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The Encoder Experts

Quickstart Class 4

Absolute Encoders WDGA
with PROFINET interface

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5 YEARS WARRANTY

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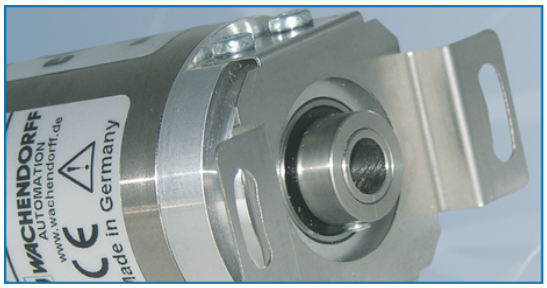

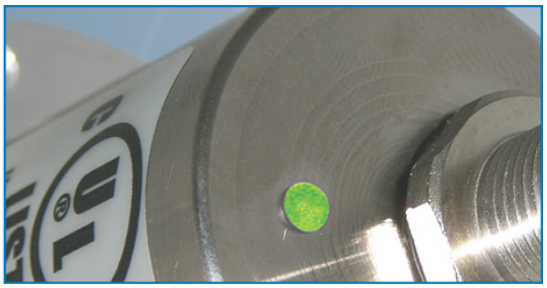

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1 General

The following examples are based on the ”STEP 7” program (version 5.5). If not already available you need the respective hardware, a DPM1 master, a DPM2 master, a DP slave (WDGA encoder with PROFIBUS) with the corresponding GSD file.

The quickstart guide is only a short basic projecting instruction, further information on the product can be found in the PROFIBUS manual.

- Please note that the contents and programs described in the quickstart guide are only examples. Wachendorff Automation does not assume any liability or warranty for the correctness of the quickstart guide nor for any direct or indirect damage arising from it.
- Please ensure the diagnosis evaluation in order to guarantee the validity of the values.

2 Installing the GSD file

The GSD file of the WDGA encoder with PROFIBUSis installed in the ”HW Config” hardware configurator (see Figure 2.1).

- The GSD file for class 4 (WDGA0DD2.GSD) can be found on our website:
  download – GSD file
- Close any open hardware projects.
- Select the required storage location under ”Tools”, ”Install GSD files . . . ”.
- ”Install” GSD file.

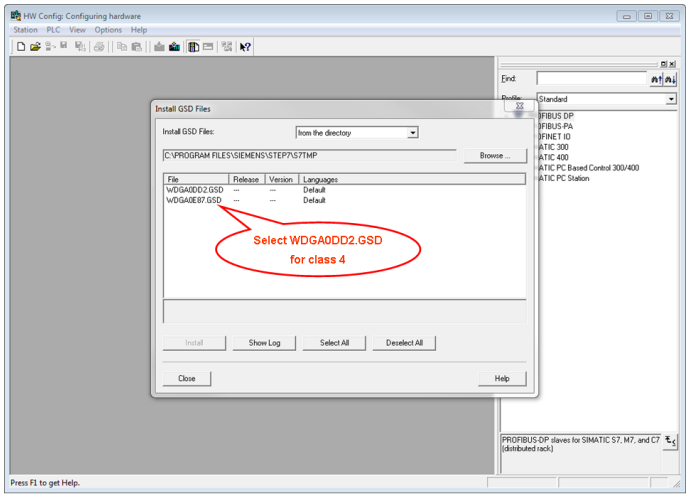


Figure 2.1: GSD-Datei – STEP 7

Then update the ”Hardware catalog”.

- The WDGA encoder appears in the ”Hardware catalog” under ”PROFIBUS-DP”, ”Other field devices”, ”encoder ”, ”Wachendorff Automation ”, ”WDGA PROFIBUS Class4” (see Figure 2.2).
- The ”WDGA PROFIBUS Class4” modules appear here.
- The selectable modules correspond to the configuration data of class 4 (see PROFIBUS manuel or Table 3.1 and 3.2).

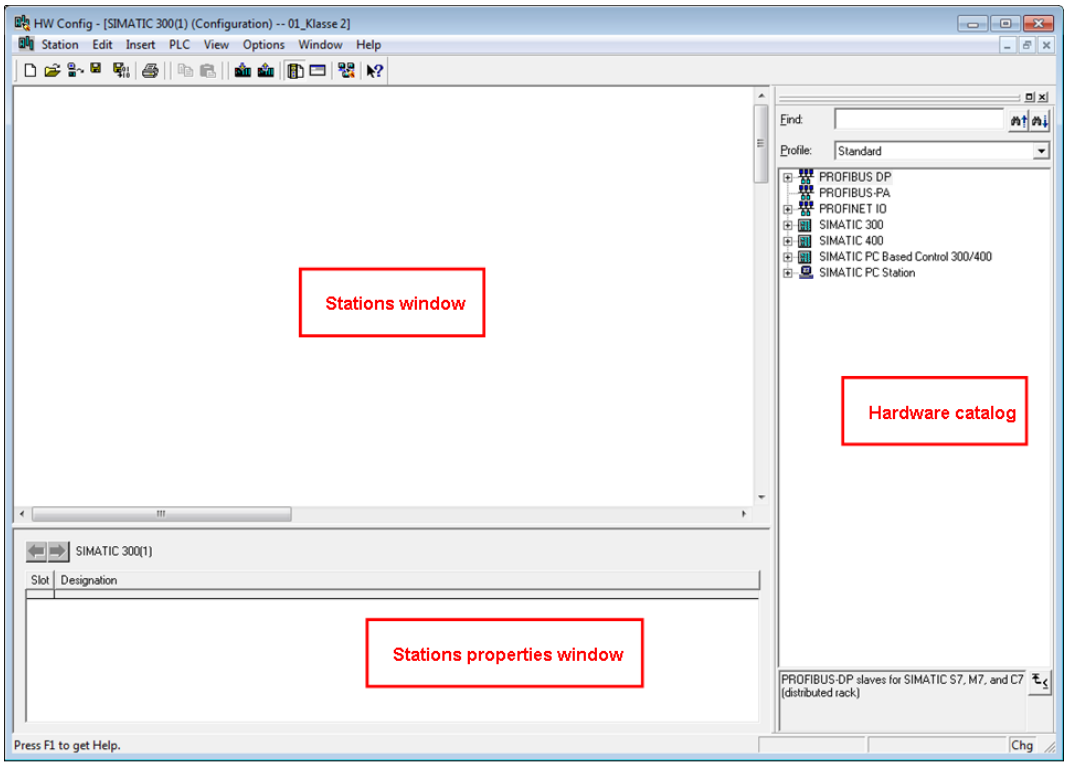


Figure 2.2: Hardware-Konfigurator – STEP 7

3 Configuration data

The selectable ”WDGA PROFIBUS Class4” modules in ”HW Config” after integration of the GSD file for the class 4 WDGA encoder are contained in Table 3.1 and 3.2.

Table 3.1: Telegram structure 81-83 — Part 1

Word	1	2	3	4	5	6	7	8	9	10
Output data Telegrams 81-84	STW2_ENC	G1_STW								
Input data Telegram 81	ZSW2_ENC	G1_ZSW	G1_XIST1		G1_XIST2					
Input data Telegram 82	ZSW2_ENC	G1_ZSW	G1_XIST1		G1_XIST2		NIST_A			

Table 3.2: Telegrammstruktur 84 – Teil 2

Word	1	2	3	4	5	6	7	8	9	10
Input data Telegram 83	ZSW2_ENC	G1_ZSW	G1_XIST1		G1_XIST2		NIST_B			
Input data Telegram 84	ZSW2_ENC	G1_ZSW	G1_XIST3				G1_XIST2		NIST_B	

The following Table 3.3 shows an overview of the control and status words. Details can be found in the PROFIBUS manual.

Table 3.3: Signal list — overview

Abbreviation	Meaning	Data	Length [bit]
G1_STW	control word Sensor 1 control word	output data	16
STW2_ENC	master sign of life Encoder Control word 2	output data	16
G1_ZSW	status word Sensor 1 status word	input data	16
G1_XIST1	32-bit position value Sensor 1 position actual value 1	input data	32
G1_XIST2	32-bit position value or error code Sensor 1 position actual value 2	input data	32
G1_XIST3	64-bit position value Sensor 1 position actual value 3	input data	64
NIST_A	16-bit speed Speed actual Value A	input data	16
NIST_B	32-bit speed Speed actual Value B	input data	32
ZSW2_ENC	Slave sign of life Encoder Status word 2	input data	16

4 Integrating the WDGA

If not already available, configure a DPM1 master in the hardware configurator. The different areas of ”HW Config” are marked in Figure 4.1.

- Go to the ”Hardware catalog”, click on the ”WDGA PROFIBUS Class4” component and drag it into the ”Stations window” to the fieldbus (here: ”PROFIBUS(1): DP master system(1)”).
- Then click the ”WDGA icon” once. The component is displayed in the ”Station properties window”.
- Drag the required ”WDGA PROFIBUS Class4” module from the ”Hardware catalog” into the ”Station properties window” to ”Slot 1”.

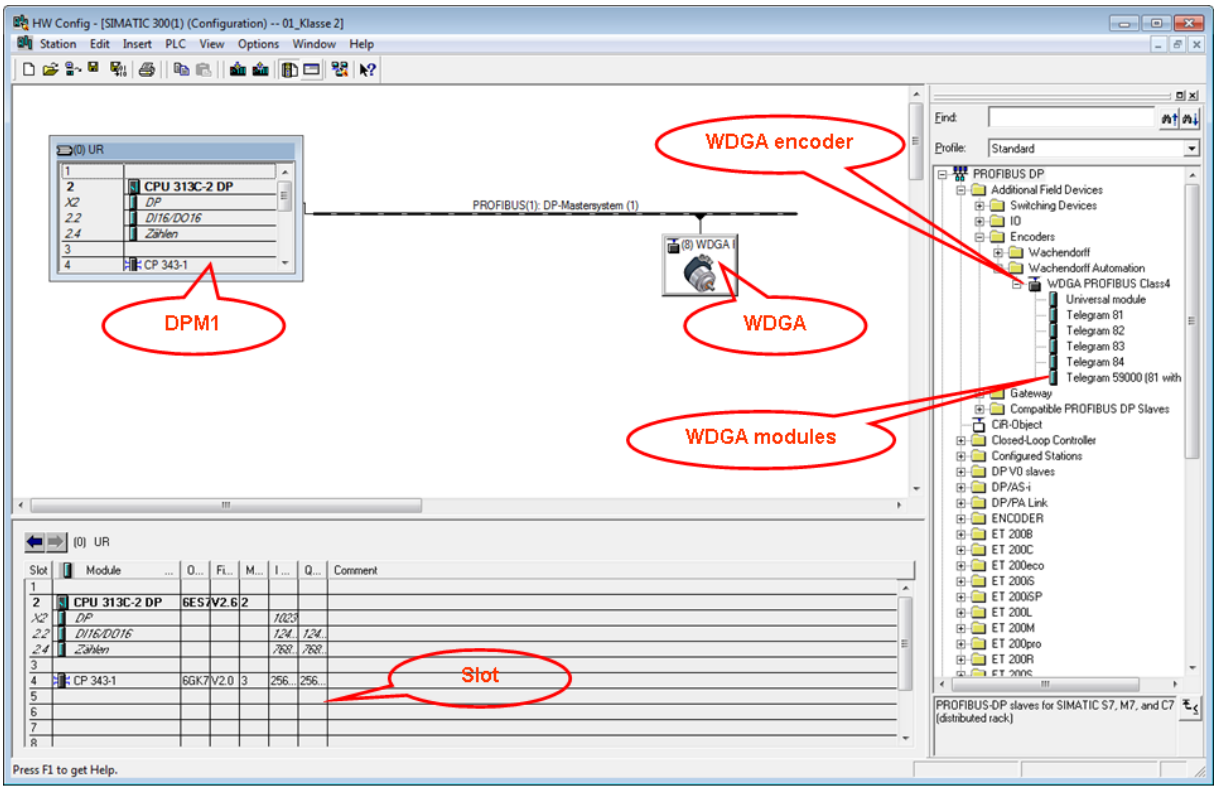


Figure 4.1: HW-Configuration – STEP 7

4.1 Assigning the slave address

The slave address previously set in the WDGA (see PROFIBUS manual) must be assigned in the hardware configuration (see Figure 4.2).

- Double-click on the ”WDGA icon”.
- Enter the respective slave address under ”General”, ”PROFIBUS. . . ”, ”Parameters”.
- Select your projected PROFIBUS in the ”Subnet” and confirm with ”OK”.

If you have a WDGA encoder with terminal box, please make sure that the indication of the rotary coding switches is consistent with the indication in the ”Station window”.

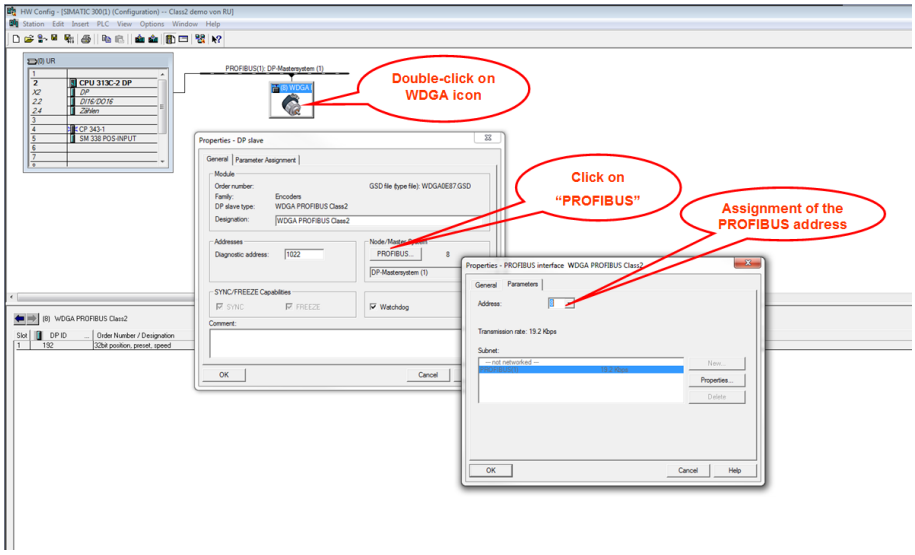


Figure 4.2: Address assignment — ”HW Config” STEP 7

4.2 Setting the I/O addresses

The I/O addresses are the S7 addresses via which the encoder is called in the controller. They are used by the controller to access the input and output data of the encoder. The I/O addresses are assigned via the ”Properties - DP slave” window (see Figure 4.3).

- Double-click on the line of the added ”WDGA module” in the ”Station properties window”.
- Enter the required I/O address in the ”Properties - DP slave” window and confirm by pressing ”OK”.
- Identical addresses are permissible for the I/O addresses.

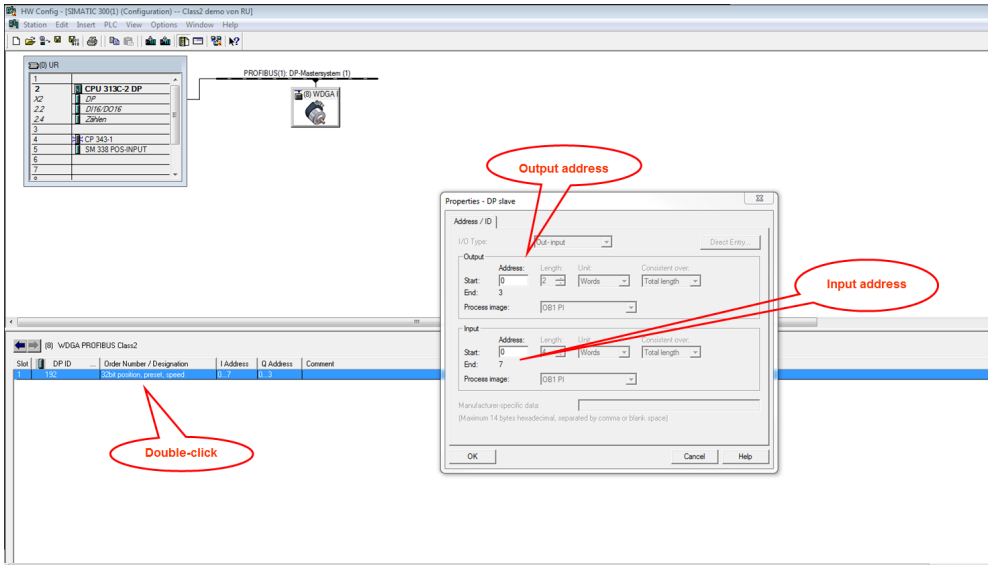


Figure 4.3: I/O addresses – STEP 7

Depending on the controller type, there can be restrictions for the permissible range of values of the I/O addresses which do not directly result in error messages. If access to the data is not possible via the addresses Ixxx or Oxxx but only via PIxxx and POxxx, you might have set values beyond the permissible range. Avoid overlapping with other slaves!

4.3 Parameterizing the WDGA

The parameterization can be effected via the ”Properties - DP slave” window (see Figure 4.4).

Click on the parameters for parameterization:

- ”code sequence” – changes the direction of rotation
- ”class 4 functionality” — activates the class 4 functionalities
- ”G1_XIST1 preset control” — effect of the presets on the position value in G1_XIST1.
- ”scaling function control” — activates the scaling
- ”Alarm channel control” — In case of deactivated ”Alarm channel control” only the 6-byte standard diagnosis is put out via the diagnosis (only has an effect in the compatibility mode).
- ”Compatibility mode” — compatibility with older encoder profile version 3.1.
- ”measuring units per revolution” — enter the ST resolution
- ”total measuring range” – enter the total resolution
- ”Maximum master sign-Of-life failures” – The parameter sets the upper limit of the error counter of the isochronous mode to the 10-fold of the value (only has an effect in the compatibility mode).

- ”Speed measuring unit” – sets the speed value unit
- ”64Bit-MUPR (lower half)” – 0-31 bit part of the ST resolution; always equal to MUPR.
- ”64Bit-MUPR (upper half)” – 32-64 bit part of the ST resolution; always 0.
- ”64Bit-TMR (lower half)” – 0-31 bit part of the total resolution.
- ”64Bit-TMR (upper half)” – 32-64 bit part of the total resolution.

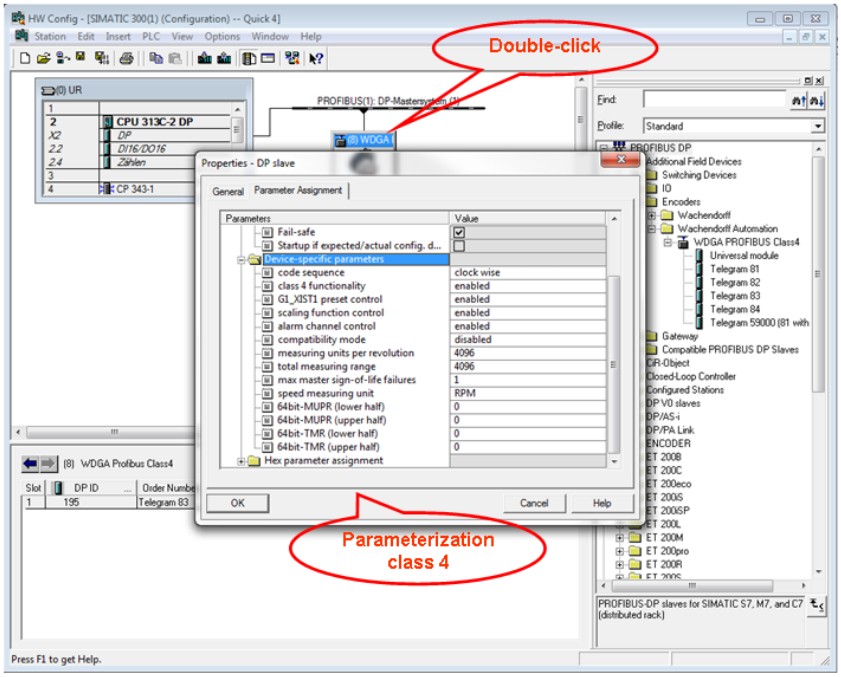


Figure 4.4: Parameterization — STEP 7

- When the hardware configuration is complete, it can be compiled and loaded into the target system (DPM1).
- Please make sure that you have compiled and not only saved the configuration.

4.4 Setting the diagnosis address

The assignment of a diagnosis address is required in order to evaluate diagnosis messages of the encoder (see Figure 4.5).

Enter the diagnosis address in the ”Properties – DP slave” window.

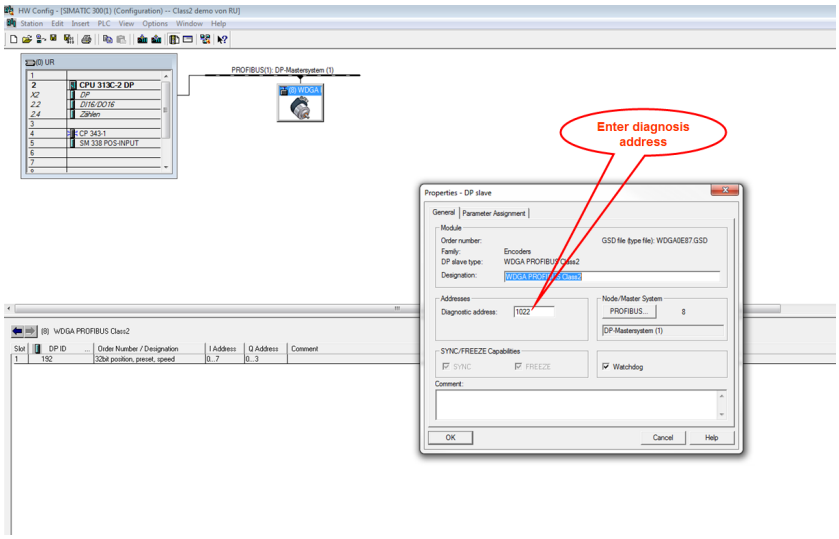


Figure 4.5: Diagnosis addresses – STEP 7

- The diagnosis address can be within the entire peripheral range of the controller.
- The diagnosis address does not occupy an I/O address.
- Assigning the diagnosis address is only required if the diagnosis functions are used (see PROFIBUS manual).
- For reading the diagnosis, see section 8.

5 Creating the symbol table

Create a symbol table or amend an existing one, if necessary.

Open the symbol table according to Figure 5.1.

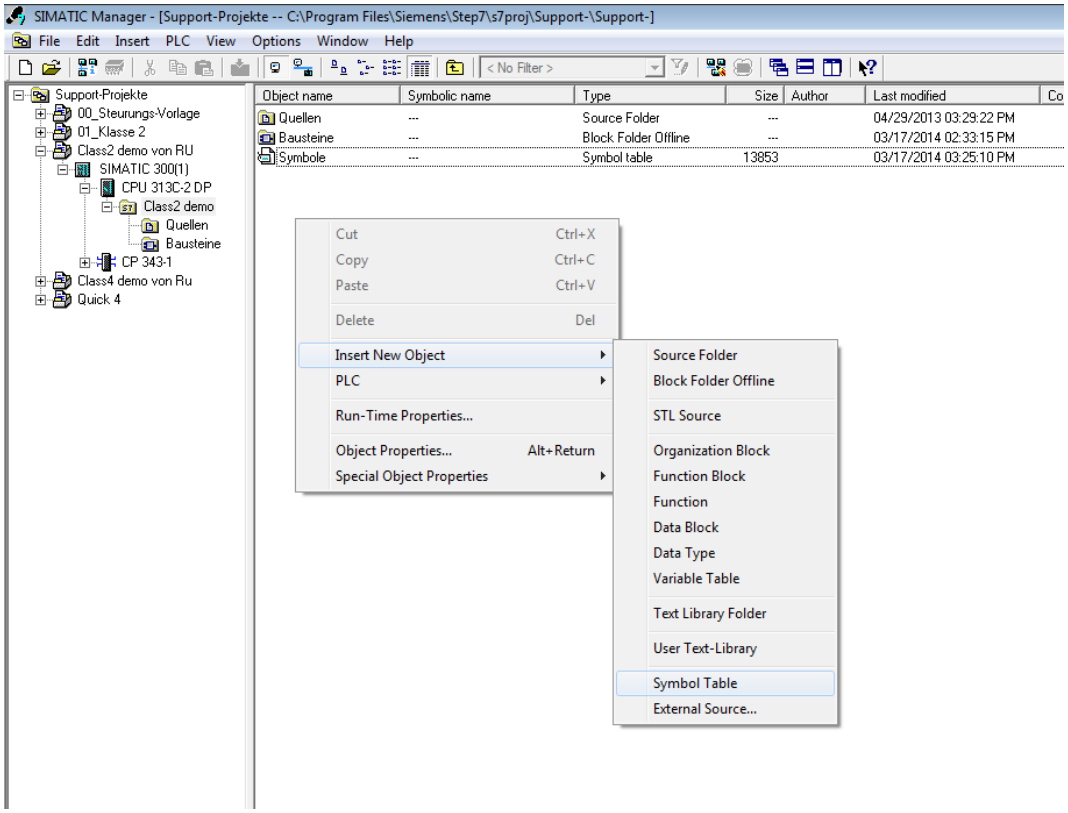
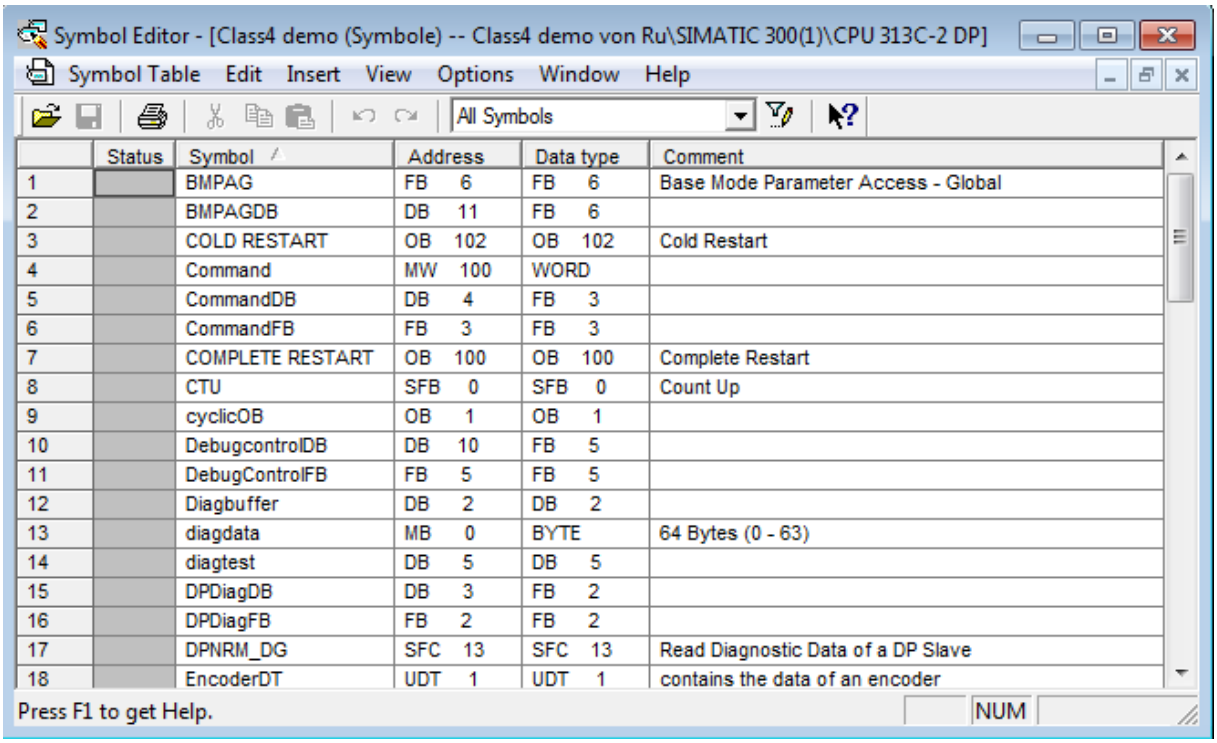


Figure 5.1: Opening the symbol table – STEP 7

- Enter your own symbol name under ”Symbol”.
- Enter your determined I/O address range via ”Address”. Please make sure to select the word sizes in accordance with the sizes of the words to be addressed (e.g. 32-bit position value see PROFIBUS manual or Table 3.1). See example in Figure 5.2.



	Status	Symbol	Address	Data type	Comment
1		BMPAG	FB 6	FB 6	Base Mode Parameter Access - Global
2		BMPAGDB	DB 11	FB 6	
3		COLD RESTART	OB 102	OB 102	Cold Restart
4		Command	MW 100	WORD	
5		CommandDB	DB 4	FB 3	
6		CommandFB	FB 3	FB 3	
7		COMPLETE RESTART	OB 100	OB 100	Complete Restart
8		CTU	SFB 0	SFB 0	Count Up
9		cyclicOB	OB 1	OB 1	
10		DebugcontrolDB	DB 10	FB 5	
11		DebugControlFB	FB 5	FB 5	
12		Diagbuffer	DB 2	DB 2	
13		diagdata	MB 0	BYTE	64 Bytes (0 - 63)
14		diagtest	DB 5	DB 5	
15		DPDiagDB	DB 3	FB 2	
16		DPDiagFB	FB 2	FB 2	
17		DPNRM_DG	SFC 13	SFC 13	Read Diagnostic Data of a DP Slave
18		EncoderDT	UDT 1	UDT 1	contains the data of an encoder

Figure 5.2: Creating a symbol table – STEP 7

6 Position & speed

Position und Geschwindigkeit beobachten (siehe 6.1):

- Open the variables table (analogous to Figure 5.1).
- Enter your created symbol names under ”Symbol”.
- Select your required ”Display format”.
- The current values appear under ”Status value” (e.g. position and speed) which you can monitor using the ”glasses icon”.

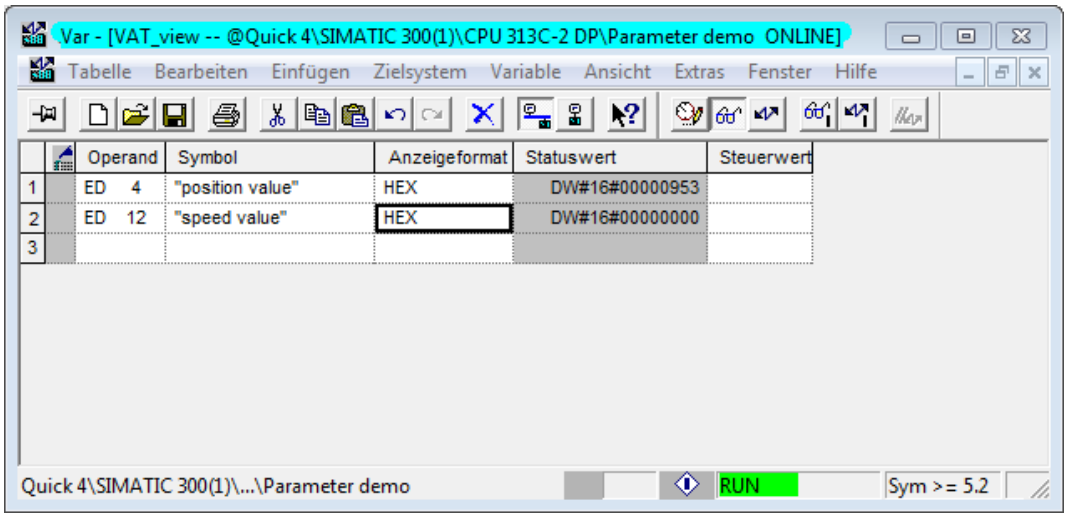


Figure 6.1: Variables table – STEP 7

Position und Geschwindigkeit in ein Steuerprogramm laden:

- Open your control program (”KOP/AWL/FUP” window).
- Use ”L” to load the position/speed with the symbol name assigned and use ”T” to transfer it into a flag selected by you.
- See example in Figure 6.2.

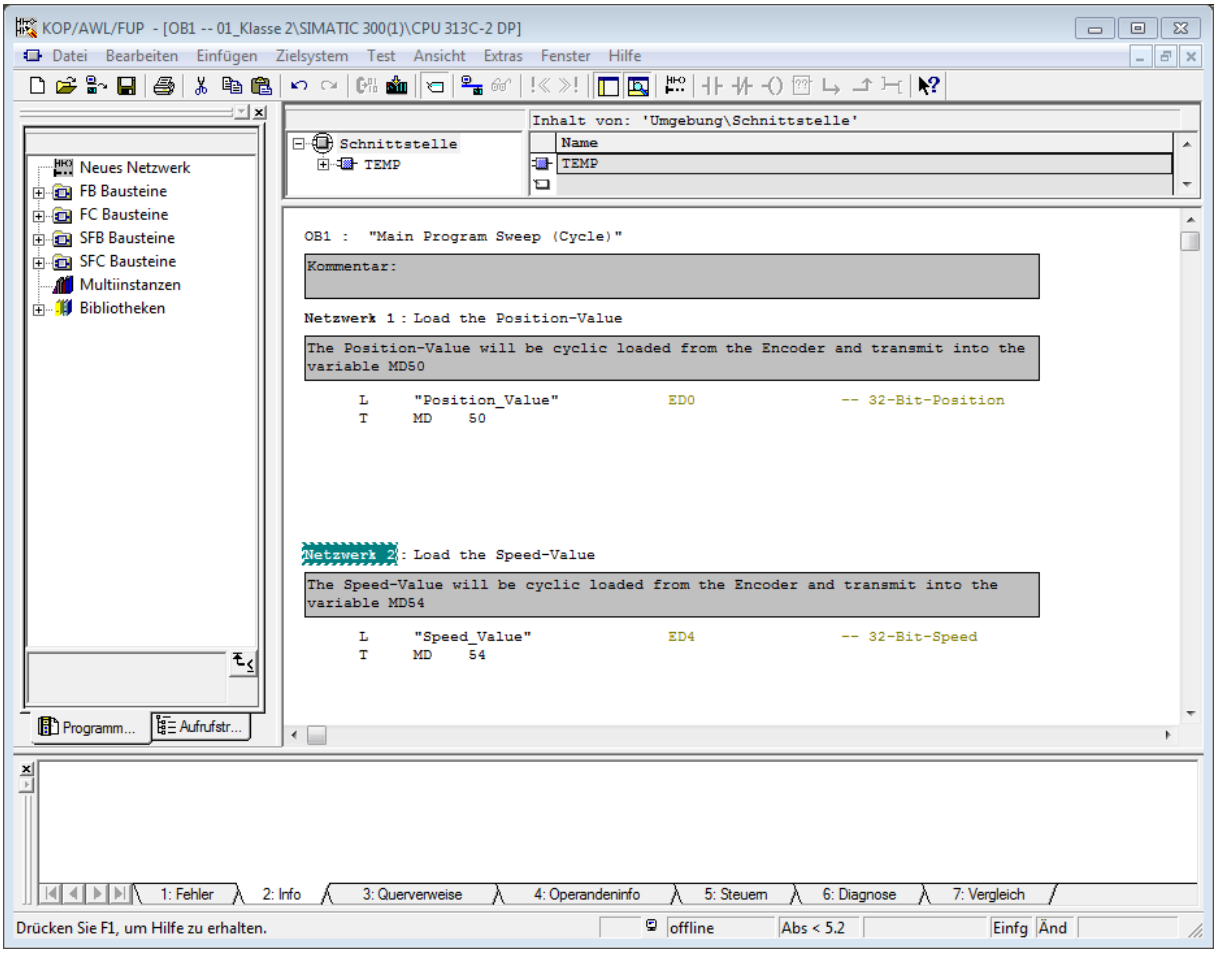


Figure 6.2: Loading values into a control program – STEP 7

7 Setting the preset value

In order to set the preset, the S7 exampleis required first. The preset routine is carried out within the FC2. Several steps are necessary to set the preset value:

Step 1:

- Open the variables table ”VAT_Control” (see Figure 7.1).
- Set the control value of ”STW2_ENC” to the hex value 0400 (”STW2_ENC” – bit 10). This puts the encoder in the ”Control by PLC” mode (see Figure 7.1; for details see PROFIBUS manual, class 4, control priority).
- Control the value using the ”Control variable” button.

- Valid range of values for the preset: TMR-1.
- The values of G1_XIST1 and G1_XIST2 must be identical, otherwise there is an error (see section 7.1).

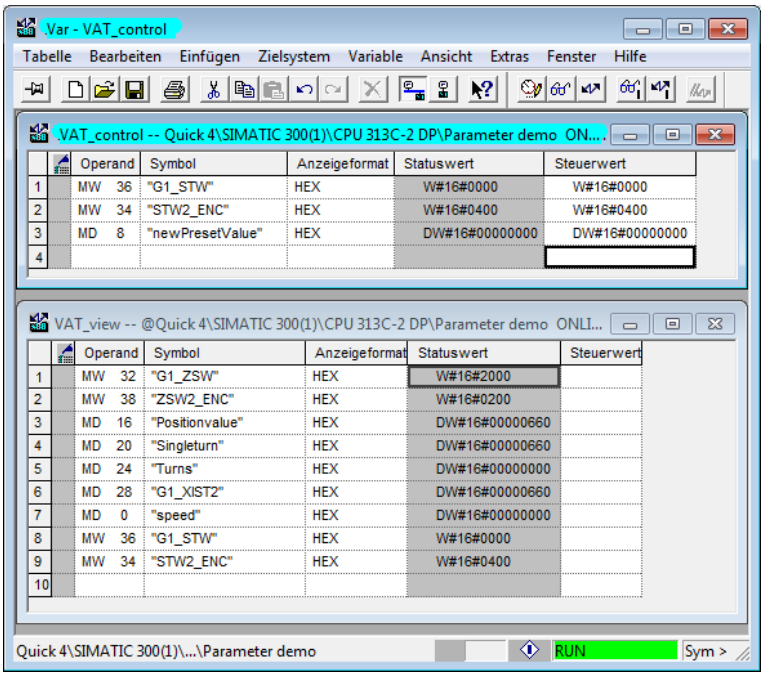


Figure 7.1: Variables table ”VAT_Control” – ”STW2_ENC” = 400

Table 7.1: STW2_ENC Output

data															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Master sign of life				0	Control by PLC	0	0	0	0	0	0	0	0	0	0

Step 2:

- Enter the required preset value for the control value with the symbol name ”ne wPresetValue” (Figure 7.2).
- Control the value using the ”Control variable” button.

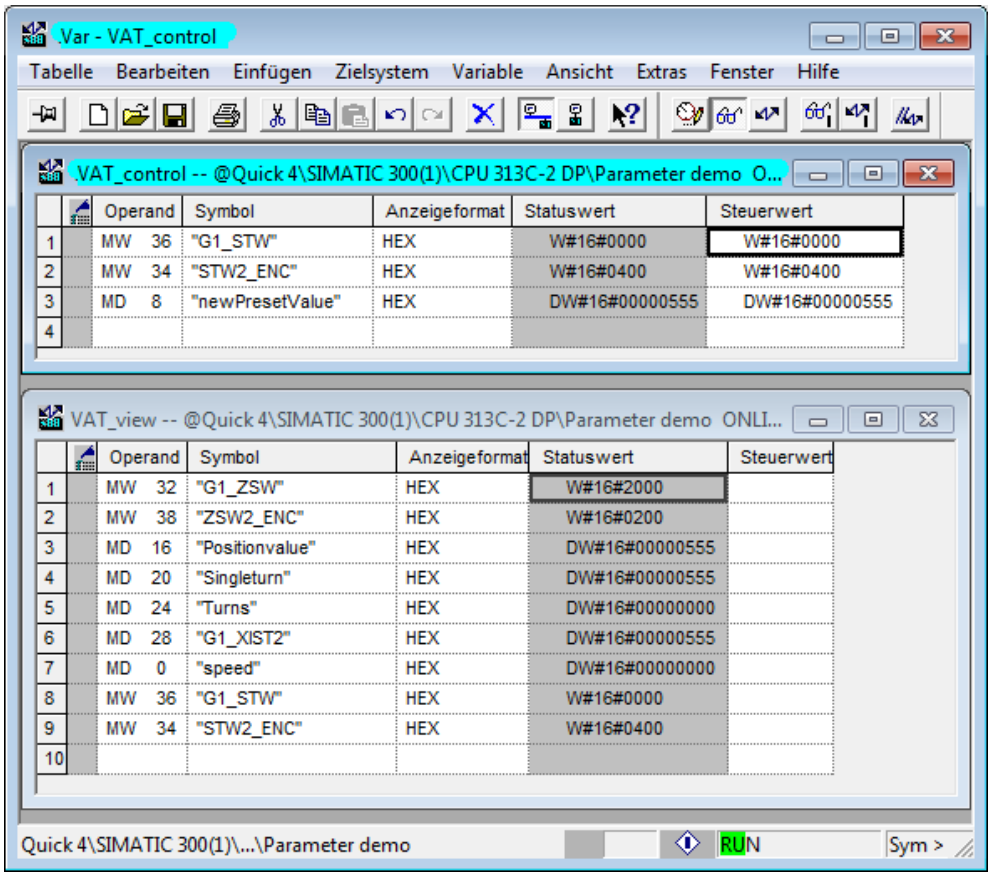


Figure 7.2: Variables table ”VAT_Control” – ”newPresetValue”

- Use the ”Monitoring” button to monitor the changing status values.

Schritt 3:

- Set the control value from ”G1_STW” to the hex value: 1000 (see Figure 7.3).
- Meaning of the hex value: 1000 (set bit 12 to ”1”) see Table 7.2.
- Control the value using the ”Control variable” button.

Table 7.2: G1_STW – output data

Output data															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Ack sensor error	Activate parking	Req abs value	Req preset	Relative preset mode	0	0	0	0	0	0	0	0	0	0	0

Bit ”Ack sensor error”:

Acknowledging a sensor error – If the bit is ”1”, the error code of G1_XIST2 is acknowledged.

Bit ”Activate parking”:

Activate parking sensor – If the bit is ”1”, the ”Parking sensor” function is activated (suppression of the error output).

Bit ”Req abs value”:

Request absolute value cyclically – If the bit is ”1”, the position is output in G1_XIST2.

Bit ”Req preset”:

Request preset – When setting the bits to ”1”, the preset process is executed. If ”Preset executed” is set, ”Req preset” should be deleted again.

Bit ”Relative preset mode”:

Relative preset mode – If the bit is ”1”, the relative preset is executed. Then the ”Preset value” is added to the current ”Position value” as ”Offset value”.

If the bit is ”0”, the absolute preset is executed. The ”Position value” is set to the ”Preset value”.

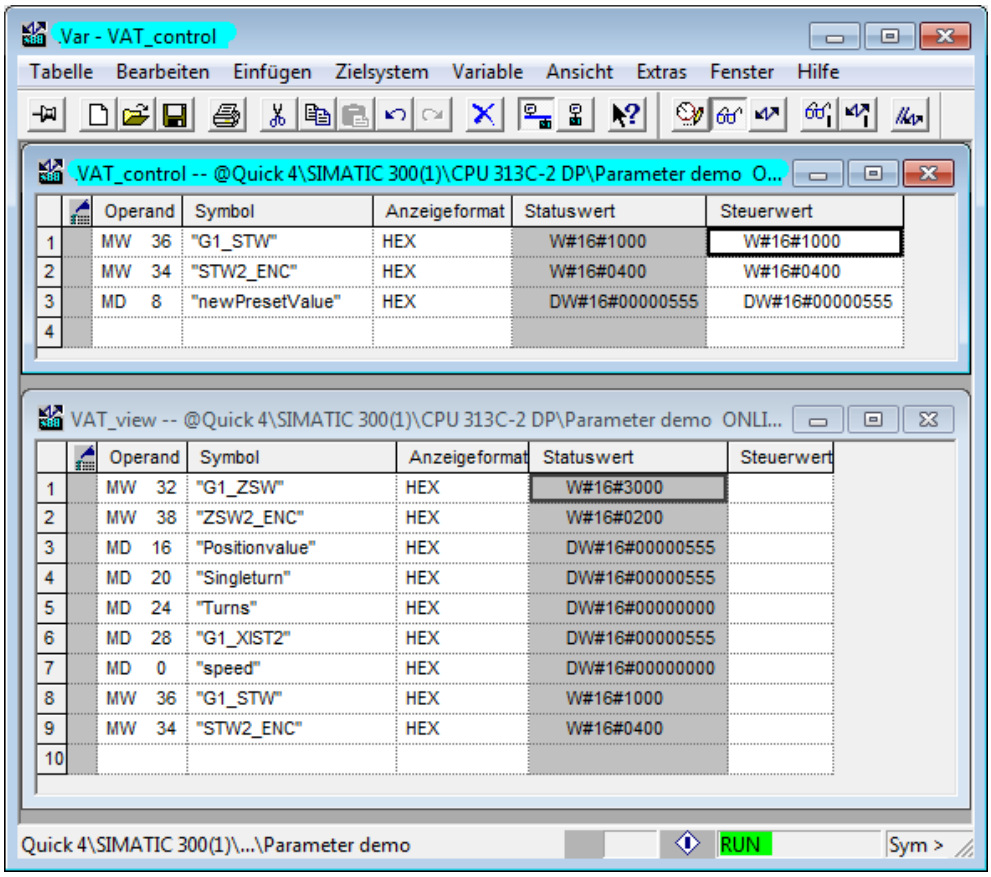


Figure 7.3: Variables table ”VAT_Control” – ”G1_STW” = 1000

Step 4:

- Due to step 3, the status value in the variables table ”VAT_View” (see Figure 7.3) changes from hex value: 2000 to hex value: 3000.
- Meaning of the hex value: 3000 (bits 12 and 13 set to ”1”) see Table 7.3.

Table 7.3: G1_ZSW – input data

Input data															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Sensor error	Parking active	Transm abs value	Preset executed	Error ack-req detected	0	0	0	0	0	0	0	0	0	0	0

Bit ”Sensor error”:

Sensor error – If the bit is ”1”, G1_XIST2 contains an error code instead of the position value.

Bit ”Parking active”:

Parking sensor active – If the bit is ”1”, the ”Parking sensor” function is active.

Bit ”Transm abs value”:

Transmit absolute value cyclically – If the bit is ”1”, the position is output in G1_XIST2.

Bit ”Preset executed”:

Preset executed – If the bit is ”1”, the preset process in the encoder is complete. This bit inverts the ”Req preset” of G1_STW and is then automatically withdrawn.

Bit ”Error ack-req detected”:

Requirement of error acknowledgment detected – If the bit is ”1”, an error must be acknowledged.

Step 5:

- Set the control value from ”G1_STW” to the hex value: 0000 (see Figure 7.2).
- This changes the status value in the variables table ”VAT_View” (see Figure 7.2) from hex value: 3000 back to hex value: 2000 (bit 13 set to ”1”).

7.1 Error management

- If the value of G1_XIST1 is not identical to the value of G1_XIST2, an error has occurred.
- The status value in the variables table ”VAT_View” (see figure 7.4) changes from hex value: 2000 to hex value: 9000 (bit 15 and 12 set to ”1”). For the meaning see table 7.3.
- For further details on the error management refer to the PROFIBUS manual, class 4, G1_XIST2 – error management).
- Please observe the valid range of values of: TMR-1.

If an error has occurred (see Figure 7.4), it must be acknowledged.

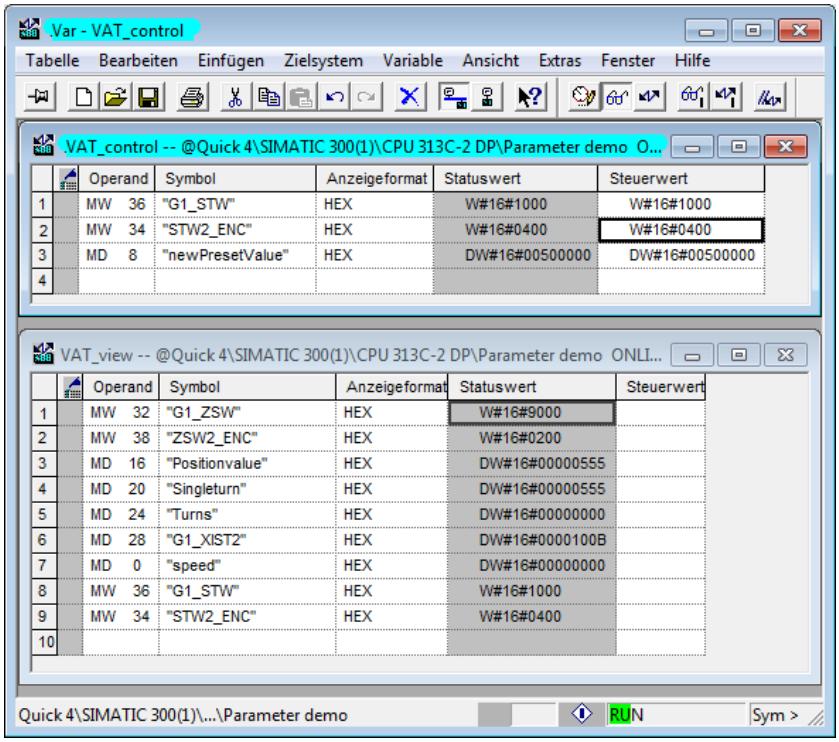


Figure 7.4: Variables table ”VAT_View” – error code in G1_XIST2

- Set the control value from ”G1_STW” to the hex value: 8000 (see Figure 7.5). Repeat this process until all errors have been acknowledged.
- Meaning of the hex value: 8000 (set bit 15 to ”1”) see table 7.2.
- Eventually set the control value of ”G1_STW” back to the hex value: 0000.

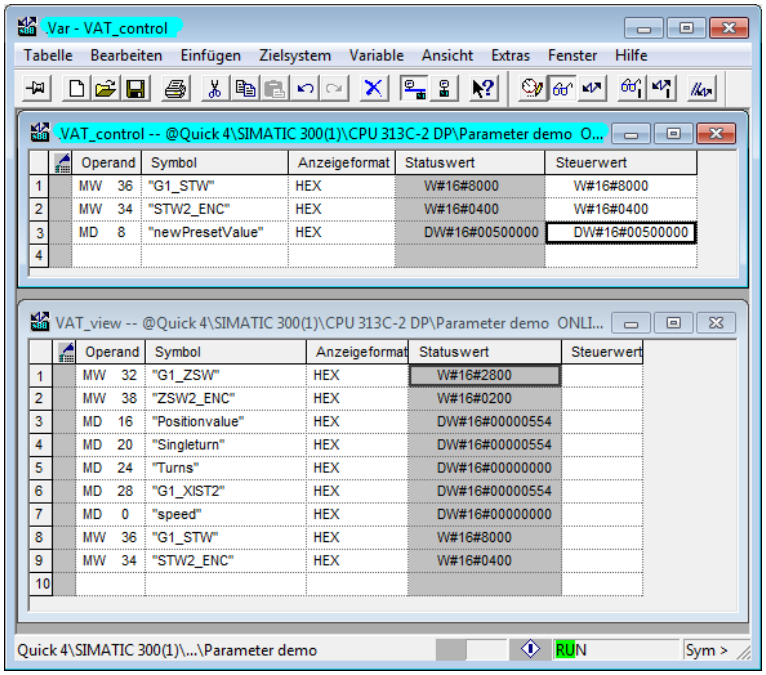


Figure 7.5: Variables table ”VAT_View” – error in G1_XIST2 acknowledged

- In the variables table VAT_View, the ”Position value” (G1_XIST1) and ”G1_XIST2” are identical again. The errors have been acknowledged.
- This changes the status value in the variables table ”VAT_View” (see Figure 7.2) from hex value: 9000 to hex value: 2800 (bit 13 and 11 set to ”1”). For the meaning, see Table 7.3.

8 Reading the diagnosis

The DP master usually retrieves the diagnosis automatically without requiring programming. Processing and recording of occurring errors must, however, be done in the control program. If this is not done, the controller may automatically switch to a safe state.

- We advise against simply discarding the diagnosis data to avoid a stop of the controller. Measures may be necessary to ensure safe operation of a system.
- Please ensure the diagnosis evaluation in order to guarantee the validity of the values.

- For setting the diagnosis address, see section 4.4.
- Further details on the diagnosis within the control program can be seen from the S7 example.
- Further information can be found in the PROFIBUS manual.

9 S7 example program

You can download an S7 example program from our website:
S7 example