;

  Var In*)
  : BOOL := TRUE; (*Used to skip Version check, but no
  Var Out*)
  : T_MaxString ;

  (*Error from File Open*)
  g:=CONCAT(CONCAT(
  opening File at ',
  Read),
  or occurred using Function Call FB_FileRingBuffer.A_Open. ErrorID is from FB_FileRingBuffe
  nErrID);
  State:=99;
  END_IF
  END_IF
  
```

Compiles the changed POU's

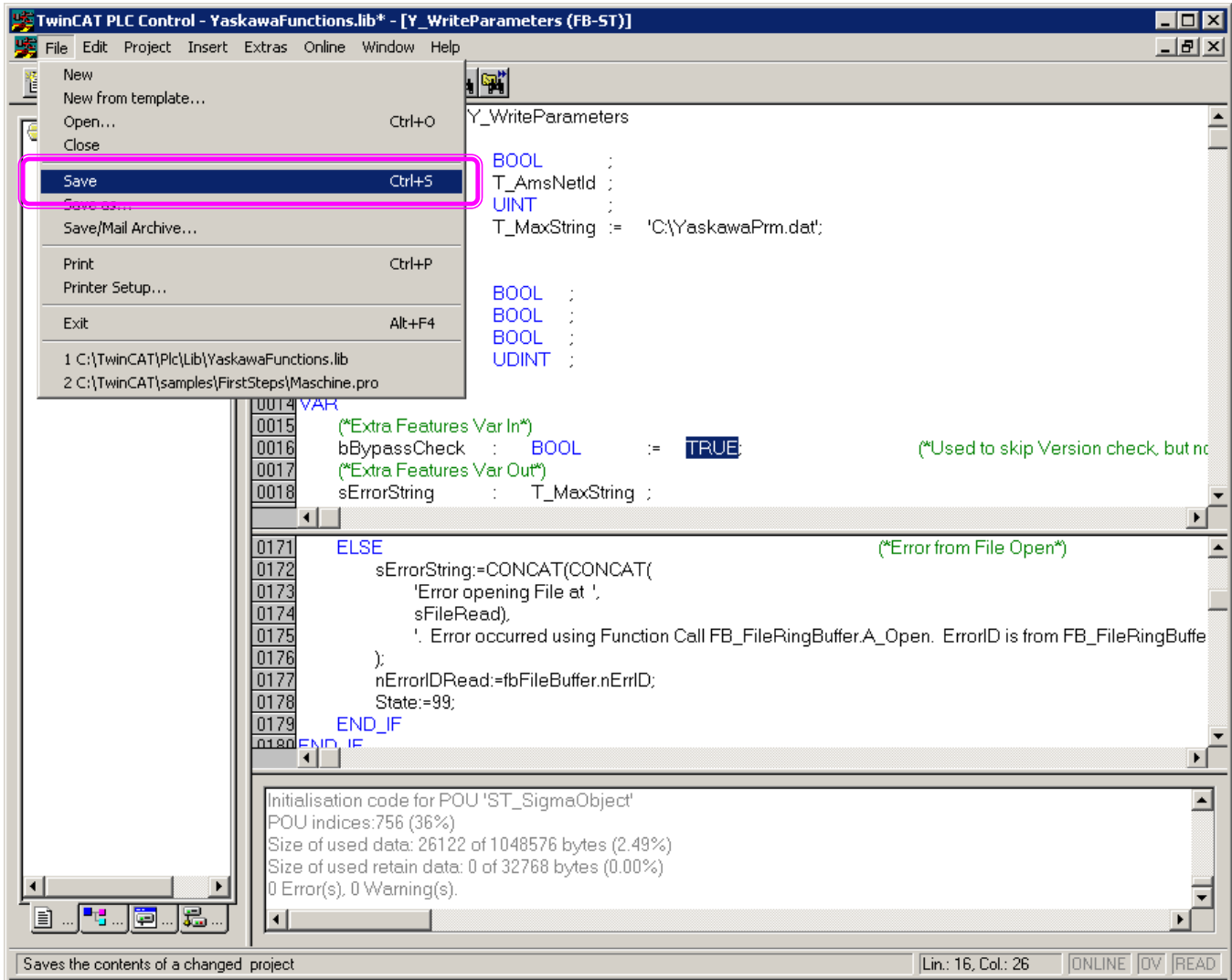
Lin.: 16, Col.: 26 ONLINE OV READ

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## 5. Save the library.



The screenshot shows the TwinCAT PLC Control interface. The 'File' menu is open, and the 'Save' option is highlighted with a pink rectangular box. The main editor window displays the ladder logic for the 'Y\_WriteParameters' function block. The code includes variable declarations for 'T\_AmsNetId' (BOOL), 'T\_MaxString' (UINT), and several other BOOL and UDINT variables. It also shows an 'ELSE' block for error handling, concatenating error messages. At the bottom, there is a status bar indicating 'Saves the contents of a changed project' and 'Lin.: 16, Col.: 26'.

```

0014 VAR
0015   (*Extra Features Var In*)
0016   bBypassCheck : BOOL := TRUE; (*Used to skip Version check, but no
0017   (*Extra Features Var Out*)
0018   sErrorString : T_MaxString ;

0171 ELSE (*Error from File Open*)
0172   sErrorString:=CONCAT(CONCAT(
0173     'Error opening File at ',
0174     sFileRead),
0175     '! Error occurred using Function Call FB_FileRingBuffer.A_Open. ErrorID is from FB_FileRingBuffe
0176   );
0177   nErrorIDRead:=fbFileBuffer.nErrID;
0178   State:=99;
0179 END_IF
0180 END_IF
  
```

Initialisation code for POU 'ST\_SigmaObject'  
 POU indices: 756 (36%)  
 Size of used data: 26122 of 1048576 bytes (2.49%)  
 Size of used retain data: 0 of 32768 bytes (0.00%)  
 0 Error(s), 0 Warning(s).

Saves the contents of a changed project | Lin.: 16, Col.: 26 | ONLINE | OV | READ