SIEMENS

SIMATIC S7
STEP 7 Sample Program for HS 724

Product Information **Release 05/00**

Version 0.4

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For the structure of the coupling software, see chapter 5 of the description of the HS 724.

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1 Introduction

1.1 Contents of This Documentation

This document covers the following topics.

- Description of all required installations and configurations
- Configuration and use of the sample program for the HS 724

1.2 Organization of This Documentation

This documentation is divided into the following sections.

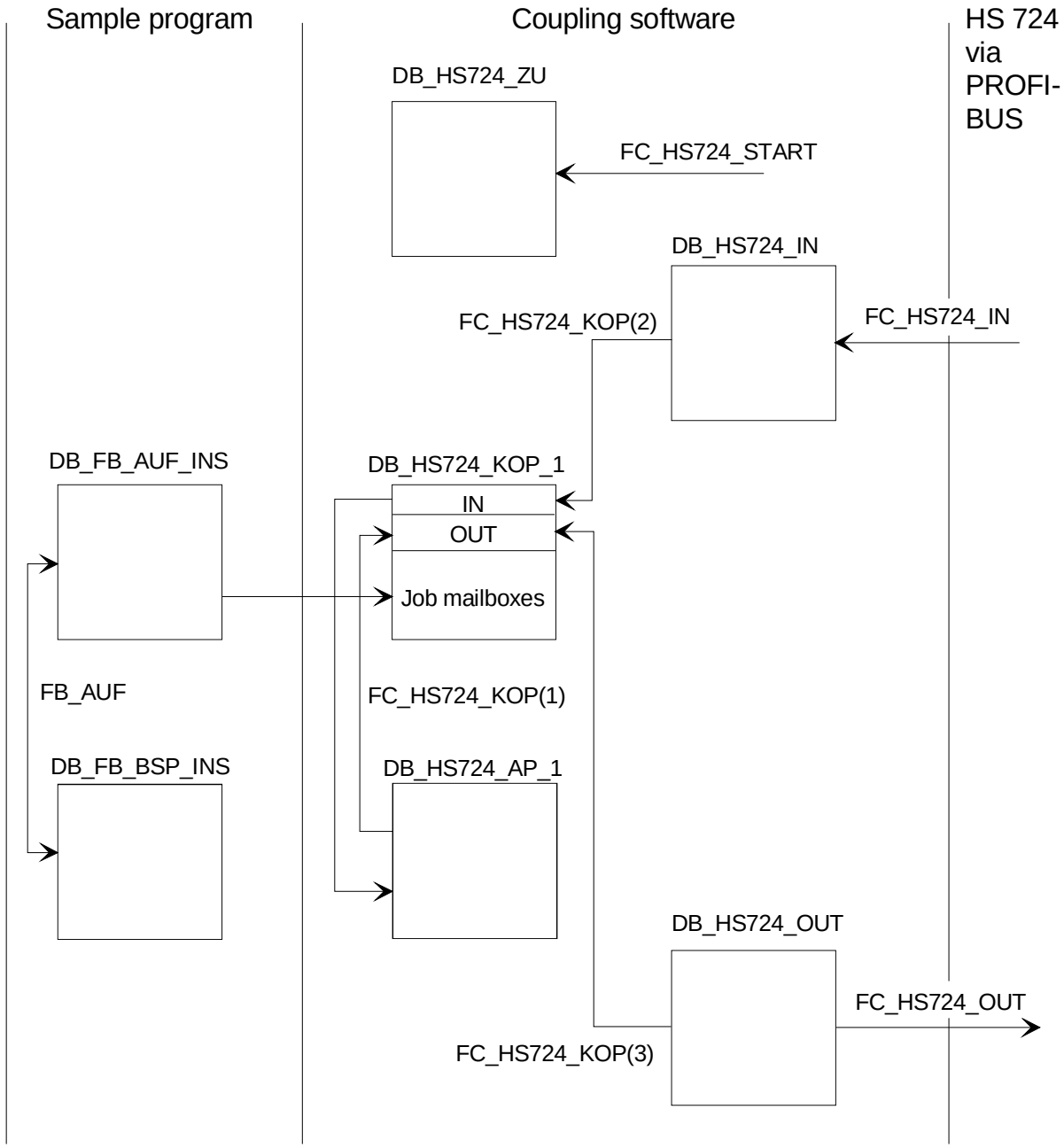
- Overview: Comprehensive presentation of the standard HS 724 software
- Installation/configuration: Installation of the software, and configuration of PROFIBUS
- Description of the sample program for HS 724

2 Overview

2.1 General

The HS 724 heating controller is used in industry to address radiant heater fields. Application areas of the HS 724 include the radiant heaters of thermoforming machines or the radiant heaters of drying ovens in the automotive industry.
The heart of this product is the ZA (i.e., central interface) which permits expansions of up to 16 LAs (i.e., power outputs). The central interface communicates as a slave via the PROFIBUS-DP fieldbus with the host controller (i.e., the master).
Controllers used: SIMATIC S5 with IM 308-C and
SIMATIC S7 (e.g., CPU 315-2 DP or CPU 414-2 DP)
This documentation describes the use of the heating controller with the SIMATIC S7.

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2.2 Blocks

The coupling software consists of the following blocks.

FC_HS724_START	Startup test
FC_HS724_IN	Read data from the HS 724
FC_HS724_OUT	Write data to the HS 724
FC_HS724_KOP	Process jobs
FC_HS724_REG	Power voltage regulation

The sample program consists of the following blocks.

FB_AUF	Transfer jobs to the coupling software
FB_BSP	User interface

FC_HS724_START Call the FC_HS724_START function once in OB 100 (startup after STOP/START or power off/on).
FC_HS724_START checks the specifications in DB_HS724_ZU and provides the processing enable of the ZA. When an error occurs, an error number is entered in DB_HS724_ZU. The processing enable of all ZAs is deleted.

FC_HS724_IN Call the FC_HS724_IN function once in organization block OB 1.
It transfers the data from the ZA 724 to the SIMATIC S7.

FC_HS724_OUT Call the FC_HS724_OUT function once in organization block OB 1.
It transfers the data from the SIMATIC S7 to the HS 724.

FC_HS724_KOP Call the FC_HS724_KOP function once in organization block OB 1 for each ZA.
It processes the jobs to the ZA via DB_HS724_KOP.

FC_HS724_REG Call the FC_HS724_REG function once in organization block OB 1.
It transfers the power voltage offset values from the ZA 724 with NSE to the other ZA 724s.

FB_AUF You can use the FB_AUF function block to simultaneously transfer up to 16 jobs to the ZA 724. Use the DB_FB_AUF_INS data block for this.

FB_BSP The FB_BSP function block uses the FB_AUF function block to transfer jobs to the coupling software of the HS 724.
It handles startup synchronization with the HS 724 after power off/on.
The diagnostic messages of the HS 724 are cyclically read by the FB_BSP function block.

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3 System Environment

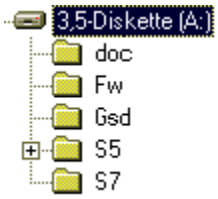
3.1 Controller

Required: a SIMATIC S7 CPU3xx or CPU4xx with integrated PROFIBUS-DP interface

3.2 Heating Controller

Components of the heating controller
- 1 ZA 724 (i.e., central interface)
- LA 724(s) (i.e., power outputs)

3.3 Program Floppy Disk



\doc directory	: This description
\Fw directory	: Firmware and loading program for the HS 724
\Gsd directory	: Type files of the HS 724
\S5 directory	: Coupling software for the SIMATIC S5
\S7 directory	: Coupling software for the SIMATIC S7

\doc directory	HS724.exe file	: Descriptions of the coupling software and sample program

\Fw directory



Firmware for HS 724 with SPC2 (MLFB: 6ES7171-1AA00-0AA0)
Firmware for HS 724 with SPC3 (MLFB: 6ES7171-1AA01-0AA0)
Loading program for the HS 724 with SPC2
Loading program for the HS 724 with SPC3

\Gsd\S5 directory	HS724__x.200	Type file of the HS 724 with 1,5
\Gsd\S7\1.5Mbit directory	SI002BTD.gsd	Type file of the HS 724 with 1,5 MBd
\Gsd\S7\12Mbit directory	SIEM002B.gsd	Type file of the HS 724 with 12 MBd

For use of the type files, see chapter 5.1.

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\S5\115U directory	Hs7240zf.seq	Symbols file
	Hs7240z0.seq	Symbols file
	S5hs55st.s5d	STEP 5 program for the CPU 945
	S5hs50st.s5d	STEP 5 program for CPU 942 to CPU 944
	Hs7240z2.ini	Symbols file
	Hs7240z1.ini	Symbols file
	Hs7240z0.ini	Symbols file
	S5hs55.et2	Configuration for the IM 308-C and CPU 945
	S5hs50_2.et2	Configuration for the IM 308-C and CPU 944
	Hs724__x.200	Type file of the HS 724
\S5\135U directory	Hs724__x.200	Type file of the HS 724
	Hs7240z0.ini	Symbols file
	Hs7240z0.seq	Symbols file
	Hs7240z1.ini	Symbols file
	Hs7240z2.ini	Symbols file
	Hs7240zf.seq	Symbols file
	S5hs23.et2	Configuration for the IM 308-C and CPU 928B
	S5hs23st.s5d	STEP 5 program for the CPU 928B
\S7 directory	Hs724a05.arj	STEP 7 program for the SIMATIC S7-400
	Hs724b05.arj	STEP 7 program for the SIMATIC S7-300
	Siem002b.gsd	GSD file for the configuration of the HS 724 in the hardware configuration

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4 Loading the Firmware for the HS 724

4.1 Which Firmware Do I Use for My ZA 724?

For the HS 724 heating controller with MLFB 6ES7171-1AA0**0**-0AA0, use the HSSYNC.EXE loading program.
For the HS 724 heating controller with MLFB 6ES7171-1AA0**1**-0AA0, use the HSSYNC-**1**.EXE loading program.

4.2 How Do I Load the Firmware of the HS 724?

You will need a "zero modem" cable to load the firmware.
If you do not have one, use a cable with the following allocation.

RxD	2	3	TxD
TxD	3	2	RxD
Gnd	5	5	Gnd

Note:
If you are using a 25-pin plug connector, use pin 7 for Gnd instead of pin 7.

To load the firmware, proceed as shown below.

1. Turn off the ZA 724.
2. Use an interface cable to connect the ZA 724 to COM1 or COM2 of the PC.
3. Call HSSYNC (for ZA 724 up to 1.5 Mbaud, 6ES7171-1AA00-0AA0) or HSSYNC-1 (for ZA 724 up to 12 Mbaud, 6ES7171-1AA01-0AA0), and enter the interface used (i.e., COM1 or COM2) on the PC.
4. Turn on the ZA 724.

The rest of the procedure is automatic.
You can watch programming progress on the PC.
The new firmware is activated by turning the ZA 724 off and on again.

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5 Configuring the HS 724 in STEP 7

5.1 Importing the GSD File

GSD files for the SIMATIC S7 configuration software are provided for configuration of the ZA 724.
The GSD file (i.e., device master file) contains all features of a DP slave. STEP 7 requires one GSD file for each DP slave so that the DP slave (HS 724) can be selected in the module catalog.

To integrate the GSD file of the HS 724 in the module catalog, proceed as shown below.

1st step Create a new project or open your own existing one.

2nd step Open the hardware configuration of your project, and select:
Options → Install New DDB Files....

3rd step Select the appropriate file for the ZA 724 you are using, based on the following table.

ZA 724: 6ES7171-1AA0**0**-0AA0	SI002BTD.GSD
ZA 724: 6ES7171-1AA0**1**-0AA0	SIEM002B.GSD

Caution:
Only one of the two GSD files can be installed at a time in STEP 7.

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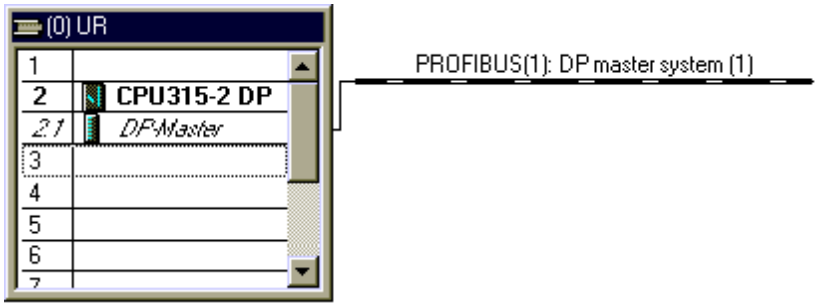
5.2 Configuring the PROFIBUS Connection Between SIMATIC S7 and MASTERDRIVES MC

Prerequisites for PROFIBUS communication

PROFIBUS communication requires the following prerequisites.

1. S7-CPU with integrated PROFIBUS interface
2. HS 724 heating controller and LA 724 power output
3. GSD file
4. PROFIBUS connection cable between S7-CPU and HS 724

Creating a PROFIBUS system

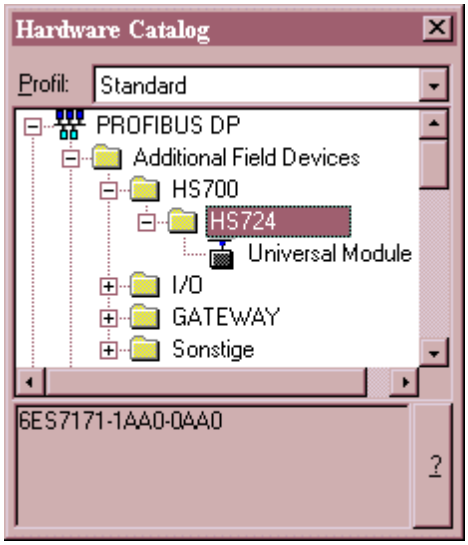


If you are integrating an S7-CPU with PROFIBUS interface in the S7 hardware configuration, use a PROFIBUS system with the characteristic “DP” and baud rate = “1.5 Mbit/sec."
In addition, a connection to the outside (i.e., DP master system [1]) is indicated. The HS 724 heating controllers can then be added on.

Note:
The baud rate for the HS 724 with MLFB 6ES7171-1AA0**0**-0AA0 is a maximum of 1.5 Mbit/sec.
The baud rate for the HS 724 with MLFB 6ES7171-1AA0**1**-0AA0 is a maximum of 12 Mbit/sec.

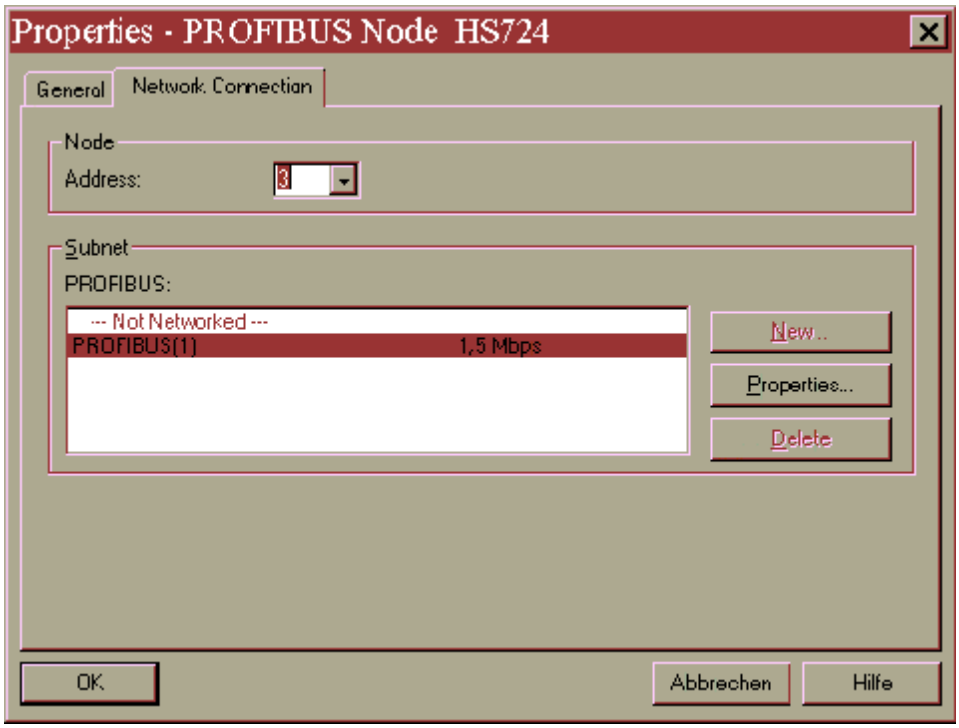
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Adding an HS 724 heating controller



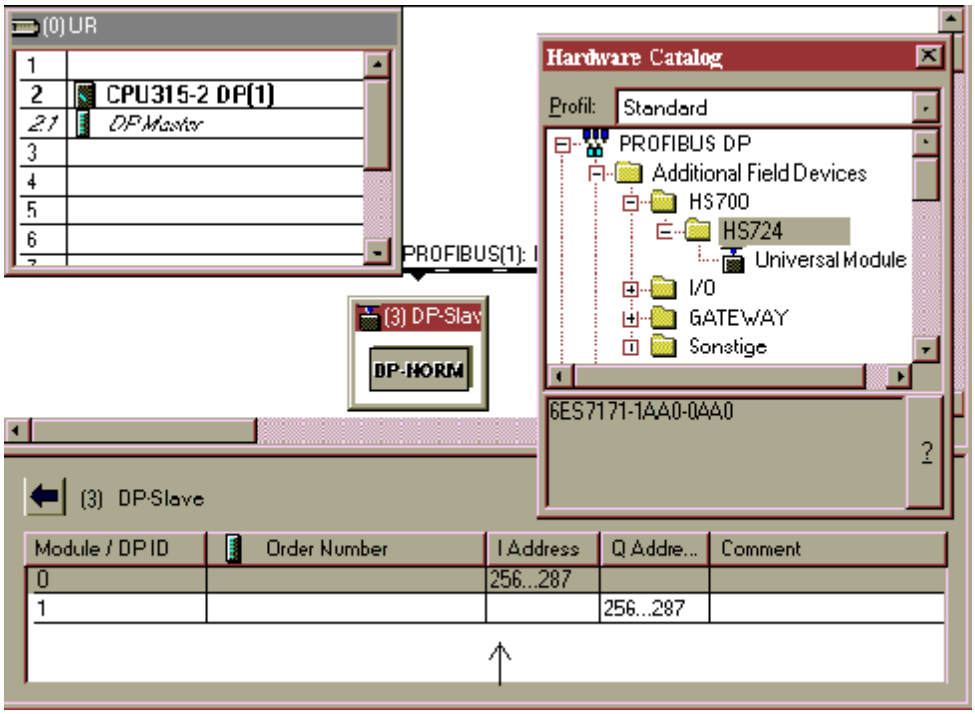
1. Open the hardware catalog.
2. Mark the PROFIBUS branch.
3. In the hardware catalog, select:
   PROFIBUS DP → Additional Field Devices → HS700.
4. Double-click “HS724."

Specifying the characteristics



The system automatically selects the next free PROFIBUS address. For our sample program, select the PROFIBUS address "3".

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When setting the configuration data in DB_HS724_ZU, you must enter the "I Address" specified here.
The system places "I Address" and "Q Address" at the next free addresses. Our sample program uses the "I Address" and "Q Address" addresses 256 to 287. These two addresses must be **identical**. The addresses can be changed manually. To do this, double-click the address area to be changed.

You can now see the results of a heating controller added to the PROFIBUS system. Repeat these steps for each additional heating controller.
Then save the S7 hardware configuration, and load it to the S7-CPU.

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6 Our Sample Program

6.1 Introduction

The included floppy disk contains the sample program described below.
This program consists of two function blocks.

- FB_AUF Transfer jobs to the HS 724
- FB_BSP Startup synchronization and diagnosis

In our sample program, the channels of the LA 724 power output are allocated to a field.

After the CPU starts up, the following jobs are transferred to the HS 724.

01 (Read module info)
82 (Initialization)
83 (Field allocation)
84 (Radiant heater setpoints)
85 (Production setpoint)
89 (Startup initialization)

If the jobs are processed correctly, the ZA 724 is switched to "heater on" operation mode (control bits in DB_HS724_KOP) during the OB 1 cycle.

Diagnosis is started on the ZA with job 87.
The general diagnosis (job 0800) is read continuously.
When necessary (response message bit of the ZA), the sample program reads additional diagnostic messages from the ZA 724 and stores these in DB_AP.

Configuring the devices

The following devices are required.

- PG 740 programmer
- Programmable controller S7-300 (file HS724b04) or S7-400 (file HS724a04) with a CPU with integrated PROFIBUS-DP interface
- ZA 724 heating controller as slave (station number = 3)
- LA 724 power output with at least three radiant heaters (one radiant heater on phase L1, and two radiant heaters on phase L3)

Assigning the inputs and outputs

Inputs and outputs are not used. The jobs are issued by the programmer device.

Assigning the flag area

Flag M 0.0 is used to enable the sample program after the startup of the PLC. However, M 0.0 may not be set until the phase sequence is present on the LA 724 power output. If the flag is set too soon, the HS 724 heating controller will report a phase sequence error.

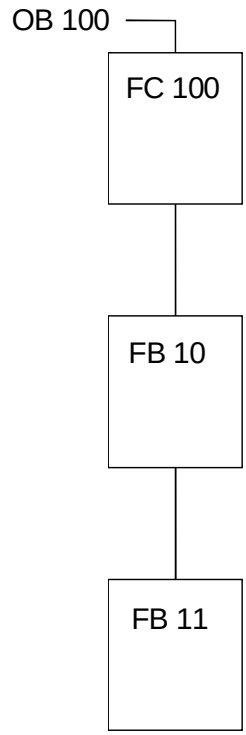
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Assigning the data area	DB 10	DB_FB_AUF_INS	Jobs to the coupling software
	DB 11	DB_FB_BSP_INS	Working data block for the sample program
	DB 70	DB_HS724_ZU	HS 724 allocation DB
	DB 71	DB_HS724_IN	HS 724 input DB
	DB 72	DB_HS724_OUT	HS 724 output DB
	DB 80	DB_HS724_KOP_1	HS 724 coupling DB for 1st ZA
	DB 81	DB_HS724_AP_1	HS 724 application DB for 1st ZA
Block allocation	FB 10	FB_AUF	Transfer jobs to the coupling software
	FB 11	FB_BSP	Sample program
	FC 100	FC_HS724_START	HS 724 start
	FC 101	FC_HS724_IN	HS 724 input
	FC 102	FC_HS724_OUT	HS 724 output
	FC 103	FC_HS724_KOP	HS 724 coupling
	FC 104	FC_HS724_REG	HS 724 regulation of the power voltage
	OB 100	RESTART	Startup after STOP/START or power off/on
	OB 1	CYCL_EXC	Cyclic program

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6.2 Software Structure

Startup: OB 100



During startup, the FC_HS724_START function checks the parameterization of the global and ZA-specific information in the DB_HS724_ZU allocation data block.

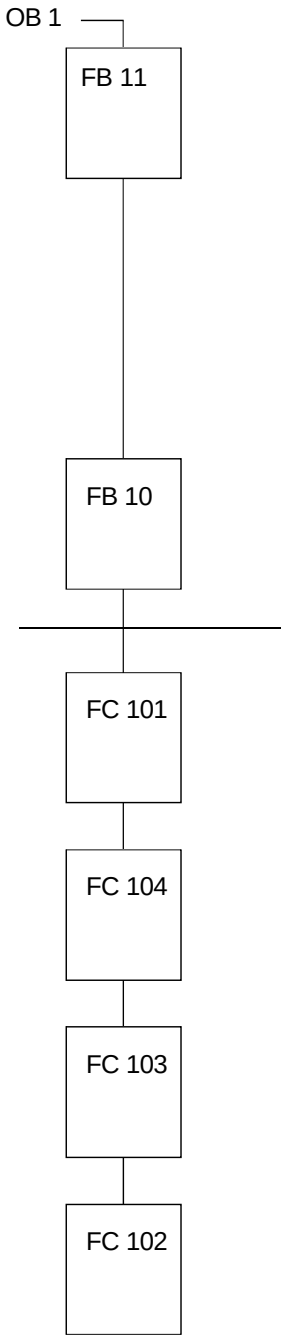
When parameterization is correct, the heating controllers are enabled in DB_HS724_ZU.freigabe. If an error is detected in the parameterization, this is indicated in the DB_HS724_ZU.fehler data block. An appropriate error message is entered in the data area of the applicable ZA in data block DB_HS724_ZU.

The FB_AUF function block is called once per ZA when the PLC starts up. During startup, the internal data of the function block are initialized in DB_FB_AUF_INS.

The FB_BSP function block is called once per ZA when the PLC starts up. During startup, the internal data of the function block are initialized in DB_FB_BSP_INS.

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Cycle: OB 1



The FB_BSP is called once per ZA 724. After the PLC starts up, the ZA 724 is reinitialized by the FB_BSP function block. The following jobs are transferred to the ZA 724.

:

0100	Module info
8200	Initialization
8300	Field allocation
8400	Radiant heater setpoints
8500	Production setpoint
0900	Phase sequence and directly grounded conductor test

After initialization, the diagnostic data of the ZA 724 are automatically read by the FB_BSP function block.

The FB_AUF function block is called once per ZA 724 during the cycle.

You can use the FB_AUF function block to simultaneously transfer up to 16 jobs to the ZA 724. The jobs are transferred to the function block via the DB_FB_AUF_INS data block.

The FC_HS724_IN function is called once during the cycle.
It reads the data of all enabled ZA 724s to the PLC.

The FC_HS724_REG function is called once during the cycle.
It processes the values of the power voltage regulation and distributes these to all enabled ZA 724s.

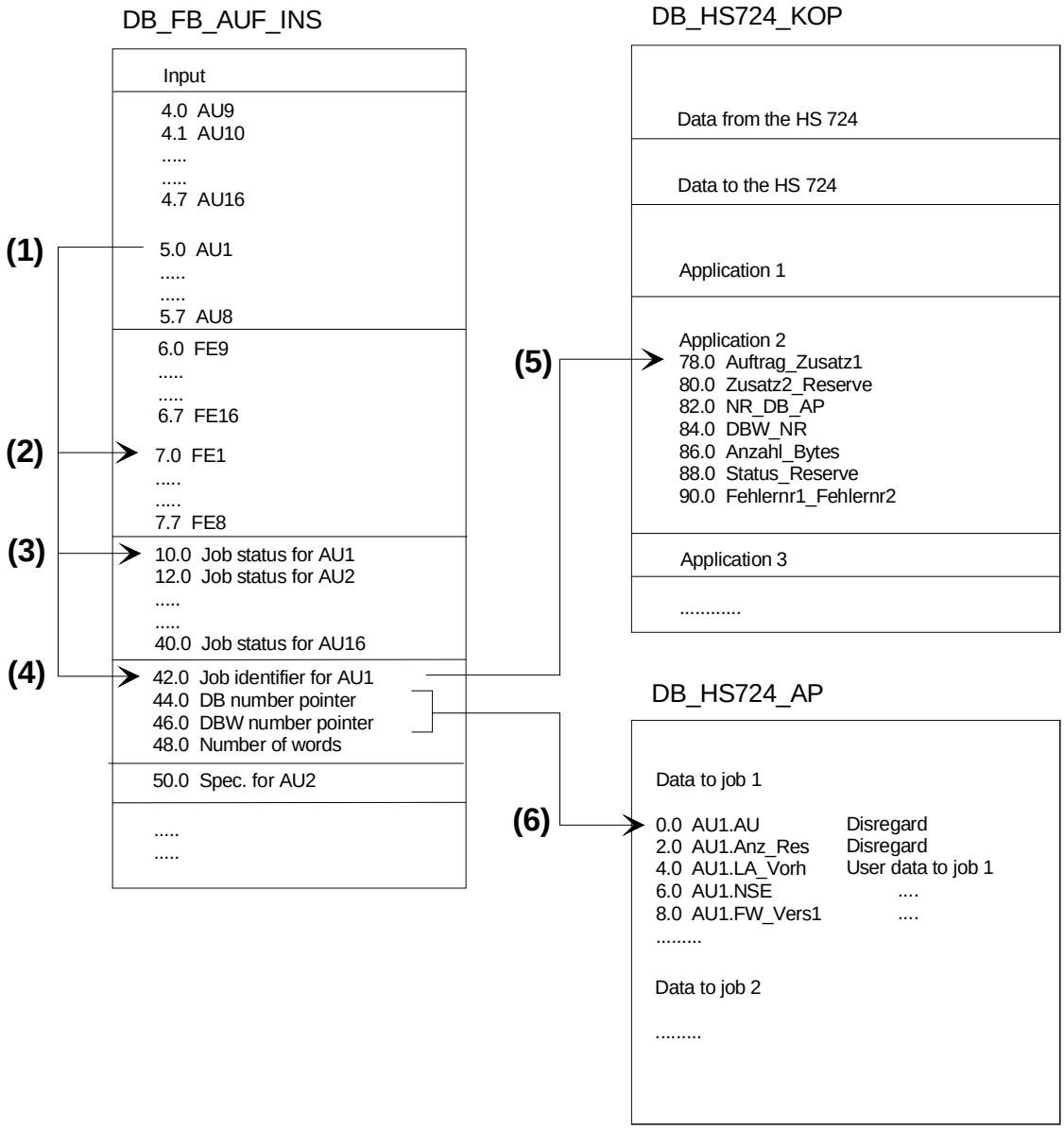
The FC_HS724_KOP is called once per ZA 724.
It coordinates the jobs to the ZA 724.

The FC_HS724_OUT function is called once during the cycle.
It writes the data to the ZA 724.

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6.3 Transferring Jobs to the Coupling Software (FB_AUF)

You can use the FB_AUF function block to simultaneously transfer up to 16 jobs to the ZA 724 of the heating controller. Use the DB_FB_AUF_INS data block for this.



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(1) The command interface is located in DBW4 of DB_FB_AUF_INS. One job is allocated to each of the 16 bits.

DBX4.0	AU9
DBX4.1	AU10
.....	
DBX4.7	AU16

DBX5.0	AU1
.....	
DBX5.7	AU8

The job is executed as soon as you set a job bit.
After the job has been executed, FB_AUF sets the job bit to "0."

(2) A status bit in DBW6 is allocated to each job bit in DBW4.

DBX6.0	Status of AU9
DBX6.1	Status of AU10
.....	
DBX6.7	Status of AU16

DBX7.0	Status of AU1
.....	
DBX7.7	Status of AU8

The job status is defined as shown below.

“0”	Job was executed correctly.
“1”	An error occurred.

(3) If the job was concluded with errors, you can read out the error code starting at DBW10. The error codes are listed in chapter 5.5 of the description of the HS 724.

(4) A job block in DB_FB_AUF_INS is allocated to each job bit.
A job block consists of the following.

- **"Auftrag"** Job identifier. (See chapter 5.3.1 of HS 724 description.)
- **"DB_NR"** Data block number (Pointer to user data)
- **"DBW_NR"** Data word number (Pointer to user data)
- **"Anz_Wo"** Number of words (Pointer to user data)

Note:
Do not forget to adjust the number of words for the user data in the "Anz_Wo" parameter when you change a job.

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The job blocks are preset as shown below.

AU1	from DBW42	Read module info (identifier 01)
AU2	from DBW50	Activate initialization (identifier 82)
AU3	from DBW58	Write field allocation (identifier 83)
AU4	from DBW66	Write radiant heater setpoints (identifier 84)
AU5	from DBW74	Write production values (identifier 85)
AU6	from DBW82	Write standby values (identifier 86)
AU7	from DBW90	Write test command (identifier 87)
AU8	from DBW98	Read general diagnosis (identifier 08)
AU9	from DBW106	Read "module error" diagnosis (identifier 0801)
AU10	from DBW114	Read "Triac short circuit" diagnosis (identifier 0802)
AU11	from DBW122	Read "external error" diagnosis (identifier 0803)
AU12	from DBW130	Read "manipulated variables > 100%" diagnosis (identifier 0804)
AU13	from DBW138	Read frequency measurement (identifier 09)
AU14	from DBW146	Free
AU15	from DBW154	Free
AU16	from DBW162	Free

(5) The job identifier (“Auftrag”) of the job is entered in application mailbox 2 of the DB_HS724_KOP.

(6) In addition, the pointer (“DB_NR”, “DBW_NR”, “Anz_Wo”) to the user data of the job is entered in application mailbox 2.

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Transferring the jobs

Task

You would like to change the radiant heater setpoints of channels 1 and 2 from 10% to 100%.
The radiant heater setpoints are transferred with job “AU4” (DB10.DBW66).
The radiant heater setpoints themselves are stored in DB_HS724_AP_1 (DB81.DBW516 to DBW522).

Is the job mailbox free?

First check to determine whether job mailbox "AU4" is free.

DB10.DBX5.3 =“0”

Specify job

The job identifier and the pointer to the user data have already been entered in job mailbox AU4. The amount of user data can be corrected to 4 words.

DB10.DBW66	=W#16#8400	Job identifier
DB10.DBW68	=81	DB_Nummer user data
DB10.DBW70	=516	DBW_Nummer user data
DB10.DBW72	=4	Number of data words to be transferred

Specify setpoints

Enter the setpoints for channels 1 and 2 in data block DB_HS724_AP_1 starting with data word DBW516.

Activate job

Set the job bit for job block AU4.

DB10.DBX5.3 =“1”

Evaluate job status

After the job has been executed by the coupling software, the job bit for job block AU4 is set to "0."
Now check the job status.

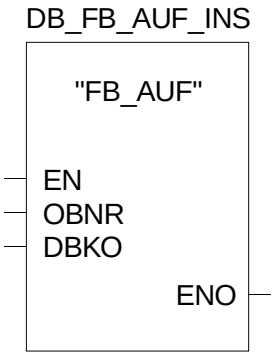
DB10.DBX7.3	=“0”	The job was executed correctly.
DB10.DBX7.3	=”1”	An error has occurred during job execution.

If an error has occurred during job execution, check the status word of the job.

DB10.DBW16 Error code. (See chapter 5.5 of the HS 724 description.)

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Calling the FB_AUF function block



DB_FB_AUF_INS Number of the data block in which the jobs to the ZA 724 are entered

EN: Not used
OBNR: Number of the OB in which the FB is called
The FB must be called during startup and cycle.
DBKO: Number DB_HS724_KOP_1, specified in DB_HS724_ZU
For the ZA 724 with the number 1 in data word 20
For the ZA 724 with the number 2 in data word 40
And so on
ENO: Not used

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6.4 Function Block FB_BSP

General

The FB_BSP function block uses the FB_AUF function block to transfer jobs to the coupling software of the HS 724.

After the system starts up (STOP/START or power on), the following jobs are executed by the FB_BSP function block.
The heating controller is switched to "initialization" operating mode for this.

Read module info from the ZA	Job 0100
Initialization on the ZA 724	Job 8200
Field allocation on the ZA 724	Job 8300
Radiant heater setpoints on the ZA 724	Job 8400
Production setpoint on the ZA 724	Job 8500
Startup initialization	Job 8900

After the jobs have been executed correctly, the heating controller is switched to "operation" and "production on" mode.

The diagnosis is then started on the HS 724 heating controller (job 8700).

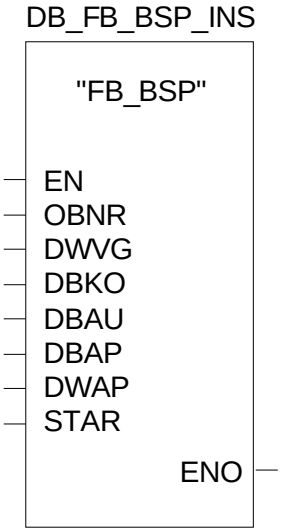
If the HS 724 heating controller started up without errors, the diagnostic messages of the HS 724 are cyclically requested by FB_BSP.

The general diagnosis (job 0800) is read continuously. When necessary, additional diagnostic messages are automatically read from the HS 724.

Job:	0801	Module error
	0802	Triac short circuit
	0803	External error
	0804	Manipulated variable > 100%

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Calling the FB_BSP function block



EN: Not used
OBNR: Number of the OB in which the FB is called
The FB must be called during startup and during the cycle.
DWVG: Specify the working register for the ZA 724 here.
Each ZA 724 requires a different register. Enter a "1" for the first ZA 724. Enter a "2" for the second ZA 724. And so on.
DBKO: Number DB_HS724_KOP, specified in DB_HS724_ZU
For the ZA with the number 1 in data word DBW20
For the ZA with the number 2 in data word DBW40
And so on
DBAU: Data block number (DB_FB_AUF_INS) > job interface of FB_AUF
DBAP: Number of the DB_HS724_AP in which the data for job 0800 (general diagnosis) of the ZA are stored
DWAP: Data word number in DB_HS724_AP starting at which the data of job 0800 (general diagnosis) are stored
STAR: The startup initialization of the ZA is started with signal status "1." When the phase sequence is applied to the radiant heaters, set the bit to "1."
ENO: Not used

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Calling function blocks FB _AUF and FB_BSP with several ZA 724s

Call the two function blocks FB_BSP and FB_AUF during startup (OB 100) and during cyclic operation (OB 1). Use the "OBNR" formal operand to transfer the number of the organization block in which the function block is called.

OB 100

```
CALL  "FB_AUF" , "DB_FB_AUF_INS"          //FB_AUF for first ZA
      OBNR:=100                           //OB number
      DBKO:="DB_HS724_ZU".za1.nr_db_kop   //No. of the DB_HS724_KOP_1
                                          //
CALL  "FB_BSP" , "DB_FB_BSP_INS"          //FB_BSP for first ZA
      OBNR:=100                           //OB number
      DWVG:=1                             //Identifier for first ZA
      DBKO:="DB_HS724_ZU".za1.nr_db_kop   //No. of the DB_HS724_KOP_1
      DBAU:=10                            //DB_FB_AUF_INS
      DBAP:="DB_HS724_AP_1".AU8.DS0       //General diagnosis
      STAR:=M0.0                          //Start at edge "0" after “1”
                                          //----------------------------------------
-
CALL  "FB_AUF" , "DB_FB_AUF2_INS"         //FB_AUF for 2nd ZA
      OBNR:=100                           //OB number
      DBKO:="DB_HS724_ZU".za2.nr_db_kop   //No. of the DB_HS724_KOP_2
                                          //
CALL  "FB_BSP" , "DB_FB_BSP_INS"          //FB_BSP for 2nd ZA
      OBNR:=100                           //OB number
      DWVG:=2                             //Identifier for 2nd ZA
      DBKO:="DB_HS724_ZU".za2.nr_db_kop   //No. of the DB_HS724_KOP_2
      DBAU:=20                            //DB_FB_AUF2_INS
      DBAP:="DB_HS724_AP_2".AU8.DS0       //General diagnosis
      STAR:=M0.0                          //Start at edge "0" after “1”
                                          //----------------------------------------
-
```


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OB 1

```
CALL  "FB_AUF" , "DB_FB_AUF_INS"          //FB_AUF for first ZA
      OBNR:=1                             //OB number
      DBKO:="DB_HS724_ZU".za1.nr_db_kop   //No. of the DB_HS724_KOP_1
                                          //
CALL  "FB_BSP" , "DB_FB_BSP_INS"          //FB_BSP for first ZA
      OBNR:=1                             //OB number
      DWVG:=1                             //Identifier for first ZA
      DBKO:="DB_HS724_ZU".za1.nr_db_kop   //No. of the DB_HS724_KOP_1
      DBAU:=10                            //DB_FB_AUF_INS
      DBAP:="DB_HS724_AP_1".AU8.DS0       //General diagnosis
      STAR:=M0.0                          //Start at edge "0" after “1”
                                          //----------------------------------------
-
CALL  "FB_AUF" , "DB_FB_AUF2_INS"         //FB_AUF for 2nd ZA
      OBNR:=1                             //OB number
      DBKO:="DB_HS724_ZU".za2.nr_db_kop   //No. of the DB_HS724_KOP_2
                                          //
CALL  "FB_BSP" , "DB_FB_BSP_INS"          //FB_BSP for 2nd ZA
      OBNR:=1                             //OB number
      DWVG:=2                             //Identifier for 2nd ZA
      DBKO:="DB_HS724_ZU".za2.nr_db_kop   //No. of the DB_HS724_KOP_2
      DBAU:=20                            //DB_FB_AUF2_INS
      DBAP:="DB_HS724_AP_2".AU8.DS0       //General diagnosis
      STAR:=M0.0                          //Start at edge "0" after “1”
                                          //----------------------------------------
-
```


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7 Manipulating the HS 724 Via the PG

7.1 Executing a Job

Enter the setpoints in data block DB_HS724_AP_1 (DB81). Transfer the job to the coupling software via DB_HS724_KOP_1 (DB80) in the first application mailbox.

DB80

DBW64 Job number. (See description of the HS 724.)

DBW66 In reserve

DBW68 Data block number of DB_HS724_AP_1

- DBW68 = 0 The application interface is free.
- >< 0 A job is being processed.

DBW70 The number of the first data word in DB_HS724_AP_1

DBW72 Number of data words which you want to transfer

DBW74 Job status

- DBB74 : 1 Job running
- 2 Job finished without errors
- 3 Job finished with errors

DBW76 Error code

For error codes, see the description of the HS 724.

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7.2 Variable Table VAT1: Module Info

VAT1:
Module info

Jobs 01, 82, and 83 are triggered by the sample program after the PLC starts up.

The watchdog of the ZA is located in bit 0 of DB80 DBB0. This bit must alternate continuously during the cycle (OB 1). If the watchdog is not used by the ZA, check the LED on the ZA.

Red LED	Green LED	Meaning
On	Off	No bus connection to the master
Flashing	Off	ZA 724 is waiting for synchronization with S7 (e.g., S7 coupling software is not running).
Off	Flashing	Initialization phase of the ZA 724 (See control bits of the S7 in DB_KOP.)
Off	On	Normal operation of the ZA 724
Flashing	Flashing	Phase sequence error or directly grounded conductor break

Variable table VAT1

```
//Start startup routine for edge change "0" > "1"
M     0.0     ---

//Job 01: Data of HS 724
DB81.DBW    4         "DB_HS724_AP_1".AU1.LA_Vorh
DB81.DBW    6         "DB_HS724_AP_1".AU1.NSE
DB81.DBW    8         "DB_HS724_AP_1".AU1.FW_Vers1
DB81.DBW   10         "DB_HS724_AP_1".AU1.FW_Vers2
DB81.DBW   12         "DB_HS724_AP_1".AU1.FW_Vers3
DB81.DBW  160         "DB_HS724_AP_1".AU9.Freq_Dre
DB81.DBW  162         "DB_HS724_AP_1".AU9.Null_Res

//Job mailbox 1
DB80.DBW    0         "DB_HS724_KOP_1".Ein_ZA.Handshake_Auftrag     //Watchdog DBX0.0
DB80.DBW   26         "DB_HS724_KOP_1".Ein_ZA.Rueck1_Rueck2         //of the ZA 724

DB80.DBW   32         "DB_HS724_KOP_1".Aus_S5.Handshake_Auftrag     //Watchdog DBX32.0
DB80.DBW   58         "DB_HS724_KOP_1".Aus_S5.Rueck1_Rueck2                 //of the S7

DB80.DBW   64         "DB_HS724_KOP_1".AP1.Auftrag_Zusatz1          //Appl. mailbox 1
DB80.DBW   70         "DB_HS724_KOP_1".AP1.DW_NR
DB80.DBW   72         "DB_HS724_KOP_1".AP1.Anzahl_Bytes
DB80.DBW   68         "DB_HS724_KOP_1".AP1.NR_DBAP
DB80.DBW   74         "DB_HS724_KOP_1".AP1.Status_Reserve
DB80.DBW   76         "DB_HS724_KOP_1".AP1.Fehlernr1_Fehlernr2
```


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7.3 Variable Table VAT2: Radiant Heater Setpoints

VAT2: Radiant heater setpoints

You can use the VAT2 variable table to specify the radiant heater setpoints.

The radiant heater setpoints are stored in DB81 starting at DBW516.
First, enter the radiant heater setpoint of the channel in DB81 starting at DBW516, and transfer the values to the PLC.
Then specify the job in DB_HS724_KOP.

DB80	DBW64	=W#16#8400	Job number 8400
	DBW70	=516	1st data word in DB81
	DBW72	=4	Number of data words
	DBW68	=81	The setp. data are located in DB81.

Variable table VAT2

```
//Radiant heater setpoints
DB81.DBW  516          "DB_HS724_AP_1".Kanal[1].Nr
DB81.DBW  518          "DB_HS724_AP_1".Kanal[1].Stellwert
DB81.DBW  520          "DB_HS724_AP_1".Kanal[2].Nr
DB81.DBW  522          "DB_HS724_AP_1".Kanal[2].Stellwert
DB81.DBW  524          "DB_HS724_AP_1".Kanal[3].Nr
DB81.DBW  526          "DB_HS724_AP_1".Kanal[3].Stellwert
DB81.DBW  528          "DB_HS724_AP_1".Kanal[4].Nr
DB81.DBW  530          "DB_HS724_AP_1".Kanal[4].Stellwert

//Job bit
DB10.DBX    5.3        ---
//Response message bit
DB10.DBX    7.3        ---

//Job mailbox 1
DB80.DBW    0          "DB_HS724_KOP_1".Ein_ZA.Handshake_Auftrag
DB80.DBW   26          "DB_HS724_KOP_1".Ein_ZA.Rueck1_Rueck2
DB80.DBW   32          "DB_HS724_KOP_1".Aus_S5.Handshake_Auftrag
DB80.DBW   58          "DB_HS724_KOP_1".Aus_S5.Rueck1_Rueck2

DB80.DBW   64          "DB_HS724_KOP_1".AP1.Auftrag_Zusatz1        //W#16#8400
DB80.DBW   70          "DB_HS724_KOP_1".AP1.DW_NR                  //516
DB80.DBW   72          "DB_HS724_KOP_1".AP1.Anzahl_Bytes           //4
DB80.DBW   68          "DB_HS724_KOP_1".AP1.NR_DBAP                //81
DB80.DBW   74          "DB_HS724_KOP_1".AP1.Status_Reserve
DB80.DBW   76          "DB_HS724_KOP_1".AP1.Fehlernr1_Fehlernr2
```


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7.4 Variable Table VAT3: Production Values

VAT3: Production values

You can use variable table VAT3 to specify the production value.

The production value always refers to a field. In our example, only one field is defined. First, enter the production value in DBW428 of DB81.
Then activate the job in DB80.

DB80	DBW64	=W#16#8500	Job number
	DBW70	=428	1st data word in DB81
	DBW72	=1	Number of data words
	DBW68	=81	The setp. data are located in DB81.

Variable table VAT3

```
//Job 85:  Production setpoint
DB81.DBW  428   "DB_HS724_AP_1".AU5.Feld1_Prod

//Job bit
DB10.DBX    5.4 ---
//Response message bit
DB10.DBX    7.4 ---

//Job mailbox 1
DB80.DBW    0   "DB_HS724_KOP_1".Ein_ZA.Handshake_Auftrag
DB80.DBW   26   "DB_HS724_KOP_1".Ein_ZA.Rueck1_Rueck2
DB80.DBW   32   "DB_HS724_KOP_1".Aus_S5.Handshake_Auftrag
DB80.DBW   58   "DB_HS724_KOP_1".Aus_S5.Rueck1_Rueck2

DB80.DBW   64   "DB_HS724_KOP_1".AP1.Auftrag_Zusatz1        //W#16#8500
DB80.DBW   70   "DB_HS724_KOP_1".AP1.DW_NR                  //428
DB80.DBW   72   "DB_HS724_KOP_1".AP1.Anzahl_Bytes           //1
DB80.DBW   68   "DB_HS724_KOP_1".AP1.NR_DBAP                //81
DB80.DBW   74   "DB_HS724_KOP_1".AP1.Status_Reserve
DB80.DBW   76   "DB_HS724_KOP_1".AP1.Fehlernr1_Fehlernr2
```


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7.5 Variable Table VAT4: Standby Values

VAT4: Standby values

You can use variable table VAT4 to specify the standby value.

The standby value always refers to a field. In our example, only one field is defined. First, enter the standby value in DBW472 of DB81.
Then activate the job in DB80.

DB80	DBW64	=W#16#8600	Job number
	DBW70	=472	1st data word in DB81
	DBW72	=1	Number of data words
	DBW68	=81	The setp. data are located in DB81.

Variable table VAT4

```
//Job 86: Standby
DB81.DBW  472   "DB_HS724_AP_1".AU6.Feld1_Stand

//Job bit
DB10.DBX    5.5 ---
//Response message bit
DB10.DBX    7.5 ---

//Job mailbox 1
DB80.DBW    0   "DB_HS724_KOP_1".Ein_ZA.Handshake_Auftrag
DB80.DBW   26   "DB_HS724_KOP_1".Ein_ZA.Rueck1_Rueck2
DB80.DBW   32   "DB_HS724_KOP_1".Aus_S5.Handshake_Auftrag
DB80.DBW   58   "DB_HS724_KOP_1".Aus_S5.Rueck1_Rueck2

DB80.DBW   64   "DB_HS724_KOP_1".AP1.Auftrag_Zusatz1        //W#16#8600
DB80.DBW   70   "DB_HS724_KOP_1".AP1.DW_NR                  //472
DB80.DBW   72   "DB_HS724_KOP_1".AP1.Anzahl_Bytes           //1
DB80.DBW   68   "DB_HS724_KOP_1".AP1.NR_DBAP                //81
DB80.DBW   74   "DB_HS724_KOP_1".AP1.Status_Reserve
DB80.DBW   76   "DB_HS724_KOP_1".AP1.Fehlernr1_Fehlernr2
```


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7.6 Variable Table VAT5: Diagnostic Messages On/Off

VAT5: Diagnostic messages on/off

You can use variable table VAT5 to switch the diagnostic messages on/off.

The tests can be switched on/off individually for each field.
In our example, only one field was defined.

Then activate the job in DB80.

DB80	DBW64	=W#16#8700	Job number
	DBW70	=384	1st data word in DB81
	DBW72	=1	Number of data words
	DBW68	=81	The setp. data are located in DB81.

Variable table VAT5

```
//Job 87:  Turn on diagnosis
DB81.DBW  384   "DB_HS724_AP_1".AU7.Feld1_Kom

//Job bit
DB10.DBX    5.6 ---
//Response message bit
DB10.DBX    7.6 ---

//Job mailbox 1
DB80.DBW    0   "DB_HS724_KOP_1".Ein_ZA.Handshake_Auftrag
DB80.DBW   26   "DB_HS724_KOP_1".Ein_ZA.Rueck1_Rueck2
DB80.DBW   32   "DB_HS724_KOP_1".Aus_S5.Handshake_Auftrag
DB80.DBW   58   "DB_HS724_KOP_1".Aus_S5.Rueck1_Rueck2

DB80.DBW   64   "DB_HS724_KOP_1".AP1.Auftrag_Zusatz1          //W#16#8700
DB80.DBW   70   "DB_HS724_KOP_1".AP1.DW_NR                    //384
DB80.DBW   72   "DB_HS724_KOP_1".AP1.Anzahl_Bytes             //1
DB80.DBW   68   "DB_HS724_KOP_1".AP1.NR_DBAP                  //81

DB80.DBW   74   "DB_HS724_KOP_1".AP1.Status_Reserve
DB80.DBW   76   "DB_HS724_KOP_1".AP1.Fehlernr1_Fehlernr2
```


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7.7 Variable Table VAT6: Diagnostic Messages

VAT6: Diagnostic messages

You can use variable table VAT6 to view the diagnostic data of the ZA 724 for the first 16 channels.

Variable table VAT6

```
DB81.DBX  168.0 "DB_HS724_AP_1".AU8.DS0                    //”Module error”
DB81.DBX  168.1 "DB_HS724_AP_1".AU8.DS1                    //”Triac short circuit”
DB81.DBX  168.2 "DB_HS724_AP_1".AU8.DS2                    //”External error”
DB81.DBX  168.3 "DB_HS724_AP_1".AU8.DS3                    //”Illegal manipulated var.”

DB81.DBX  169.0 "DB_HS724_AP_1".AU8.TF                     //
DB81.DBX  169.1 "DB_HS724_AP_1".AU8.DF                     //”1” Phase seq. has wrong direction.
DB81.DBX  169.2 "DB_HS724_AP_1".AU8.NL                     //”1” Directly grounded con. break
DB81.DBX  169.3 "DB_HS724_AP_1".AU8.NE_L1                  //”1” NSE phase L1 defective
DB81.DBX  169.4 "DB_HS724_AP_1".AU8.NE_L2                  //”1” NSE phase L2 defective
DB81.DBX  169.5 "DB_HS724_AP_1".AU8.NE_L3                  //”1” NSE phase L3 defective

DB81.DBW  222   "DB_HS724_AP_1".AU801.K_1_16               //”Module error”
DB81.DBW  220   "DB_HS724_AP_1".AU801.K_17_32

DB81.DBW  274   "DB_HS724_AP_1".AU802.K_1_16               //”Triac short circuit”
DB81.DBW  272   "DB_HS724_AP_1".AU802.K_17_32

DB81.DBW  326   "DB_HS724_AP_1".AU803.K_1_16               //”External error”
DB81.DBW  324   "DB_HS724_AP_1".AU803.K_17_32

DB81.DBW  378   "DB_HS724_AP_1".AU804.K_1_16               //”Illegal manipulated var.”
DB81.DBW  376   "DB_HS724_AP_1".AU804.K_17_32
//Job mailbox 1
DB80.DBW   0   "DB_HS724_KOP_1".Ein_ZA.Handshake_Auftrag
DB80.DBW   26  "DB_HS724_KOP_1".Ein_ZA.Rueck1_Rueck2
DB80.DBW   32  "DB_HS724_KOP_1".Aus_S5.Handshake_Auftrag
DB80.DBW   58  "DB_HS724_KOP_1".Aus_S5.Rueck1_Rueck2
```


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7.8 Variable Table VAT7: NSE Data

VAT7: In the VAT7 variable table you can view the data for the NSE.
NSE data

Variable table VAT7

```
//NSE
DB80.DBW   26   "DB_HS724_KOP_1".Ein_ZA.Rueck1_Rueck2     //Status bit, NSE offset L1
DB80.DBW   26   "DB_HS724_KOP_1".Ein_ZA.Rueck1_Rueck2     //Status bit, NSE offset L1 [%]
DB80.DBW   28   "DB_HS724_KOP_1".Ein_ZA.Rueck3_Rueck4     //NSE offset L2
                                                            NSE offset L3

DB80.DBW   58   "DB_HS724_KOP_1".Aus_S5.Rueck1_Rueck2     //Status bit, NSE offset L1
DB80.DBW   58   "DB_HS724_KOP_1".Aus_S5.Rueck1_Rueck2     //Status bit, NSE offset L1 [%]
DB80.DBW   60   "DB_HS724_KOP_1".Aus_S5.Rueck3_Rueck4     //NSE offset L2
                                                            NSE offset L3

DB81.DBW   28   "DB_HS724_AP_1".AU2.Norm_InZ          //Stand. value, integration time
DB81.DBW   30   "DB_HS724_AP_1".AU2.Watchdog          //Reserved, watchdog

DB81.DBX  169.3 "DB_HS724_AP_1".AU8.NE_L1             //NSE L1 defective
DB81.DBX  169.4 "DB_HS724_AP_1".AU8.NE_L2             //NSE L2 defective
DB81.DBX  169.5 "DB_HS724_AP_1".AU8.NE_L3             //NSE L3 defective
```


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7.9 Variable Table VAT8: Application Mailbox 2

VAT8: Application mailbox 2

In the VAT8 variable table, you can view application mailbox 2 in DB_HS724_KOP.

Variable table VAT8

```
//Application mailbox 2
M     0.0     ---

DB80.DBW   78   "DB_HS724_KOP_1".AP2.Auftrag_Zusatz1
DB80.DBW   80   "DB_HS724_KOP_1".AP2.Zusatz2_Reserve
DB80.DBW   82   "DB_HS724_KOP_1".AP2.NR_DBAP
DB80.DBW   84   "DB_HS724_KOP_1".AP2.DW_NR
DB80.DBW   86   "DB_HS724_KOP_1".AP2.Anzahl_Bytes
DB80.DBW   88   "DB_HS724_KOP_1".AP2.Status_Reserve
DB80.DBW   90   "DB_HS724_KOP_1".AP2.Fehlernr1_Fehlernr2
```


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7.10 Variable Table VAT9: Jobs to the HS 724

VAT9:
Jobs to the HS 724

In the VAT9 variable table, you can view the job interface in DB_AUF.

Variable table VAT9

//Sample program, command interface			
DB10.DBW	4	"DB_FB_AUF_INS".Befehl	//Command interface
DB10.DBW	6	"DB_FB_AUF_INS".Fehler	//Status of the command interface
DB10.DBW	10	"DB_FB_AUF_INS".AU1_FEH_ZU	//Error code for job block 1
DB10.DBW	12	"DB_FB_AUF_INS".AU2_FEH_ZU	//Error code for job block 2
DB10.DBW	14	"DB_FB_AUF_INS".AU3_FEH_ZU	//Error code for job block 3
DB10.DBW	16	"DB_FB_AUF_INS".AU4_FEH_ZU	//Error code for job block 4
DB10.DBW	18	"DB_FB_AUF_INS".AU5_FEH_ZU	//Error code for job block 5
DB10.DBW	20	"DB_FB_AUF_INS".AU6_FEH_ZU	//Error code for job block 6
DB10.DBW	22	"DB_FB_AUF_INS".AU7_FEH_ZU	//Error code for job block 7
DB10.DBW	24	"DB_FB_AUF_INS".AU8_FEH_ZU	//Error code for job block 8
DB10.DBW	26	"DB_FB_AUF_INS".AU9_FEH_ZU	//Error code for job block 9
DB10.DBW	28	"DB_FB_AUF_INS".AU10_FEH_ZU	//Error code for job block 10
DB10.DBW	30	"DB_FB_AUF_INS".AU11_FEH_ZU	//Error code for job block 11
DB10.DBW	32	"DB_FB_AUF_INS".AU12_FEH_ZU	//Error code for job block 12
DB10.DBW	34	"DB_FB_AUF_INS".AU13_FEH_ZU	//Error code for job block 13
DB10.DBW	36	"DB_FB_AUF_INS".AU14_FEH_ZU	//Error code for job block 14
DB10.DBW	38	"DB_FB_AUF_INS".AU15_FEH_ZU	//Error code for job block 15
DB10.DBW	40	"DB_FB_AUF_INS".AU16_FEH_ZU	//Error code for job block 16

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