SIEMENS

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Heater controller SIPLUS HCS724I

Operating Instructions

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Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

DANGER

indicates that death or severe personal injury will result if proper precautions are not taken.

WARNING

indicates that death or severe personal injury may result if proper precautions are not taken.

with a safety alert symbol, indicates that minor personal injury can result if proper precautions are not taken.

CAUTION

without a safety alert symbol, indicates that property damage can result if proper precautions are not taken.

NOTICE

indicates that an unintended result or situation can occur if the relevant information is not taken into account.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Siemens products

Note the following:

WARNING

Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

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Introduction

Contents of this documentation

This document explains the functions of the SIPLUS HCS724I heater controller and its intended use.

Further documentation

The following manuals describe how you operate the HCS724I with the PROFIBUS DB field bus and how you can design your user program with the *STEP 7* programming software:

- Manual for PROFIBUS networks
- Manual entitled *Programming with STEP 7*V5.x

You will also need the manual for the DP master used.

Introduction

Safety Instructions

Before working on the heater controller or the connected components, ensure the system is disconnected.

WARNING

- In the switching cabinet, voltages of > 60 V occur. Suitable safety precautions must therefore be taken before commissioning and maintenance work.
- The use of a residual current protective device as the sole protection against indirect touching is forbidden.
- Do not touch the metal housing of the modules with bare fingers. Danger of burning due to hot surfaces!

Fuse replacement

WARNING

Before changing a fuse, you must isolate the load circuit from the supply.

CAUTION

Use only the prescribed fuse types. If you use the LA 724I/LA 724I HP with fuses that are not permissible, the device could be destroyed.

Description of the components

3.1 HCS724I overview

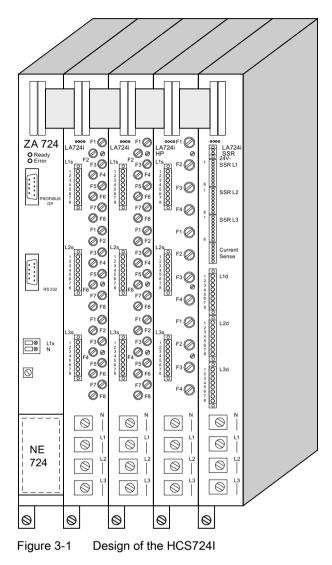
3.1.1 Field of application

The HCS724I heater controller is used for controlling heat emitters used in industry. One preferred use of the HCS724I is to control heat emitters in the areas of thermoforming and blow molding. It is also used for paint dryers in the automotive industry, for plastics welding and for extrusion.

In principle, the HCS724I can be used wherever resistive loads have to be switched and monitored.

3.1 HCS724I overview

3.1.2 Installation



The main component of the product is the central interface module (ZA 724), which enables the unit to be expanded by a maximum of 16 power output modules/load switching units (LA 724I xx). For different power classes, there are three types of power output modules/load switching units available:

- The LA 724I for controlling 24 channels with a power output of 1150 W per channel
- The LA 724I HP for controlling 12 channels with a power output of 2300 W (230 V) / 4000 W (400 V) per channel
- The LA 724I SSR with 24 channels for switching solid state relays (SSR; external circuitbreakers) with a power output per channel of up to 20 kW at 230 V/36 KW at 400 V

As a DP slave, the ZA 724 communicates with the higher-level controller (DP master) via the PROFIBUS DP field bus.

Note

Several HCS724I units acting together can be operated from one DP master, whereby the channels are counted serially.

The size of the HCS724I group greatly depends on the resources available in the DP master.

The control information generated by the ZA 724 is transferred via a parallel bus between the components, and the respective status of the power output modules is reported back to the ZA 724 in the same way. As an option, a line-voltage sensing submodule (NE 724) can be integrated in order to carry out line-voltage compensation.

The individual components are built into a metal housing and are mounted on a support plate in the switching cabinet.

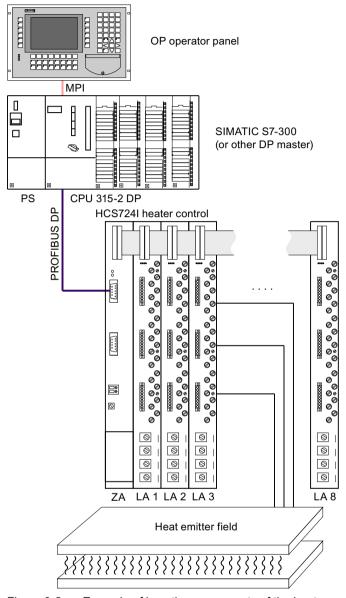
Customized solutions without a metal housing are possible on request.

3.1 HCS724I overview

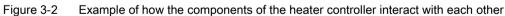
3.1.3 System components

A complete system includes the following components:

- A higher-level controller acting as the PROFIBUS DP master, e.g. SIMATIC S7 (with e.g. CPU 315-2 DP or CPU 414-2 DP)
- A ZA 724 central interface module acting as a PROFIBUS DP slave with integrated µP system for controlling the LA 724I xx power output modules/load switching units
- 1 to 16 LA 724I xx power output modules/load switching units
- NE 724 line-voltage sensing submodule (optional)
- SM 724I current measuring module (optional)
- Operator panel (optional)



• Heat emitter field/heat emitter



3.1 HCS724I overview

Interconnecting HCS724I units

Several HCS724I units, each with one ZA 724 central interface module and with a maximum of sixteen LA 724I power output modules can be connected to a PROFIBUS DP master.

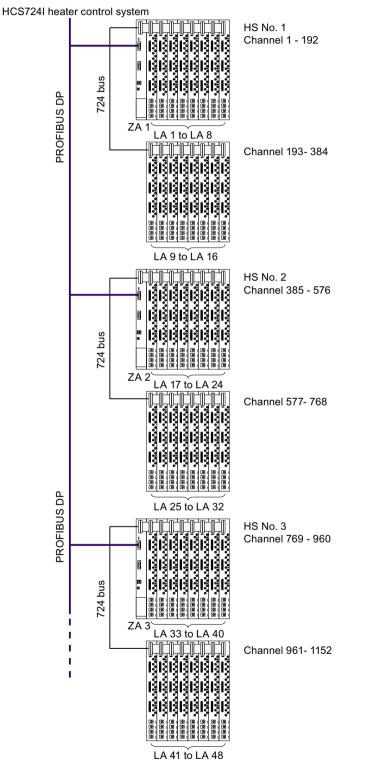


Figure 3-3 Example of operation of an interconnected group of HCS724I devices

3.2 ZA 724 central interface module

3.2.1 ZA 724 features

The ZA 724 central interface module has the following features:

- Module installed in a metal housing
- Possibility of connecting a maximum of 16 power output modules/load switching units, whereby the LA 724I, LA 724I HP and LA 724I SSR devices can be connected in any combination
- Communication with the higher-level system via the PROFIBUS DP interface
- PROFIBUS DP addresses ranging from 00 to 99 can be set with rotary switches
- Bus transfer rates of up to 12 Mbaud
- Optional: expansion with the NE 724 line-voltage sensing submodule for integrated compensation of fluctuations in the line voltage and for power calculation purposes
- Automatic detection of the line frequency
- Control of up to 384 channels in half-wave and full-wave mode
- Uniform load distribution over all channels and over all the HCS724I devices operated together
- Operation of the outputs without direct component
- Monitoring of all power outputs and all connected load switching units
- Parameterization of channel control and diagnostics

3.2 ZA 724 central interface module

3.2.2 ZA 724 layout

Front view of the ZA 724

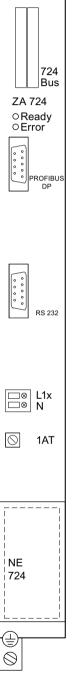


Figure 3-4 Front view of the ZA 724

The picture above is a front view of the central interface module.

The central interface module contains the following components:

- LED indicators showing the station status
- PROFIBUS DP slave interface (electrically isolated by optocouplers)
- 2 rotary switches for setting the PROFIBUS DP address (see "Setting the bus address") (Page 40)
- RS 232 serial interface (non-floating) for firmware updates
- Parallel bus interface to the power output modules/load switching units
- Terminals for mains connection
- Internal voltage supply to the power output modules/load switching units
- Floating voltage supply for the PROFIBUS DP slave interface

Voltage supply

The input AC voltage of 230 V (min. 187 V, max. 264 V) is transformed with an integrated transformer to an AC voltage of 24 V. A controlled DC voltage of 5 V is then generated from this for the module logic.

When the voltage supply is switched on, an automatic reset signal for the μ P system is generated. As a result, the power output modules and also the processor are reset to a defined operating state.

For the PROFIBUS DP, there is a floating voltage supply which is obtained from the controlled 5 V voltage.

Mains supply synchronization

In order to ensure synchronization of the power output modules/load switching units with the connected mains supply, the system is synchronized with Phase L1.

3.2 ZA 724 central interface module

3.2.3 ZA 724 connectors

The ZA 724 has five plug-in connections (see table below) and one slot for the optional linevoltage sensing submodule NE 724 (see also Figure 3-4 Front view of the ZA 724 (Page 18)).

Labeling		Function
724 bus	Connection of the LA 724 to	the parallel bus
	Power output modules 1 to 8:	right-hand-side connector (1st row)
	Power output modules 9 to 16:	left-hand-side connector (2nd row)
PROFIBUS DP	Connection of higher-level sy	stem via PROFIBUS DP
RS 232	Sub-D connector for connect	ion to PC
L1x	Terminal for connection of ph	hase L1
N	Terminal for connection of the	e neutral conductor
	Connection of the protective	conductor via a conductor rail

Table 3-1 Plug-in connectors of the ZA 724

3.3 LA 724I power output module

3.3.1 LA 724I features

The LA 724I power output module has the following features:

- Module integrated in a metal housing
- 24 power channels with a maximum of 1150 W switching power per output at 230 V AC, grouping of 8 outputs per phase

Due to the different physical properties of heat emitters, restrictions can be imposed on their permissible switching capacity depending on the type of heat emitter. Short-wave halogen or infrared emitters ("flash emitters") have a high starting current due to their relatively low cold resistance. The starting current can be several times the rated current, especially during the first half waves.

Overloading of the internal fuses of the LA 724I can occur depending on the number of switching operations as well as the duration of switching operations and pause times.

NOTICE

Restriction of the switching power

If flash emitters with an output of more than 750 W at 230 V are used, switching operations can result in extremely high currents and the triggering of the channel fuses.

We therefore recommend that you have these emitters gauged by Siemens AG.

- 5 A fuse, accessible from outside, for each power channel
- Internal protection for each phase with 32 A

Note

The total current per phase must not exceed 32 A.

- Connection of the phases via conductor rails
- Connection of the heat emitters via front connectors

Note

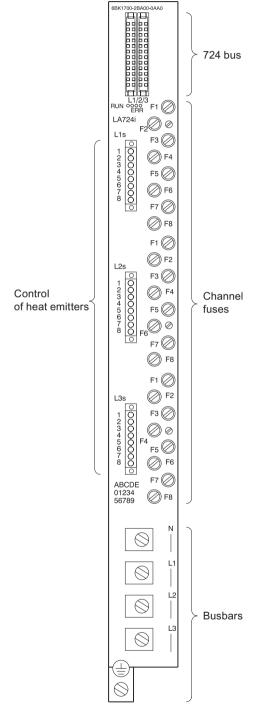
The mating connectors for connection of the heat emitters are not included in the scope of supply. You have to order these separately.

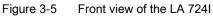
- No settings have to be made on the module
- Diagnostics feature for detecting internal and external faults
- Diagnostics feature for detecting an emitter failure where emitters are connected in parallel; this is done by means of current measurement
- Two-stage temperature monitoring by NTC thermistors (alarm stage, shutdown stage)
- LED indicators for channel faults and temperature monitoring

3.3 LA 724I power output module

3.3.2 LA 724I design

Front view of the LA 724I





Suppressor circuit

The bidirectional triode thyristor (Triac) and the optical bidirectional triode thyristor (Opto Triac) are protected against overvoltages of the electric mains supply by Transil diodes. In addition, the bidirectional triode thyristor is protected against short-circuit and overload by a fuse.

Voltage isolation

The control circuit works with safety extra-low voltage (SELV) and is safely isolated from the line and load-current circuits in accordance with EN 50178.

Temperature monitoring

For monitoring the heat-sink temperature, there is an NTC thermistor on the heat sink.

At 92 °C \pm 3 °C, this temperature-dependent resistor sends a signal to the S7 CPU via the ZA 724.

When a second switching threshold at 100 $^\circ\text{C}$ ±3 $^\circ\text{C}$ is reached, the power outputs of the module are switched off.

3.3.3 LA 724I connectors

The power output module has the following plug-in connections:

Labeling	Function
724 bus	Connection of the subsequent power output module (right-hand socket) and the preceding power output module or central interface module (left-hand socket) to the parallel bus
L1s	Connection of heat emitters 1 to 8 to phase L1
L2s	Connection of heat emitters 9 to 16 to phase L2
L3s	Connection of heat emitters 17 to 24 to phase L3
Ν	Connection of the neutral conductor via a conductor rail
L1	Connection of phase L1 via a conductor rail
L2	Connection of phase L2 via a conductor rail
L3	Connection of phase L3 via a conductor rail
	Connection of the protective conductor via a conductor rail

Table 3- 2	Plug-in connectors of the LA 724I
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3.3 LA 724I power output module

3.3.4 Performance profile of the LA 724I

The following illustration shows the performance profile of the LA 724I.

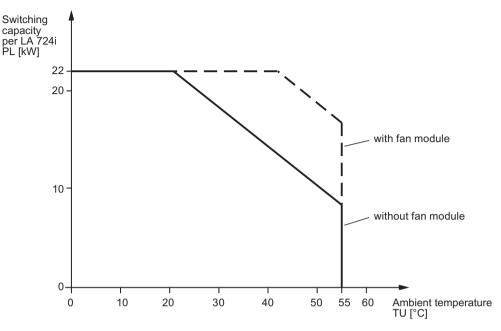


Figure 3-6 Performance profile of the LA 724I

Evaluation example 1

Requirements:

- Ambient temperature T_U = 40 °C
- Operation without fan module
- 24 emitters (channels)
- Ongoing production at 100 % simultaneity (all emitters working at 100 % setpoint)

What is the maximum permissible emitter output?

We can derive the following from the illustration above:

At T_U = 40 °C, the switching power of the LA 724I is $P_L \approx 14.5$ kW.

$$P_{emitter} = \frac{P_{L}}{24} = 604 \text{ W}$$

Evaluation example 2

Requirements:

- Ambient temperature $T_U = 55 \ ^{\circ}C$
- Operation without fan module
- 24 emitters (channels)
- Production : Standby = 4 : 1
- 85 % simultaneity (e.g. all emitters working at 85 % setpoint)

Are 500 W emitters permissible?

We can derive the following from the illustration above:

At T_U = 55 °C, the switching power of the LA 724I is P_L \approx 8.5 kW.

$$P_{emitter} = \frac{P_{L}}{24} \times \frac{1}{0.85} \times \frac{5}{4} = 520 \text{ W}$$

Result: 500 W emitters are permissible.

3.4 LA 724I HP power output module

3.4 LA 724I HP power output module

3.4.1 LA 724I HP features

The LA 724I HP power output module has the following features:

- Module integrated in a metal housing
- 12 power channels with a maximum of 2300 W of switching power at 230 V AC or 4000 W of switching power at 400 V AC per output, groups of 4 outputs per phase

Due to various physical properties of heat emitters, restrictions can be imposed on their switching power, depending on the type of emitter. Short-wave halogen or infrared emitters, so-called flash emitters, have a high switch-on current due to their relatively low cold resistance. This switch-on current can be a multiple of the rated current especially during the initial half-waves.

- 16 A fuse for each power channel, accessible from the outside
- Internal protection for each phase with 40 A

Note

The total current per phase must not exceed 40 A.

- Connection of the phases via conductor rails
- Connection of the heat emitters via front connectors

Note

The mating connectors for connection of the heat emitters are not included in the scope of supply. You have to order these separately.

- No settings have to be made on the module
- · Diagnostics feature for detecting internal and external faults
- Diagnostics feature for detecting an emitter failure where emitters are connected in parallel; this is done by means of current measurement
- Two-stage temperature monitoring by NTC thermistors (alarm stage, shutdown stage)
- LED indicators for channel faults and temperature monitoring

Description of the components 3.4 LA 7241 HP power output module

3.4.2 LA 724I HP design

Front view of the LA 724I HP

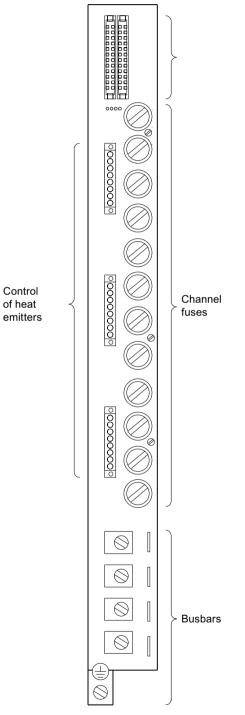


Figure 3-7 From

Front view of the LA 724I HP

3.4 LA 724I HP power output module

Suppressor circuit

The bidirectional triode thyristor (Triac) and the optical bidirectional triode thyristor (Opto Triac) are protected against overvoltages of the electric mains supply by Transil diodes. In addition, the bidirectional triode thyristor is protected against short-circuit and overload by a fuse.

Voltage isolation

The control circuit works with safety extra-low voltage (SELV) and is safely isolated from the line and load-current circuits in accordance with EN 50178.

Temperature monitoring

For monitoring the heat-sink temperature, there is an NTC thermistor on the heat sink.

At 92 °C \pm 3 °C, this temperature-dependent resistor sends a signal to the S7 CPU via the ZA 724.

When a second switching threshold at 100 $^\circ\text{C}$ ±3 $^\circ\text{C}$ is reached, the power outputs of the module are switched off.

3.4.3 LA 724I HP connectors

The power output module has the following plug-in connections:

Labeling	Function
724 bus	Connection of the subsequent power output module (right-hand socket) and the preceding power output module or central interface module (left-hand socket) to the parallel bus
L1s	Connection of heat emitters 1 to 4 to phase L1
L2s	Connection of heat emitters 5 to 8 to phase L2
L3s	Connection of heat emitters 9 to 12 to phase L3
Ν	Connection of the neutral conductor via a conductor rail
L1	Connection of phase L1 via a conductor rail
L2	Connection of phase L2 via a conductor rail
L3	Connection of phase L3 via a conductor rail
	Connection of the protective conductor via a conductor rail

Table 3- 3	Plug-in connectors of the LA 724I HP
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3.4.4 Performance profile of the LA 724I HP

Note

If you use the LA 724IHP in combination with a fan module, you extend its range of applications and increase the reliability of the power output, even if there are high ambient temperatures.

We therefore recommend that you always operate the LA 7241 together with the LM 724 fan module.

3.4.4.1 Star connection

Performance profile of the star connection

The following illustration shows the performance profile of the LA 724I HP with a star connection.

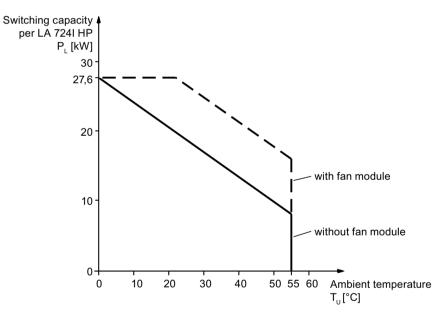


Figure 3-8 Performance profile of the LA 724I HP with star connection

Description of the components

3.4 LA 724I HP power output module

Evaluation example of star connection

Requirements:

- Ambient temperature T_U = 40 °C
- Operation without fan module
- Star connection
- Production : Standby = 4 : 1
- 100 % simultaneity (e.g. all emitters working at 100 % setpoint)

Can five 250 W emitters be connected in parallel?

From the performance profile with star connection we can see:

At T_U = 40 °C, the switching power of the LA 724I HP is $P_L \approx 13$ kW.

$$P_{channel} \le \frac{P_{L}}{12} \times \frac{5}{4} = 1354 \text{ W}$$

$$P_{emitter} = \frac{1}{5} \times P_{channel} = 270 \text{ W}$$

Result: Parallel connection of five 250 W emitters is permissible.

3.4.4.2 Delta connection

Performance profile of the delta connection

The following illustration shows the performance profile of the LA 724I HP with a delta connection.

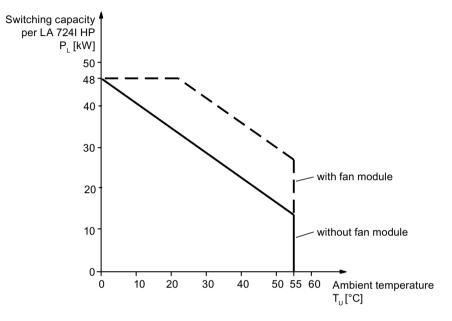


Figure 3-9 Performance profile of the LA 724I HP with delta connection

Evaluation example

Requirements:

- Ambient temperature T_U = 50 °C
- Operation with fan module
- Delta connection
- Ongoing production at 100 % simultaneity (all emitters working at 100 % setpoint)

What is the maximum permissible emitter output?

From the performance profile we can see:

At T_U = 50 °C, the switching power of the LA 724I HP with fan module is $P_L \approx 30.4$ kW.

$$P_{emitter} \leq \frac{P_{L,\Delta}}{12} = \frac{30,4}{12} \text{ kW} = 2,54 \text{ kW}$$

Result: The emitter power output must not exceed 2.54 kW.

3.5 LA 724I SSR load switching unit

3.5 LA 724I SSR load switching unit

3.5.1 LA 724I SSR features

The LA 724I SSR load switching unit has the following features:

- Module integrated in a metal housing
- 24 power channels with a digital control signal of 24 V per output for switching external solid state relays (SSR).
 Maximum 20 kW switching power at 230 V or 36 kW at 400 V per output.
 Grouping of 8 outputs per phase
- Protection for each channel is to be provided externally.

Note

The total current per phase must not exceed 400 A.

- Connection of the SSRs via front connectors
- Optional:
 - Connection for feedback from emitters for diagnostic purposes; voltage measurement for the detection of external faults
 - Connection of the phases via conductor rails
- Optional:

Connection of the current-measuring module for diagnostic purposes; current measurement for detection of external faults and for monitoring of power output in the case of emitters connected in parallel

Note

The mating connectors for the connections of the SSR, the SM 724I, the 24 V supply and the voltage monitoring unit are not included in the scope of supply. You have to order these separately.

- No settings have to be made on the module
- Monitoring of the 24 V supply voltage
- LED indicators for channel faults and faults in the 24 V supply voltage

3.5.2 LA 724I SSR layout

Front view of the LA 724I SSR

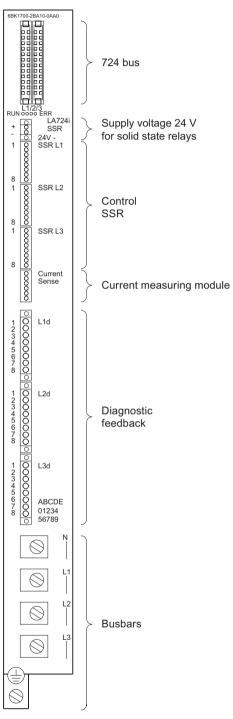


Figure 3-10 Front view of the LA 724I SSR

3.5 LA 724I SSR load switching unit

Voltage isolation

The control circuit works with safety extra-low voltage (SELV) and is safely isolated from the line and load-current circuits in accordance with EN 50178.

24 V monitoring

The connected 24 V supply is monitored for failure. In the event of failure, the outputs to the SSR are deactivated.

3.5.3 LA 724I SSR connectors

The load switching module has the following plug-in connections:

Labeling	Function
724 bus	Connection of the subsequent power output module (right-hand socket) and the preceding power output module or central interface module (left-hand socket) to the parallel bus
+/- 24 V-	24 V supply voltage for the solid state relays
SSR L1	Connection of SSR 1 to 8 to phase L1
SSR L2	Connection of SSR 9 to 16 to phase L2
SSR L3	Connection of SSR 17 to 24 to phase L3
Current Sense	Connection for the current measuring module
L1d	Voltage monitoring of SSR 1 to 8 for phase L1
L2d	Voltage monitoring of SSR 9 to 16 for phase L2
L3d	Voltage monitoring of SSR 17 to 24 for phase L3
Ν	Connection of the neutral conductor via a conductor rail
L1	Connection of phase L1 via a conductor rail
L2	Connection of phase L2 via a conductor rail
L3	Connection of phase L3 via a conductor rail
	Connection of the protective conductor via a conductor rail

3.6 NE 724 line-voltage sensing submodule

3.6.1 Features of the NE 724

The line-voltage sensing submodule is a separate module and, as an option, can be inserted in the ZA 724 if line-voltage fluctuations are to be compensated. The module is plugged into the slot of the ZA 724 from the front. The slot is located in the busbar area. If the NE 724 is not used, the opening is closed up with the busbar cover. If the line-voltage sensing submodule is used, the cover is used for shock-hazard protection.

Note

Central interface modules are supplied from the factory without line-voltage sensing. If you want to detect the line voltage and compensate for fluctuations, you have to order the NE 724 module separately and install it yourself (see "Connecting the NE 724" (Page 63)).

Product features

The NE 724 line-voltage sensing submodule has the following features:

- Measures the voltage at phases L1, L2 and L3
- Connection of phases L1, L2, L3 and the neutral conductor via Teflon-coated cable
- Electrical isolation by means of a transformer
- Bus interface to the ZA 724
- Evaluation of the line voltage and calculatino of correction factors

Function

Compensation of line-voltage fluctuations

To compensate line-voltage fluctuation, you have to plug in an NE 724 line-voltage sensing submodule into a ZA 724 within a network of several HCS724I units. The module calculates correction factors and transfers the results to the DP master. The DP master then distributes the data to all slaves.

Voltage measuring for enhanced diagnostics

An NE 724 is required for each ZA 724 in order to measure voltage values for enhanced diagnostics (see "Monitoring functions of the HCS724I" (Page 79)). The determined voltage value is used for detecting faults in emitters connected in parallel.

3.6 NE 724 line-voltage sensing submodule

3.6.2 NE 724 layout

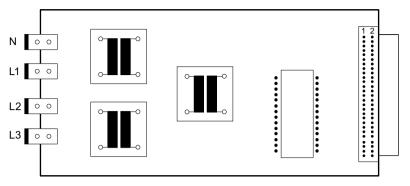


Figure 3-11 Structure of the NE 724

The illustration above shows the structure of the printed circuit board of the line-voltage sensing submodule. The line-voltage sensing submodule contains the following components:

- Three voltage adapters and filter units on the 230 V side
- Three transformers for electrical isolation and voltage adaptation
- Three precision rectifiers with downstream filter
- A 4-channel A/D converter
- A -5V voltage supply for the converter
- A plug-in connector for connecting to the ZA 724

The module is approximately 180 mm long and approximately 80 mm wide.

3.6.3 NE 724 connectors

The line-voltage sensing submodule has the following plug-in connections:

Table 3-5 Plug-in connectors of the NE 724

Labeling	Function
Ν	Connection of the neutral conductor
L1	Connection of phase L1
L2	Connection of phase L2
L3	Connection of phase L3
none	Plug-in connection to the ZA 724

3.7 LM 724 fan module

The LM 724 fan module has the following features:

- Standard fan in an IP00 housing
- Is suspended under 2 modules of the HCS724I (see "Installing the optional fan module" (Page 43))
- Use is optional, depending on the switching power needed (see "Performance profile of the LA 724I" (Page 24) and "Performance profile of the LA 724I HP" (Page 29))

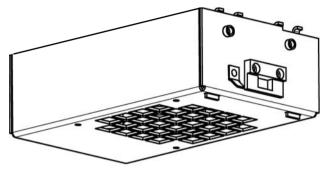


Figure 3-12 LM 724 fan module

3.8 SM 724I current measuring module

3.8 SM 724I current measuring module

The SM 724I current measuring module is needed if an LA 724I SSR is to be used to carry out a diagnosis by means of current measurement. This diagnosis is recommended if emitters connected in parallel are used in order to detect failure of an individual emitter.

The SM 724I is to be mounted in the switching cabinet:

- directly on a suitably stable mounting surface (recommended)
- on a rail

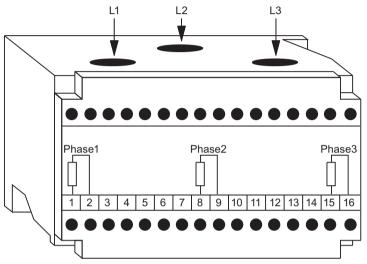


Figure 3-13 SM 724I current measuring module

Mounting

4.1 Requirements for the mounting location

The HS HCS724I heater controller is designed for stationary installation in a switching cabinet.

Note

- The components of the HCS724I are designed with degree of protection IP00. The necessary shock-hazard protection must be provided by the switching cabinet in which the HCS724I is installed.
- When the unit is installed, the EMC directives are to be complied with.
- The HCS724I is not suitable for connection to the public low-voltage grid but is to be supplied from a separate medium-voltage transformer (industrial power network).

- In the switching cabinet, voltages of > 60 V occur. Suitable safety precautions must therefore be taken before commissioning and maintenance work.
- The use of a residual current protective device as the sole protection against indirect touching is forbidden.
- Do not touch the metal housing of the modules with bare fingers. Danger of burning due to hot surfaces!

Requirements for the switching cabinet

In order to reliably prevent hazards for the operating personnel, the switching cabinet must satisfy the following requirements:

- Closed cabinet
- Grounded cabinet
- It must be ensured that interface connections and ribbon cables at the devices are not touched by live cables which only have a single layer of insulation and pass through the switching cabinet.

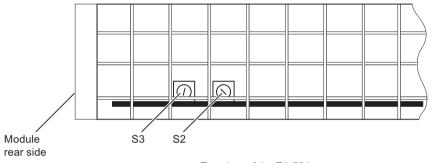
4.2 Setting the bus address

Communication of the heater controller with the master (e.g. S7 CPU) takes place via the PROFIBUS DP field bus and requires that the bus address (slave address) be set on the central interface module. The ZA 724 has two rotary switches for this purpose. These switches can be used to set the address somewhere in the range of 00 to 99.

Steps

- 1. Use rotary switch S2 to set the units position of the PROFIBUS DP address.
- 2. Use rotary switch S3 to set the tens position of the PROFIBUS DP address.

The rotary switches are in such a position that they are accessible from above through the fan openings of the housing of the central interface module.



Top view of the ZA 724

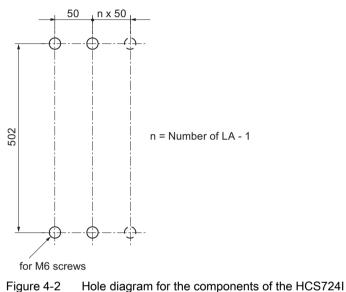
Figure 4-1 Setting the bus address

4.3 Installation of components on the mounting panel

The central interface module and the power output modules/load switching units of the HCS724I are built into metal housings. These housings are mounted on a support plate in the switching cabinet.

Steps

- 1. Disconnect the switching cabinet from the voltage supply.
- 2. Mark out the support plate according to the following hole diagram and then drill the holes.



3. Screw the housing onto the fastening lugs on the support plate.

Use M6 screws.

If two tiers are placed one above the other for **two-tier installation of the HCS724I**, the upper tier will be additionally heated by the warm air coming from the lower tier.

For greater switching capacities and for operation with optional fan modules, you should place an air guidance plate between the two tiers if necessary.

The two tiers of an HCS724I can also be placed next to each other. This prevents them from causing each other's temperature to increase.

Note

Mounting

4.3 Installation of components on the mounting panel

Clearances for installation

When the HCS724I is being installed in a switching cabinet, the minimum distances from cabinet walls, cable ducts etc. as shown in the following illustration are to be adhered to.

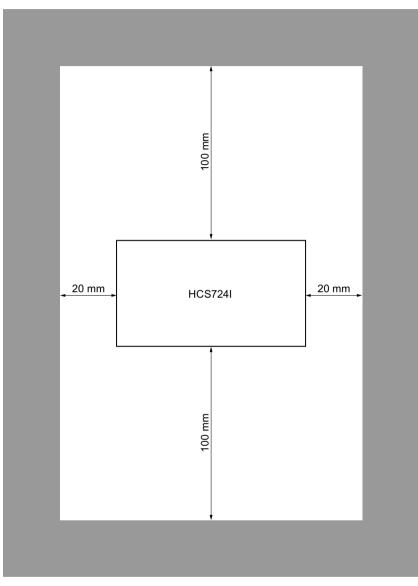


Figure 4-3 Clearances for installing an HCS724I

4.4 Installing the optional fan module

Depending on the switching capacity needed (see "Performance profile of the LA 724I" (Page 24) and "Performance profile of the LA 742i HP" (Page 29)), the LA 724I / LA 724I HP must be retrofitted with the optional fan module.

Principles of installation

The fan module is suspended under two LA 724I xx modules or under the ZA 724 interface module and under one LA 724I load switching unit.

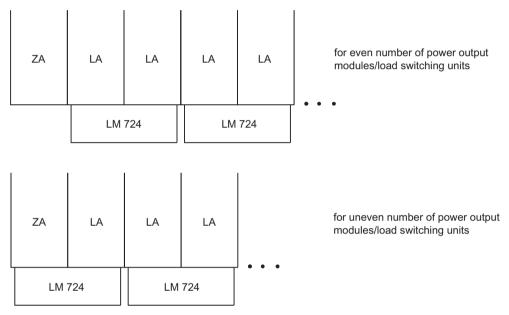


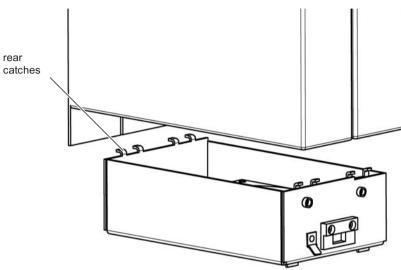
Figure 4-4 Installation of the optional fan module

Mounting

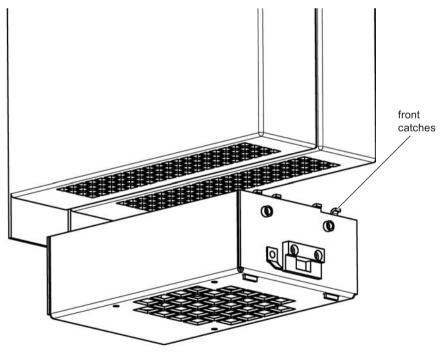
4.4 Installing the optional fan module

Steps

- 1. Loosen the clamping plate at the front of the fan module (unscrew 2 oval-head screws but not completely, and then push towards the rear).
- 2. First, hitch the catches of the fan module into the perforated metal plates of the modules at the rear.

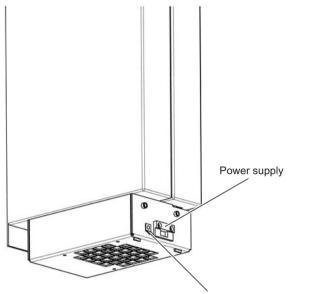


3. Then, hitch the clamping plate into the front perforated metal plates of the modules. Fasten the clamping plate in place with two M3 x 8 oval-head screws.



4. Reconnect all the protective conductors.

The protective conductor must have a cross-section of 0.75 mm^2 and be pushed onto the Faston plug-in tab with a lockable 6.3×0.8 Faston plug-in connector. It must be ensured that the connection cannot become loose.



Protective ground connection

5. Connect the power supply for the fan. 230 V AC is needed to operate the fan.

WARNING

Before you connect the fan, the mains lead must be disconnected from the supply.

- Connect the mains lead (0.75 mm²) to the connector supplied.

- Plug the connector into the bushing terminal on the front of the fan module.

- Secure the connector with 2 screws.

Note

Secure the power leads to the fan in such a way that cable protection according to EN 60204, Part 1, or EN 50178 is ensured.

When the fan module is operating, do not reach through the perforated metal plate at the bottom and touch the fan wheel!

Mounting

4.4 Installing the optional fan module

Connection

5.1 Connecting the PROFIBUS DP field bus

For communication between the central interface module and the higher-level controller (master), the two components must be connected to each other by means of the PROFIBUS DP field bus.

Steps

- 1. Plug the bus cable connector into the 9-pin Sub-D socket "PROFIBUS DP"
- 2. Secure the connector to the socket.

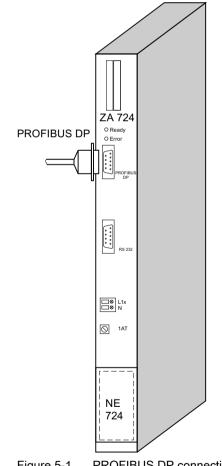


Figure 5-1 **PROFIBUS DP connection**

5.2 Connecting the parallel bus

The power output modules/load switching units are connected to the central interface module by a parallel bus, which is looped through by means of a flat ribbon cable.

Each ZA 724 has 2 bus lines, to each of which a maximum of eight LA 724I xx load operating units can be connected.

Steps

- 1. Press the connector of the flat ribbon cable into the right-hand "724 bus" socket of the cental interface module until it engages.
- 2. Press the connector of the flat ribbon cable into the left-hand "724 bus" socket of the first power output module/load switching unit until the connector engages.

Only if use is made of **several power output modules/load switching units per central interface module:**

3. Press the connector of another flat ribbon cable into the right-hand "724 bus" socket of the power output module/load switching unit last connected until the connector engages.

4. Press the connector of the flat ribbon cable into the left-hand "724 bus" socket of the next power output module/load switching unit until the connector engages.

To connect additional power output modules/load switching units, repeat steps 3 and 4 (see illustration "Connecting the parallel bus").

If power output modules/load switching units are arranged in two tiers:

5. Press the connector of the flat ribbon cable for the 2nd tier into the left-hand "724 bus" socket

of the central interface module until the connector engages.

6. Press the connector of the flat ribbon cable into the left-hand "724 bus" socket of the first power output module of the second tier until the connector engages.

To connect additional power output modules/load switching units, repeat steps 3 and 4 (see illustration "Installation options").

Note

The flat ribbon cables for connecting a 2nd tier have to be ordered separately.

For order numbers, see "Order numbers > Accessories" (Page 153).

Connection

5.2 Connecting the parallel bus

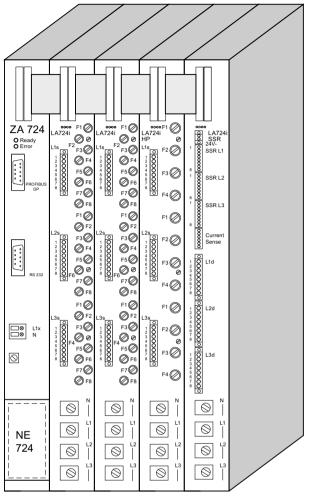


Figure 5-2 Connecting the parallel bus

Connection

5.2 Connecting the parallel bus

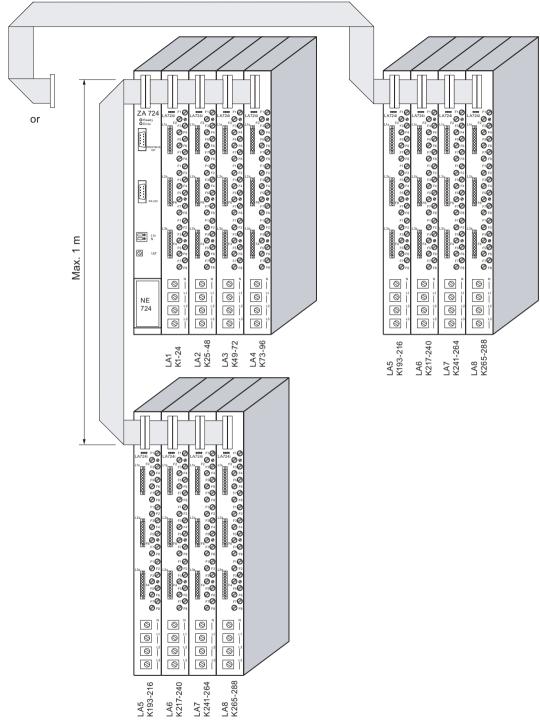


Figure 5-3 Installation options

5.3 Connecting the power supply to the ZA 724

The module is supplied with operating voltage by means of a power unit integrated on the central interface module.

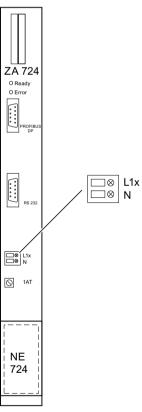
Steps

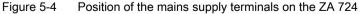
- 1. Connect the protective conductor to the "PE" conductor rail.
- 2. Strip the insulation from the end of the mains supply lead.
- Connect phase L1 to the screw-type terminal marked "L1x". The HCS724I is not suitable for connection to the public low-voltage grid but is to be supplied from a separate medium-voltage transformer (industrial power network).

Note

L1x must have the same phase as the L1 conductor rail.

4. Connect the neutral conductor to the screw-type terminal marked "N".





5.4 Connecting heat emitters

5.4.1 LA 724I/LA 724I HP

The heat emitters are connected to the socket connectors on the front of the power output modules by means of three 8-pin plug connectors with screw-type terminals. The three-phase power system is connected via five conductor rails (three phases + one neutral conductor + one PE)

Only plug connectors for the heat emitters into the socket connectors or withdraw them after disconnecting them from the supply. Before you connect the three-phase power system to the conductor rails, disconnect the mains leads from the supply.

Any messages received from the DP master (e.g. station failure of the HCS724I or interruption of DP communication) must be evaluated by the user, who must then react accordingly to ensure the safety of the system (e.g. check heat emitters and, if necessary, switch off individual heat emitters).

Note

The cables leading to and coming from the heat emitters are to be laid outside the control cabinet in **one** cable conduit.

Steps

- 1. Connect the protective conductor to the "PE" conductor rail.
- 2. Remove the insulation from the end of the heat emitter cables and firmly attach the cables in the screw-type terminals of the 8-pin plug connector.
- 3. Plug the plug connectors of heat emitters 1 to 8 into the socket connectors L1s.
- 4. Plug the plug connectors of heat emitters 9 to 16 into the socket connectors L2s.
- 5. Plug the plug connectors of heat emitters 17 to 24 into the socket connectors L3s.
- 6. Connect the neutral conductor to the "N" conductor rail.
- 7. Connect phase L1 to the "L1" conductor rail.
- 8. Connect phase L2 to the "L2" conductor rail.
- 9. Connect phase L3 to the "L3" conductor rail.

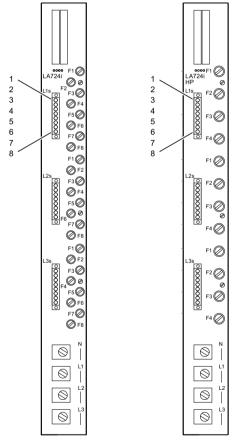


Figure 5-5 Front view of the LA 724I/LA 724I HP with the sockets for connecting heat emitters

Connection

5.4 Connecting heat emitters

Socket connector	Pin	CI	Channel number		
		LA 724I	LA 724I HP		
L1s	1	1			
	2	2	1		
	3	3			
	4	4	3		
	5	5			
	6	6	5		
	7	7			
	8	8	7		
L2s	1	9			
	2	10	9		
	7	15			
	8	16	15		
L3s	1	17			
	2	18	17		
			•		
	7	23			
	8	24	23		

Table 5-1 Assignment of the heat emitters to the pins of the sockets

After the conductor rails have been connected, the covers of the conductor rails must be fitted again to provide protection against electric shock. After the operating voltage has been switched on in the control cabinet, the conductor rails carry line voltage (230 V AC). It is permitted to carry out wiring or maintenance work only after the system has been disconnected from the supply.

Star connection

The following illustration shows the connection of the heat emitters to the LA 724I/LA 724I HP in a star connection (Y circuit).

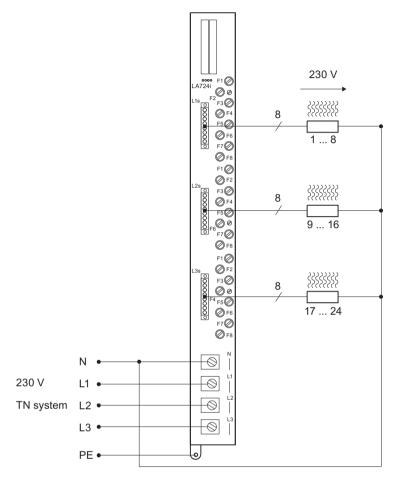


Figure 5-6 Star connection of heat emitters to LA 724I/LA 724I HP

Note

Unrestricted mixed operation of emitters for 230 V and 400 V is not possible in a network of HCS724I devices. Please contact Technical Support

5.4 Connecting heat emitters

Delta connection

The following illustration shows the connection of the heat emitters to the LA 724I HP in a delta connection (Δ circuit).

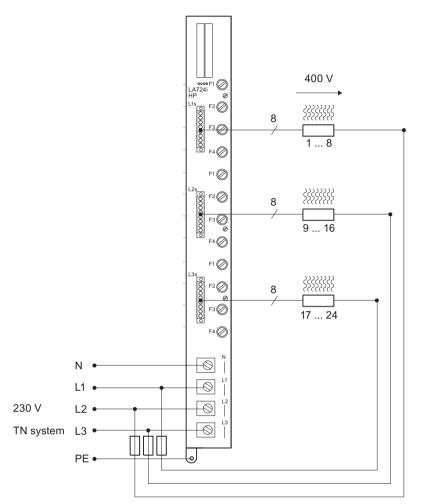


Figure 5-7 Delta connection of heat emitters to LA 724I HP

Note

Secure the return leads from the heat emitters in such a way that cable protection according to EN 60204, Part 1, or EN 50178 is ensured. The plant builder is responsible for correct protection of the system.

Note

Unrestricted mixed operation of emitters for 230 V and 400 V is not possible in a network of HCS724I devices. Please contact Technical Support.

Multiple power supply

The HCS724I is to be supplied with power via several paths (incoming supply) if supply via a single path would result in the maximum phase current on the conductor rail being exceeded. The following diagram shows an example of supply via two paths.

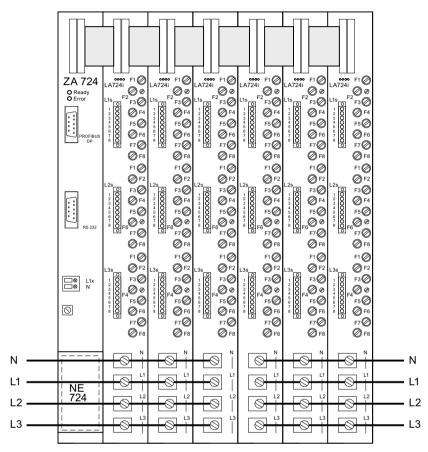


Figure 5-8 Example of supplying a HCS724I via two paths

Note

During configuration, it must be ensured that the maximum current of 120 A per conductor rail is not exceeded.

5.4 Connecting heat emitters

5.4.2 LA 724I SSR

The solid state relays are connected to the plug connectors on the front of the load switching units by means of three 8-pin socket connectors. The three-phase power system is connected via four conductor rails (three phases + one neutral conductor)

Only plug socket connectors for the solid state relays onto the plug connectors or withdraw them from the connectors after disconnecting them from the supply. Before you connect the three-phase power system to the conductor rails, disconnect the mains leads from the supply.

Any messages received from the DP master (e.g. station failure of the HCS724I or interruption of DP communication) must be evaluated by the user, who must then react accordingly to ensure the safety of the system (e.g. check heat emitters and, if necessary, switch off individual heat emitters).

Steps

- 1. Connect the protective conductor to the "PE" conductor rail.
- Remove the insulation from the end of the cables of the solid state relays and firmly attach the cables in the screw-type terminals of the 8-pin orange-colored socket connectors.
- 3. Plug the socket connectors of SSR 1 to 8 onto the plug connectors SSR L1.
- 4. Plug the socket connectors of SSR 9 to 16 onto the plug connectors SSR L2.
- 5. Plug the socket connectors of SSR 17 to 24 onto the plug connectors SSR L3.
- Securely connect the 24 V supply to the 2-pin socket connector and plug the socket connector into the "24V-" plug connnector. Caution: Ensure correct polarity!

Note

Only diagnosis by means of voltage measurement or only diagnosis by means of current measurement is possible - not both at the same time.

For diagnosis by voltage measurement, you must also carry out the following steps:

- 7. Connect the neutral condutor to the "N" conductor rail.
- 8. Connect phase L1 to the "L1" conductor rail.
- 9. Connect phase L2 to the "L2" conductor rail.
- 10. Connect phase L3 to the "L3" conductor rail.

11. Connect the cables from the output of the SSR to the 8-pin green plug connectors.

Note

The feedback signals from the SSRs for voltage measurement must be sent along the same channel as switching signals.

12. Plug the plug connector of SSRs 1 to 8 into the socket connector L1d.

13. Plug the plug connector of SSRs 9 to 16 into the socket connector L2d.

14. Plug the plug connector of SSRs 17 to 24 into the socket connector L3d.

For diagnosis by current measurement, you must also carry out the following steps:

7. Connect the cables from the current measuring module to the 6pin orange-colored socket connector.

8. Plug the socket connector of the measuring cable onto the "Current Sense" plug connector.

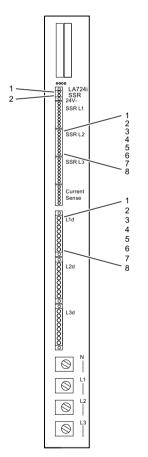


Figure 5-9 Front view of the LA 724I SSR with the sockets for SSR connection

5.4 Connecting heat emitters

Pin/socket connector	Pin	SSR (channel)
SSR L1 and L1d	1	1
	2	2
	:	:
	8	8
SSR L2 and L2d	1	9
	2	10
	:	:
	8	16
SSR L3 and L3d	1	17
	2	18
	:	:
	8	24

Table 5-2 Assignment of the SSRs to the pins of the plug/socket connectors

Table 5-3 Assignment of the current measuring module to the pins of the plug connector

Plug connector	Pin	Terminal on current measuring module
Current Sense	1	1
	2	2
	3	8
	4	9
	5	15
	6	16

Table 5-4 Assignment of the 24 V power supply to the pins of the plug connector

Plug connector	Pin	Signal
24V-	1	+24 V
	2	0 V

After the conductor rails have been connected, the covers of the conductor rails must be fitted again to provide protection against electric shock. After the operating voltage has been switched on in the control cabinet, the conductor rails carry line voltage (230 V AC).

It is permitted to carry out wiring or maintenance work only after the system has been disconnected from the supply.

Star connection

The following illustration shows the connection of the heat emitters to the LA 724I SSR in a star connection (Y circuit).

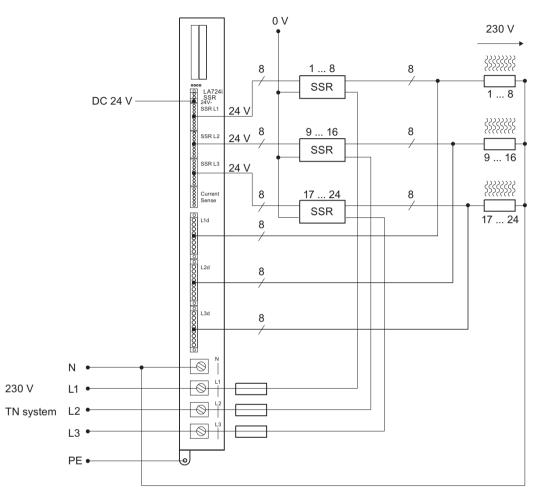


Figure 5-10 Star connection of the heat emitters to LA 724I SSR (example with voltage signal feedback for diagnostic purposes)

Note

Unrestricted mixed operation of emitters for 230 V and 400 V is not possible in a network of HCS724I devices. Please contact Technical Support.

5.4 Connecting heat emitters

Delta connection

The following illustration shows the connection of the heat emitters to the LA 724I SSR in a delta connection (Δ circuit).

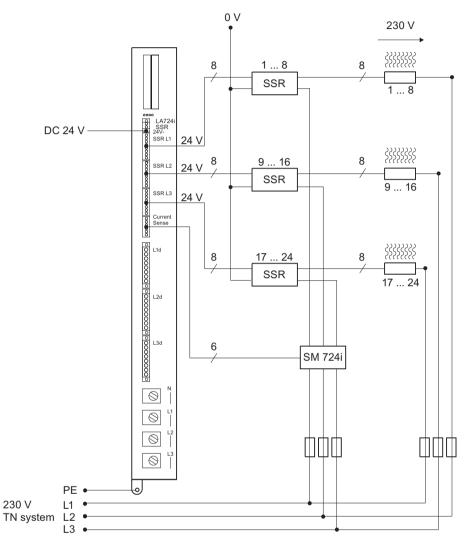


Figure 5-11 Delta connection of the heat emitters to LA 724I SSR (example with current signal feedback for diagnostic purposes)

Note

Secure the return leads from the heat emitters in such a way that cable protection according to EN 60204, Part 1, or EN 50178 is ensured. The plant builder is responsible for correct protection of the system.

Note

Unrestricted mixed operation of emitters for 230 V and 400 V is not possible in a network of HCS724I devices. Please contact Technical Support.

5.4.3 Connecting the NE 724

The NE 724 submodule is plugged into the slot of the ZA 724 from the front and pressed into the plug-in connector. The cables of the submodule are connected to the neighboring LA 724I xx with the 3 phases and the neutral conductor.

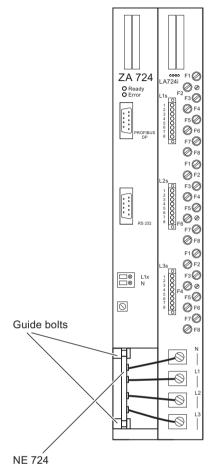
Steps

- 1. Remove the conductor-rail cover of the ZA 724 and LA 724I xx.
- 2. Push the NE 724 submodule, together with the plug-in connector, into the slot of the ZA 724.

Make sure that the printed circuit board is resting in the grooves of the guide bolts (see illustration below).

3. Carefully push the submodule inwards until the plug-in connector engages.

5.4 Connecting heat emitters



4. Connect the cable of the NE 724 submodule to the conductor-rail terminals of the neighboring LA 724I xx (see illustration below).

Figure 5-12 Position and connection of the NE 724

5. Re-attach the conductor-rail cover to the ZA 724 and LA 724I xx.

Note

The conductor-rail covers only engage in the front plate if the conductor rails and the NE 724 have been connected correctly.

Start-up

6.1 Hardware requirements

Controller

The controller needed is for example

- a SIMATIC S7 CPU 3xx or CPU 4xx with integrated PROFIBUS DP interface
- or a DP standard master

Heater controller

A heater controller includes the following components:

- 1 ZA 724 central interface module
- 1 to 16 LA 724I xx power output modules/load switching units
- NE 724 line-voltage sensing submodule (optional)
- SM 724I current measuring module (optional)

6.2 Software requirements

CD contents

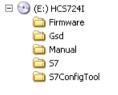


Figure 6-1 CD contents

Directory \Firmware

contains the Flash loaders and the current firmware

Start-up

6.2 Software requirements

Directory \Gsd

contains the language-specific GSD files for the HCS724I for installation in the planning tool of the DP master.

SIEM80FF.gsg / SIEM80FF.gsd	German
SIEM80FF.gse	English
SIEM80FF.gsf	French
SIEM80FF.gsi	Italian
SIEM80FF.gss	Spanish

Directory \Manual

contains the description in this document in electronic form.

Directory \S7

Archive with the current STEP 7 program (for transferring projects to the SIMATIC Manager)

Directory \S7ConfigTool

Configuration tool for generating the data blocks used in the STEP7 program

6.3 Incorporating the GSD file

For purposes of heater control, there is a GSD file entitled SIEM80FF.GSD in which the configuration of the DP slave is stored.

This file is needed to carry out PROFIBUS configuration. It is included in the scope of supply of *STEP 7*.

The following table describes how you incorporate the GSD file in *STEP 7* if this GSD is not yet available in the version of your planning software.

Step	<i>STEP 7</i> , as of V5.0, ServicePack 3		
1	Start <i>STEP 7</i> and then select the menu command Tools > Install New GSD file in HW Config.		
2	From the next dialog box, select the GSD file you want to install and confirm with OK . Result: The heater controller appears in the hardware catalog of the PROFIBUS DP folder. (other field devices - general)		
3	Configure the heater controller using <i>STEP 7</i> (refer to the online help in <i>STEP 7</i>).		

Table 6-1 Incorporating the GSD file in your planning software

If a DP master is used which is not an S7 DP master, install the GSD file as described in the instructions for the DP master.

Features of the DP slave

- 32 bytes for output data, consistent
- 32 bytes for input data, consistent
- 64 bytes for diagnostic data (not yet used)
- Baud rates up to 12 Mbaud
- Supported standard: PROFIBUS DP

6.4 Procedure for (standard) commissioning

6.4 Procedure for (standard) commissioning

Steps

- 1. Use rotary switches S2 and S3 on the central interface module to set the PROFIBUS address (see "Setting the bus address" (Page 40))
- 2. Mount the components in the control cabinet (see "Mounting components on the support plate" (Page 41) and "Installing the optional fan module" (Page 43)).
- 3. Connect the parallel bus (see "Connecting the parallel bus" (Page 48))
- 4. Install the NE 724 line-voltage sensing submodule (optional) and connect it (see "Connecting the NE 724" (Page 63))
- 5. Connect the supply voltage (see "Connecting the supply voltage to the ZA 724" (Page 51))
- 6. Connect the PROFIBUS DP (see "Connecting the PROFIBUS DP fieldbus" (Page 47))
- 7. Connect the heat emitters (see "Connecting the LA 724I / LA 724I HP" (Page 52) and "Connecting the LA 724I SSR" (Page 58))
- 8.
- If the system is used with an S7 master: Load the S7 project provided as an example and adapt it to the application.
 For a description of the S7 interface, see "Functions > Data exchange between an S7 DP master and the ZA 724" (Page 88)
- If the system is used with a master that is not an S7 master: Create your user program for operating the HCS724I.
 For a description of the DP interface, see "Functions > Data exchange between a non-S7 DP master and the ZA 724" (Page 113)

Functions

7.1 Initialization (start-up)

Start-up behavior

- For approximately 1 second, the firmware checks whether a request for a firmware update has been sent via the serial interface. If yes, it changes over to the Flash loading procedure.
- The firmware then checks the system. In the event of a problem (e.g. serious fault: Flash not loaded), the system comes to a standstill during starting.
- During the initialization phase, data exchange is started between the DP master and the ZA 724 (see "DB_HS_INIT" (Page 92) and "FC_HS_INIT" (Page 99)):
 - Information on the status of the HCS724I
 - Transfer of the configuration data to the HCS724I
 - Carrying out start-up tests

Note

An exact description of the jobs or the contents for initialization is given in "Functions > Data exchange between an S7 DP master and the ZA 724" (Page 88) and "Functions > Data exchange between a non-S7 DP master and the ZA 724" (Page 113).

Start-up tests

During the initialization phase, the line frequency and the rotating field can be tested in the HCS724I. The tests are activated in one of the initialization message frames and carried out on the HCS724I.

The result has to be checked in the DP master by the user. A description of the data needed for the test is given in "Data exchange between an S7 DP master and the ZA 724" (Page 88) and "Data exchange between a non-S7 DP master and the ZA 724" (Page 113).

Line-frequency test

This test must be performed during starting. The result of the test is the frequency which is found (50/60 Hz).

If the frequency could not be determined, the value 255 is returned. Despite this, however, the HCS724I starts up with the settings for 50 Hz. This can result in diagnostics errors.

Rotating-field test

This test can be carried out during starting and for purposes of support during commissioning.

At higher switching capacities, multiple power-infeed is necessary and therefore the LA 724I xx devices can be selected with whose channels the rotating field is to be tested. For testing of the rotating field, the first channel of a phase must be wired on the power output module, namely channels 1, 9 and 17. The test is carried out with the channels switched off. During the test, the channels must be pulsed for the duration of a full wave only in the case of the LA 724I SSR with connected SM 724I current measuring module.

7.2 Operating the HCS724I

Introduction

After successful initialization, the HCS724I heater controller must be switched to "heating mode" with the corresponding control bits. The ZA 724 modules cyclically check the data for changes and also monitor the power output modules/load switching units. The heat emitters are operated with the current controller values.

Operating cycle

During operation, the following procedures are carried out cyclically:

- The temperature of the LA 724I/LA 724I HP power output modules is monitored
- The 24 V supply voltage of the LA 724I SSR load switching unit is monitored
- Data is exchanged with the DP master
- The power outputs are controlled and monitored.

Connected to the PROFIBUS DP, the ZA 724 central interface modules behave like DP slaves.

Data exchange between the DP master and the HCS724I takes place in the form of cyclical PROFIBUS DP data transfer. Output data are data which are transferred from the DP master to the HCS724I and input data are the data which are sent from the HCS724I to the DP master.

These data signals are each divided into two areas.

"Real" cyclical data are contained in the first 4 bytes: selection of operating mode by the DP master, group signaling of defects by the HCS724I and exchange of correction data for line-voltage compensation.

In the remaining 28 bytes, message frames are transferred between the DP master and the HCS724I. In this way, the HCS724I is parameterized by the DP master and, in addition, detailed diagnostic information and information regarding the commissioning of the HCS724I is transferred to the DP master. The diagnostic mechanism via PROFIBUS DP is not used.

Note

An exact description of the data contents is given in "Functions > Data exchange between an S7 DP master and the ZA 724" (Page 88) and "Functions > Data exchange between a non-S7 DP master and the ZA 724" (Page 113).

7.2.1 Manipulated value calculation

After the applicable emitter setpoints and field factors have been transferred, the heater controller calculates the controller outputs for the individual channels of the LA 724I xx power output modules. When this is being done, line-voltage correct values can also be taken into consideration.

Setpoint definition

For each channel, up to three setpoints can be stipulated for different operating modes.

Value	Description	Range	Dimension
Channel setpoint for start-up	Setpoint for a channel which is used in the start-up mode.	0 to 100	1 % *
Channel setpoint for production with profile 1	Setpoint for a channel which is used in the "production with profile 1" mode.	0 to 100	1 % *
Channel setpoint for production with profile 2	Setpoint for a channel which is used in the "production with profile 2" mode.	0 to 100	1 % *
* With a set configuration parameter, 0.5 % increments can be achieved (see "Operation of power output modules/load switching units", Precision (Page 77)).			

Table 7-1 Values for setpoint calculation

Definition of field factor

For each field, up to two factors by which the current channel setpoint is multiplied can be parameterized.

Value	Description	Range	Dimension
Factor for production	Field factor by which the setpoints for profile 1 and profile 2 in the "production" mode are multiplied for all channels of the associated field	0 to 255	0.01
Factor for standby	Field factor by which the setpoints for profile 1 in the "standby" mode are multiplied for all channels of the associated field	0 to 255	0.01

Table 7-2 Values for setpoint calculation

At least 1 field must be configured in each HCS724I.

Definition of line-voltage compensation

For determining the correction value per phase, see "Line-voltage correction" (Page 75)

Definition of controller outputs for the operating modes

The controller output of a channel depends on the parameterized channel setpoint, the parameterized field factors and the operating mode used.

Standby mode

Controller output = <u>Channel setpoint for profile 1 x field factor for standby mode x correction value</u> 100

Production with profile 1 mode

Controller	Channel setpoint for profile 1 x field factor for production mode x correction value
output =	100

Production with profile 2 mode

Controller output = Channel setpoint for profile 2 x field factor for standby mode x correction value 100

Start-up mode

Controller output = Channel setpoint for start-up

Functions

7.2 Operating the HCS724I

Calculation of controller outputs

The following diagram is a graphic illustration of how controller outputs are calculated.

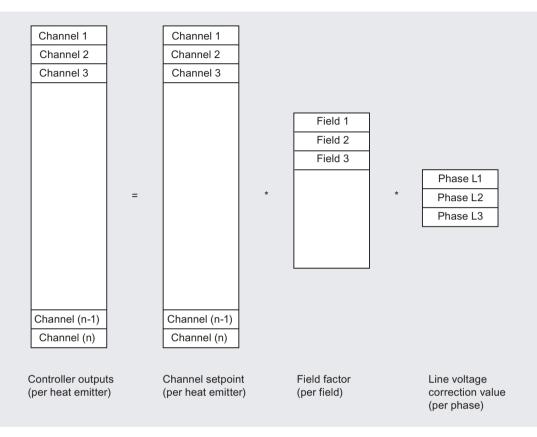


Figure 7-1 Principle of controller output calculation

Updating the controller outputs

If new data arrive from the S7 (emitter setpoints and field factors), the controller outputs are recalculated.

Changed emitter setpoint	\rightarrow	The associated channel controller output is recalculated.
Changed field factor	\rightarrow	All channel controller outputs of the field in question are recalculated.
Changed line-voltage correction value	\rightarrow	The controller outputs are recalculated for all channels of the phase in question.

7.2.2 Mains compensation

In order to eliminate line-voltage fluctuations, the HCS724I can be equipped with an NE 724 line-voltage sensing submodule as an option.

The central interface module scans the line voltages cyclically and integrates them, using the integration time transferred during initialization.

Configuration

The function can be activated/deactivated by means of a parameter.

- The function is active and the NE 724 connected
 → The correction values are calculated and reported to the DP master.
- The function is active
 - \rightarrow The correction values are adopted by the DP master.

If the line-voltage sensing submodule is active, the DP master has to distribute the correction values to all interconnected HCS724I devices.

Determining the correction value

The central interface module calculates a phase-related line-voltage correction value from the line voltages detected and from the normalizing values transferred during initialization (desired line-voltage).

Correction value = $\left(\frac{\text{Normalizing value}}{\text{Supply voltage}}\right)^2 \times 100$

If the line voltage corresponds to the desired line voltage stipulated in advance (normalizing value), the correction value is 100 %, i.e. the setpoints are multiplied by a factor of 1.

The correction values for all three phases are transferred in the cylical data sent to the DP master via PROFIBUS DP. The DP master then passes on the current line-voltage correction values for calculation of the controller outputs to all the connected central interface modules.

7.2 Operating the HCS724I

Calculation example

The following examples show how the correction value is calculated and also show the resulting change in the emitter setpoint for a line-voltage smaller or larger than the normalizing value.

The normalizing value is to be 230 V.

Line voltage = 210 V (< normalizing value)

Correction value =
$$\left(\frac{230}{210}\right)^2 x \ 100 = 120 \%$$

The parameterized emitter setpoint is multiplied by this correction value:

Emitter setpoint before correction: 80 % Emitter setpoint after correction: 96 %

• Line voltage = 240 V (> normalizing value)

Correction value =
$$\left(\frac{230}{240}\right)^2 x \ 100 = 92 \%$$

The parameterized emitter setpoint is multiplied by this correction value:

Emitter setpoint before correction: 80 % Emitter setpoint after correction: 73 %

Normalizing values

The normalizing values are phase-related and are permanently assigned to the channels. For each LA 724I xx, the following is applicable:

Channels 1 to 8	Phase L1
Channels 9 to 16	Phase L2
Channels 17 to 24	Phase L3

Malfunction

If the line voltage detected by the NE 724 is below 80 % or above 120 % of the entered normalizing value, a line-voltage sensing fault is assumed. The correction value is set to "1" and a signal is sent to the S7 CPU.

7.2.3 Operation of the power output modules/load switching units

Operation (activation/deactivation) of the power output modules/load switching units with the controller outputs is synchronized by phase L1.

From this signal, all the subsequent zero passages for L1, L2 and L3 are formed. For each zero passage signal, the corresponding phase is controlled.

New data

If, during operation, new data arrive from the S7 (emitter setpoints, production setpoints or line-voltage correction values), processing of the outputs is not stopped. The new values are processed step by step (for controller output calculation, see "Controller output calculation" (Page 72)) and used for controlling the power outputs.

Control

The channels can be operated either with half-wave or full-wave control. In the case of halfwave control, the channel is controlled - in relation to the parameterized controller output every time there is a zero passage but, with full-wave control, this is only done for every mains-supply period.

The controller outputs are set in values from 0 to 100 %.

In the case of half-wave control, the reference basis is 1 second and, for full-wave control, it is 2 seconds.

Example

1 % in the case of half-wave control

 \Rightarrow Switching of the emitter with 1 of 100 half waves.

Precision

The controller outputs are calculated from different variables (see "Line-voltage correction" (Page 75)). The figures are rounded up to the next integral percentage value.

A "superimposed" cycle can be configured by means of a configuration parameter. The figures in this case are rounded up to the next 0.5 % value. Here, however, there is an increase in the cycle to 2 seconds in half-wave mode or 4 seconds in full-wave mode.

Example

At 50.5 %, one cycle is controlled with 50 % and the following cycle with 51 %.

Note

Channel control with 0.5 % only makes sense if slow heat emitters, e.g. quartz emitters or heating cartridges, are used. In the case of Flash emitters, a satisfactory result cannot be achieved in this way.

7.2 Operating the HCS724I

Load distribution

Uniform load distribution over all outputs of a phase is achieved by means of a static control table. This also applies to the use of several interconnected HCS724I devices linked to a DP master.

By means of appropriate configuration, uniform load distribution can be achieved over the three phases.

Direct component

In the case of half-wave control, the channles are controlled without a direct component.

7.3 Monitoring functions of the HCS724I

The heater controller monitors

- the outputs of the power output modules/load switching units
- the temperature of the LA 724I/LA 724I HP power output modules
- the 24 V supply voltage of the LA 724I SSR load switching unit

If a fault has occurred, a fault signal is provided for the DP master.

Each power output can be enabled for the test directly or by means of the associated field.

Communication between the DP master and the HCS724I is monitored on the PROFIBUS DP.

Note

The temperature of the heat emitters is not monitored by the HCS724I.

7.3 Monitoring functions of the HCS724I

7.3.1 Cyclic monitoring of the outputs of the LA 724I xx

During operation, the outputs are monitored by the software. An output is included in the test if both the channel and the associated field have been enabled for the test.

Test types

For testing, a distinction is made between a) standard diagnosis and b) extended diagnosis with current measurement.

 Standard diagnosis: If an emitter is operated from one channel, the focus is on fault localization: Faults on the module or external faults. Diagnosis is carried out by means of voltage measurement. For exact differentiation of the fault, a current measurement is subsequently carried out.

• Extended diagnosis:

If several emitters are operated from one channel, an important factor is the information as to whether one or several emitters have failed.

For this purpose, a current measurement with power calculation is carried out. The power calculation is carried out with the voltage values from the NE 724 or with the parameterized data.

Note

It is only permissible to use extended diagnosis with current measurement for detecting an emitter failure in a situation where emitters are connected in parallel.

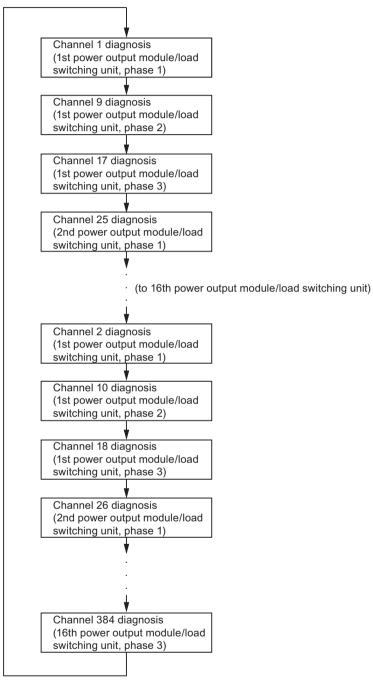
If one emitter per channel is being used, standard diagnosis must be selected.

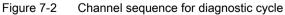
Note

For current measurement with the LA 724I SSR, an external SM 724I current measuring module is needed. The diagnosis system assumes that, when standard diagnosis is used, the signals of the load circuit are fed back to the LA 724I SSR and that, when extended diagnosis with current measurement is used, only the current measuring module is connected and no signals are sent back from the load circuit.

Test cycles

If all the outputs have been enabled for the test, the sequence of steps in the test are as follows:





If a channel has not been enabled for the test, it is ignored during the sequence.

Functions

7.3 Monitoring functions of the HCS724I

Test parameters

For the test cycle, the switching signal of the channel must be changed. This means that the switching signal is falsified:

• Standard diagnosis:

The measuring cycle covers two full waves; for one full wave, the channel is pulsed and, for the other full wave, it is de-energized.

It is only in the event of a fault that all the channels of the current phase are de-energized for a full wave in order to detect the external fault.

• Extended diagnosis:

The measuring cycle covers two full waves. For one full wave, the channel is deenergized and, for the other full wave, the test channel is pulsed and the remaining channels of the phase are de-energized. This is necessary for current measurement.

A diagnostic cycle always includes all the channels enabled for the test.

In order to optimally adapt the diagnostic cycle to the process, the following configurations are possible:

- Channels can be excluded from the test by means of the channel parameters or the field parameters. A channel is only tested if, in both types of parameter, the channel has been enabled for testing.
- For each channel, it is possible to parameterize whether current measurement is to be carried out as a standard measure or not. If standard diagnosis has been chosen, current measurement is only carried out to locate a fault that has been detected. In other cases, current measurement with evaluation is carried out for the channel in each test cycle.
- The diagnostic cycle is performed only in Standby and Production modes.
- It is possible to configure how many repeat measurements are to be carried out before a detected fault is reported to the DP master or indicated by the LED.
- A configurable pause between the tests of two channels can be set (at 50 Hz in increments of 50 ms).
- A pause between two diagnostic cycles can be configured. After the last channel has been tested, a start is normally made again with the first channel to be tested. If a pause is configured, x diagnostic cycles are omitted before a start is made with the first channel to be tested.

Cycle duration

A test cycle for 384 channels lasts approximately 20 seconds.

Types of fault LA 724I and LA 724I HP

The diagnostic function distinguishes between the following faults in the standard diagnostic cycle:

- Module fault 1 (fault type 1)
 - The circuit-breaker cannot be closed (Triac is highly resistive).
 - The module fuse has blown.

These faults cannot be specified in more detail by the diagnostic function of the HCS724I.

• Module fault 2 (fault type 2)

The circuit-breaker cannot be closed (Triac has a short-circuit).

- External fault (fault type 2 external) The heating circuit has been interrupted due to
 - blown external fuse
 - cable break
 - heat emitter defect.

In the case of extended diagnosis, the following faults are also detected:

- Rated power at the channel is exceeded (fault type 4). At the output, one or several emitters are being operated at too high a power level. The rated power and the deviation can be configured.
- **Power at the channel falls below the rated power** (fault type 3). At the output, emitters are being operated at too low a power level or at least one emitter has failed. The rated power and the deviation can be configured.

Note

In the case of heat emitters whose resistance is heavily dependent on the temperature (e.g. Flash emitters), bear in mind that the resistance and therefore the actual power depends on the emitter's setpoint. In other words, at 10 %, the power of a half wave is higher than at 100 %. This is reflected by the measured value.

If this behavior is not taken into account, it can lead to a fault signal of the extended diagnosis function. If necessary, the value for the tolerance range (permissible deviation from the rated power) is to be adapted or the diagnostic function is to be deactivated.

7.3 Monitoring functions of the HCS7241

Fault types LA 724I SSR

The diagnostic function distinguishes between the following faults in the standard diagnosis cycle.

A more differentiated distinction in the case of multiple faults is not possible.

- Module fault (fault type 5)
 - The output driver is defective.
 - The 24 V switching cable has a short-circuit.
 - The 24 V switching cable has been interrupted.
- External fault 1 (fault type 1)
 - SSR is defective and cannot be switched on.
 - The cable leading to the SSR has been interrupted.
 - The external channel fuse has blown.
- External fault 2 (fault type 2)
 - SSR is defective and cannot be switched off.
 - Emitter defect
 - Cable break

In the case of extended diagnosis, the following faults are also detected:

- Rated power at the channel is exceeded (fault type 4). At the output, one or several emitters are being operated at too high a power level. The rated power and the deviation can be configured.
- Power at the channel falls below the rated power (fault type 3). At the output, emitters are being operated at too low a power level or at least one emitter has failed. The rated power and the deviation can be configured.

Note

In the case of heat emitters whose resistance is heavily dependent on the temperature (e.g. Flash emitters), bear in mind that the resistance and therefore the actual power depends on the emitter's setpoint. In other words, at 10 %, the power of a half wave is higher than at 100 %. This is reflected by the measured value.

If this behavior is not taken into account, it can lead to a fault signal of the extended diagnosis function. If necessary, the value for the tolerance range (permissible deviation from the rated power) is to be adapted or the diagnostic function is to be deactivated.

7.3.2 Monitoring of the outputs of the LA 724I xx by means of a "job"

Monitoring of the outputs by means of a separate job is possible, especially for testing and commissioning.

In the HCS724I, this job triggers a diagnostic cycle via the channels of all the existing LA 724I xx devices. Parameterized pauses or repeat measurements as described in the previous section are not evaluated.

What is decisive for the test is the type of channel diagnosis selected. Standard diagnosis (diagnosis by means of current measurement) is set for each channel (default setting).

The result of diagnosis is directly reported to the DP master; it is not stored in the HCS724I.

The description of the job is given in "Functions > Data exchange between an S7 DP master and the ZA 724" (Page 88) and "Functions > Data exchange between a non-S7 DP master and the ZA 724" (Page 113).

Note

This job can also be used during operation if a diagnostic cyle is to be carried out explicitly at certain times.

If this is done, it must be ensured that cyclical diagnosis has been switched off. This is done by blocking diagnosis for all the fields used.

7.3.3 Controller outputs of the LA 724I xx

The controller output is calculated by multiplication of the channel setpoint by the field factor and the factor resulting from line-voltage compensation.

If the product exceeds 100 %, the controller output is restricted to 100 % and an alarm is output. Heating continues.

Functions

7.3 Monitoring functions of the HCS724I

7.3.4 Temperature at the power outputs

At the LA 724I and LA 724I HP power output modules, the temperature of the heat sink is monitored permanently.

If the temperature exceeds the set limit (T \geq 92 °C), this is reported to the DP master.

Exceeding of the alarm threshold does not lead to an interruption of the heating cycle.

In the DP master, there must be a reaction to this alarm signal. For example, the user must take appropriate measures for cooling (use fan).

If the temperature of the heat sink continues to rise, the power outputs of the module are deactivated at approximately 100 °C. This fault signal is also sent to the DP master.

Note

When both faults have been eliminated, the operating mode for recommencement of heating must be reactivated via the DP master.

7.3.5 24 V on the load controllers

The 24 V supply voltage is permanently monitored at the LA 724I SSR load switching unit.

If the 24 V supply voltage fails, this failure is reported to the DP master.

The control outputs of the module are thus rendered inactive.

Note

When both faults have been eliminated, the operating mode for recommencement of heating must be reactivated via the DP master.

7.3.6 Communication

The connection between the DP master and DP slave is monitored with the help of PROFIBUS DP mechanisms.

In the DP master, the failure of a slave is detected and indicated to the user, who can then react accordingly.

In the HCS724I, a failure of the DP master or communication is detected. The HCS724I reacts according to the configuration:

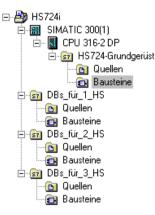
The current status of the outputs is maintained or all outputs are de-energized.

Note

When both faults have been eliminated, the operating mode for recommencement of heating must be reactivated via the DP master.

7.4 Data exchange between an S7-DP master and ZA 724

7.4.1 STEP 7 project provided



The *STEP 7* project in the "HS724i.zip" file on the CD supplied contains all the functions and data needed for operating one or several HCS724I devices on the PROFIBUS DP.

The project must be copied onto the hard disk by selecting "Unzip File..." and loaded into the *STEP 7* Manager.

In addition to the functions, function blocks and data blocks described in the following chapters, the software contains the following application as an example:

- DB_PLC_TEST This data block contains all the necessary test data.
- OB1

Cyclical sequence control program which controls the HCS724I.

• OB100

Program used as an example for the reaction to start/restart in an S7-300 CPU

In the project, the following hardware configuration is stored as an example:

- CPU 316-2 DP
- CPU program with blocks for operation of an HCS724I with 384 channels
- Data blocks prepared for the operation of
 - one HCS724I unit with 384 channels
 - two HCS724I units each with 384 channels
 - three HCS724I units each with 384 channels

If necessary, the CPU can be replaced with another CPU. If two or three HCS724I are operated as an interconnected group, the data blocks can be copied from the corresponding directory (e.g. DBs_for_2_HS) into the CPU data block directory. The hardware configuration must be supplemented accordingly.

The data blocks can also be generated using the configuration tool supplied on the CD (see "Generating the data blocks" (Page 107))

The application is designed to support a group of up to 24 HCS724I units. The data blocks for this purpose must, however, be adapted accordingly.

Numbers have been assigned for the data blocks, functions and function blocks. They can be renamed (exception: DB_HS_WORK).

If, for some reason, the number of DB_HS_WORK has to be changed, consult HCS724I Support.

The blocks have not been disabled. The comments are available in German and English. For changing over between languages, please refer to the Help function of the S7 Manager.

Note

Disclaimer

SIEMENS AG assumes no liability for any claims arising from use of the *STEP 7* project (examples of data/function blocks) provided in the scope of supply; in particular not for personal injury, damage to property or financial loss that are the direct or indirect consequence of using the data/function blocks provided as examples within the scope of supply.

7.4.2 Software structure

The S7 software for operating the HCS724I features an interface composed of data blocks and function blocks/functions which enable an application to gain access to one or more HCS724I modules in a relatively simple manner.

The data needed for the sequence of steps involved in control of the equipment are managed in data blocks. The structure of these blocks has been fixed permanently in advance.

Access to the HCS724I devices by means of orders in the PROFIBUS DP data is enabled by means of functions.

Because the entire PROFIBUS data area of an HCS724I, i.e. 32 bytes of input data and 32 bytes of output data, has to be consistent, access to the replica of the peripheral devices takes place via SFC14 "DPRD_DAT" and SFC15 "DPWR_DAT". These SFCs exist in each S7 CPU.

If more than 384 heat emitters have to be controlled, several HCS724I modules can be operated as an interconnected group via the S7 interface. For the purposes of shared management, the HCS724I modules and their channels are simply numbered in sequence:

- First HCS724I, channel numbers 1 to 384
- Second HCS724I, channel numbers 385 to 768

There is an indirect restriction of the number of modules that can be managed due to the limited memory of the S7 CPU and due to the time needed for supplying the HCS724I with data.

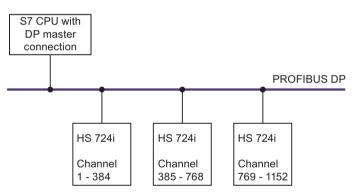


Figure 7-3 Several HCS724I modules connected to one S7 CPU

Block structure

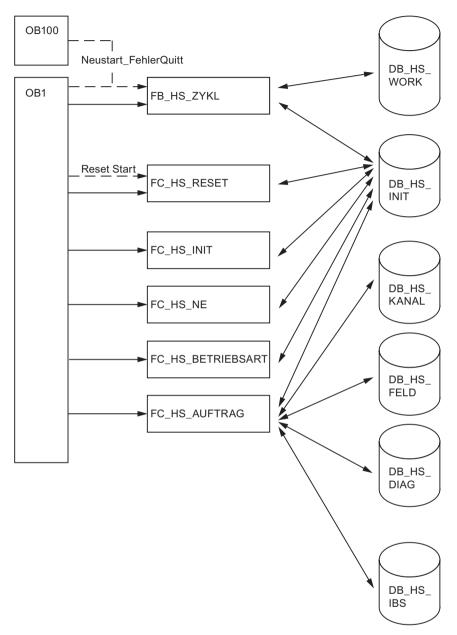


Figure 7-4 Structure of S7 program

The S7 software for the HCS724I is essentially composed of the following areas, which are explained in the chapters below:

- · Data blocks for the management of parameters and configuration data
- Data blocks for storing diagnostic and commissioning information
- · Functions in the form of a user interface for the performance of different tasks
- Function block for communication with the HCS724I via PROFIBUS DP

Functions

7.4 Data exchange between an S7-DP master and ZA 724

7.4.3 Data blocks

In the software, data blocks constitute the actual user interface.

The following data blocks are needed for operating the HCS724I modules:

DB_HS_INIT	(initializing data)
DB_HS_KANAL	(data for parameterizing the individual power outputs)
DB_HS_FELD	(data for managing the outputs in groups)
DB_HS_DIAG	(information on the status of outputs and power output modules)

The following data blocks are optional for operating the HCS724I modules:

DB_HS_IBS (measured values from the HCS724I - essentially only for commissioning)

The DB_HS_WORK contained in the structure contains working data. It is managed by the S7 DP master.

7.4.3.1 DB_HS_INIT

In this data block, all the data are contained which are needed for configuring an HCS724I. These data are needed once for intialization and are then no longer changed. In addition to the HCS724I configuration data, there is also the necessary S7 information for assigning addresses to one or several HCS724I modules. The data block also contains the information supplied from the HCS724I to the DP master during initialization.

Structure of an entry in the data block

The following table shows the structure of an entry in the data block. The number of structures corresponds to the number of HCS724I modules operated together. The data block contains an array composed of these structures.

The data marked with a star are transferred from the HCS724I to the S7 during the initialization phase and should be checked for correctness by the user.

Name	Туре	Meaning			
AnzHS	WORD	Number of a	Number of available HCS724I modules		
EAdr	INT		Starting address from the input range of the HCS724I, is set with HW Config during DP configuration		
AAdr	INT		Iress from the output range of the HCS724I, is set with during DP configuration		
NrKanal	INT	operated, th	Number of the first channel of the HCS724I (If one HCS724I is operated, the number 1 is to be entered here. This channel number must always be in a 24 pattern (1, 25,).)		
PrDrehfeld	WORD		he rotating field test for each LA 724I xx (there is one LA 724I module)		
		Bit = 0:	Do not perform test		
		Bit = 1:	Perform test		
Reserv	BYTE	-			
ErgPrNetzfreq*	BYTE	Result of the	e line frequency test		
		50:	50 Hz		
		60:	60 Hz		
		0xFF:	undefined		
ErgPrDrehfeld*	WORD	Result of the rotating field test (there is one bit for each LA 724I x module)			
		Bit = 0:	Test without faults		
		Bit = 1:	Fault found during rotating-field test		
LaInfo*	ARRAY	Information	Information on each LA 724I xx found:		
	(BYTE)	0x00:	No module present		
		0x01:	LA 724I present		
		0x02 :	LA 724I HP present		
		0x10:	LA 724I SSR present		
		0xFF:	Old LA 724 found (fault)		
NeInfo*	BYTE	Information	on the optional NE 724		
		0:	NE 724 is not present		
		1:	NE 724 is present		
Reserv*	BYTE	0 (reserved	for later information on the ZA 724)		
ZaInfo*	ARRAY (BYTE)	Firmware version of the ZA 724 in the format Vxx.yy.zz			

7.4.3.2 DB_HS_KANAL

In this data block, all the parameters needed for a channel are collected: This data block must always be present.

Structure of an entry in the data block

The following table shows the structure of an entry in the data block. The number of structures corresponds to the number of channels that exist. The data block contains an array composed of these structures.

Note

If a group of interconnected HCS724I modules is used, all the channels have to be entered here; the DB only exists once.

Name	Туре	Meaning	Meaning		
NrKanal	INT		Number of the configured channel, value range 1 to xx (depending on the number of channels used)		
Sollwert	BYTE	value range	Setpoint for production mode with profile 1 and for standby mode in [%], value range 0 to 100 With Bit7 = 1, 0.5 % can be set.		
SwAnlauf	BYTE		starting [%], value range 0 to 100 , 0.5 % can be set.		
Sollwert2	BYTE		Setpoint for production mode with profile 2 in [%], value range 0 to 100 With Bit7 = 1, 0.5 % can be set.		
Diag	BYTE Test setting for the channel (see "Job 11: field diagnostics" (Page 12				
			Channel is not tested		
			Channel is tested with standard diagnosis		
		2:	Channel is tested with extended diagnosis		
Pnenn	INT	This paramet	Rated power to be expected at a channel in [W] This parameter must have been assigned a valid value if extended diagnosis with current measurement is used.		
Pabw	INT	Permissible upward and downward deviation from the rated power in [W] This parameter must have been assigned a valid value if extended diagnosis with current measurement is used.			

7.4.3.3 DB_HS_FELD

In this data block, all the parameters needed for a field description are contained: This data block must always be present.

Structures of the possible entries in the data block

The following table shows the structures of the possible entries in the data block. The number of structures corresponds to the number of fields that are needed. The data block contains an array of the different structures.

Note

If a group of interconnected HCS724I modules is used, all the fields have to be entered here; the DB only exists once.

Here, there must be one field per HCS724I as a minimum configuration for operation.

Name	Туре	Meaning			
NrFeld	BYTE	Number of the field, value range 1 to 127			
Туре	BYTE	Field type			
		0:	0: All channels between the beginning and the end		
		1:	Every second channel betwee	een the beginning and the end	
		2:	List with channels		
FakProd	BYTE		or for production mode with pro alues 0 to 255	ofile 1 and profile 2 in [0.00),	
FakStBy	BYTE		Field factor for standby mode in [0.00], Value range 0 to 255		
Diag BYTE		Test setting for the channel (see "Job 10: Channel diagnostics" (Page 123))			
		0:	None of the field's channels are tested.		
		1: All the field's channels enabl		led for the test are tested.	
Reserv	BYTE	0			
		Entries for	r field types 0 and 1	Entries for field type 2	
AKanal	INT	Number o	f the first channel in the field	-	
EKanal	INT	Number of the last channel in the field		-	
AnzKanal	INT	-		Number of subsequent channels	
NrKanal	ARRAY (INT)	-		Channel numbers in the field	

In order to delete a field, field type 2 with AnzKanal = 0 must be used.

7.4.3.4 DB_HS_DIAG

This data block contains all the diagnostic information. This includes the module-specific fault signals and alarms as well as the channel-specific fault signals and alarms. This data block must be present.

Structures of the different entries in the data block

The following table shows the structures of the different entries in the data block. The number of structures corresponds to the number of HCS724I modules and the number of channels. The data block contains an array composed of these structures.

Note

If a group of interconnected HCS724I modules is used, the fault information of all power output modules/load switching units and channels has to be entered here; the DB only exists once.

Name	Туре	Meanin	Meaning		
NrHS	BYTE	Consec	Consecutive number of the HCS724I		
ErrNeL1 BYTE		Fault in	Fault in line voltage sensing L1		
		0:	No fault		
		xx:	Measured value		
ErrNeL2	BYTE	Fault in	line voltage sensing L2		
		0:	No fault		
		xx:	Measured value		
ErrNeL3	BYTE	Fault in	line voltage sensing L3		
		0:	No fault		
		xx:	Measured value		
ErrInitLa	BYTE	Error du	Error during initialization of the HCS724I		
		0x01:	Old power output found		
		0x02 :	Power output module/load switching unit without ID found		
		0x04:	It was not possible to determine the frequency.		
		Several	faults can be signaled at the same time.		
Reserv	BYTE	0			
ErrTemp1	BYTE	Fault al	arm for the first LA 724I xx (first tier):		
		1:	Temperature warning threshold exceeded (LA 724I / LA 724I HP)		
		2:	Temperature trip threshold exceeded (LA 724I/LA 724I HP)		
		3:	24 V supply voltage failed (LA 724I SSR)		
-					
ErrTemp16	BYTE	Fault alarm for the sixteenth LA 724I xx (second tier)			

Name	Туре	Meaning		
NrKanal	INT	Number of channel		
ErrKanal	BYTE	Fault information about the channel		
		0: Output is o.k.		
		1: Fault type 1		
		2: Fault type 2		
		3: Fault type 2, external		
		4: Fault type 3		
		5: Fault type 4		
		6: Fault type 5		
		(For types of fault, see "Cyclic monitoring of LA 724I xx outputs" (Page 80))		
WKanal	BYTE	Alarm that has occurred for this channel		
		0: Controller output is o.k.		
		1: Incorrect controller output due to setpoint x field value		
		2: Incorrect controller output due to line voltage compensation		

7.4.3.5 DB_HS_IBS

This data block contains all the information resulting from the commissioning jobs. This includes the module-specific actual values as well as the channel-specific actual values. This data block must be present if commissioning jobs are used.

Structures of the different entries in the data block

The following table shows the structures of the different entries in the data block. The number of structures corresponds to the number of HCS724I modules and the number of channels. The data block contains an array composed of these structures.

Note

If a group of interconnected HCS724I modules is used, the commissioning information of all power output modules/load switching units and channels has to be entered here; the DB only exists once.

The values are only valid if the HCS724I has been initialized and an operating mode has been activated. The channel measured values are only valid if expanded diagnosis with current measurement has been parameterized for the channel.

Name	Туре	Meaning	
NrHS	BYTE	Consecutive number of the HCS724I	
ErrTemp1	INT	Measured temperature for the first power output module (first tier) in [°C] If a measured value is not available, 0 must be entered here.	
· · · · · · · · · · · · · · · · · · ·			
ErrTemp16	INT	Measured temperature for the sixteenth power output module (second tier)	

Name	Туре	Meaning	
NrKanal	INT	Number of channel	
Stellgröße	BYTE	Current controller output of the channel in [%]	
Reserv	BYTE		
Strom	INT	Measured current belonging to the currently measured nominal power in [10 ⁻² A]	
Leistung	INT	Currently measured nominal power at the channel in [W]	

7.4.4 Functions and function blocks

In addition to the central function blocks for managing the different HCS724I modules, there are also some functions which are preferably used for controlling the cyclical data.

The tasks of the functions are described in the following sections of this document.

7.4.4.1 FC_HS_INIT

The heater controllers must be initialized once during starting. For this purpose, there is a function which has to be called after start-up of an HCS724I. The function is responsible for initializing the HCS724I.

In addition to the data from the DB_INIT, which can be different for every HCS724I, the data which have to be identical for all HCS724I modules are transferred when the function is started.

Note

If a group of interconnected HCS724I modules are operated, initialization of **all** HCS724I modules must have been completed successfully in order to be able to start operation.

The function can be started cyclically in order to be able to carry out automatic initialization after a cold start/hot restart of the DP master.

Parameter	Declaration	Data type	Description		
NrDbInit	INPUT	BLOCK_DB	Number of the data block which contains the configuration data.		
ErrDP	INPUT	BYTE	Pulsing of the channels in the event of a fault (PROFIBUS fault):		
			0:	None of the outputs are pulsed any more (setpoint 0 %)	
			1:	The outputs retain the last value which was set	
NeFunktion	INPUT	BYTE	Line voltage	e compensation function	
			0:	deactivated	
			1:	activated	
			This has an effect on all the HCS724I modules connected.		
NeNennSpg	INPUT	INT	Nominal value of the line voltage (e.g. 230 V) is used		
			as the n	ormalizing value for line voltage compensation	
			for power calculation without NE 724		
NeZeit	INPUT	BYTE	Integration time for line voltage compensation in multiples of 300 ms		
			0:	No repetition of the measurement	
			1 254:	Number of repetitions	
			Only necessary if the function has been activated.		

Functions

7.4 Data exchange between an S7-DP master and ZA 724

Parameter	Declaration	Data type	Description			
DiagTZyk	INPUT	BYTE	Diagnostic cycle: Number of pause cycles between two diagnostic cycles 0 to x			
DiagTKanal	INPUT	BYTE	Diagnostic cycle: Number of pause times between two channel diagnoses 0 to x			
DiagRepeat	INPUT	BYTE	Diagnostic cycle: Number of repetitions when a fault is detected, until the fault is actually reported to the master (0 to 10)			
LSControl	INPUT	BYTE	Pulsing of th	Pulsing of the power outputs with		
			0:	Half-wave mode (time basis s)		
			1:	Full-wave mode (time basis 2 s)		
			2:	Half-wave mode, 0.5 % increments (time basis 2 s)		
			3:	Full-wave mode, 0.5 % increments (time basis 4 s)		
BetStDr	INPUT	BYTE	Emitters are being operated			
			0:	In star circuit (230 V)		
			1:	in delta circuit (400 V) - only LA 724I HP/LA 724I SSR		
RetVal	OUTPUT	WORD	Feedback regarding execution			
			The parameter supplies a fault code:			
			• 0000 No fault			
			 See "Alarm, error and system messages > Error messages in the S7 environment" (Page 133) 			

7.4.4.2 FC_HS_AUFTRAG

This function can be used to transfer data which has been changed in the DB_HS_KANAL or DB_HS_FELD data block to the HCS724I or to read data from the HCS724I into the DB_HS_DIAG or DB_HS_IBS data block. In the job code, the user must set the corresponding bit.

More than one job can be inserted in the job code. The cyclical function block works through all the entered jobs from the LSB (low-value bit) and sends a feedback signal only when either all jobs have been processed or if a fault has occurred.

Note

Whereas the data blocks DB_HS_INIT, DB_HS_KANAL, DB_HS_FELD and DB_HS_DIAG always have to be present, the DB_HS_IBS data block is only checked if a corresponding job has been entered.

Parameter	Declaration	Data type	Description			
NrDbInit	INPUT	BLOCK_DB	Number of the data block which contains the configuration data.			
NrDbKanal	INPUT	BLOCK_DB	Number of the data block which contains the channel descriptions data.			
NrDbFeld	INPUT	BLOCK_DB	Number of the data block which contains the field descriptions.			
NrDbDiag	INPUT	BLOCK_DB	Number of the data	data block which contains the diagnostic		
NrDblbs	INPUT	BLOCK_DB	Number of the commissioning	data block which contains the gata.		
AuCode	INPUT	DWORD	Here, a coded entry is made bit by bit, indicating which data have changed in the data blocks and are therefore to be transferred or which data is to be collected for diagnostic purposes (e.g. new setpoints, new field values):			
			0x0000008	Chanel setpoints profile 1/Standby		
			0x00000010	Channel setpoints profile 2		
			0x00000020	Channel setpoints start-up		
			0x00000040	Field definition		
			0x0000080	Field factor for production mode		
			0x00000100	Field factor for standby mode		
			0x00000200	Diagnostic setting for channels		
			0x00000400	Diagnostic setting for fields		
			0x00080000	Reading of the general diagnosis		
			0x00100000	Reading of the channel diagnosis		
			0x00200000	Reading of the channel alarms		
			0x00400000	Triggering of a diagnostic cycle with result		
			0x20000000	Current channel controller output (during commissioning)		
			0x40000000	Current channel measured values (during commissioning)		
			0x80000000	Current temperature measured values (during commissioning)		
			Several data can be entered.			
RetVal	OUTPUT	WORD	Feedback rega	arding execution		
			The parameter supplies a fault code:			
				• 0000 No fault		
			 See "Alarm, error and system messages > Error messages in the S7 environment" (Page 133) 			

7.4.4.3 FC_HS_NE

The function is only needed if correction values are to be used for line voltage sensing.

With this function, the line voltage correction values are distributed. The data of the HCS724I with NE 724 are taken from the input data area and transferred to all HCS724I modules.

Parameter	Declaration	Data type	Description	
NrDbInit	INPUT	BLOCK_DB	Number of the data block which contains the configuration data.	
ArtNe	INPUT	BOOL	Line v	oltage correction:
			0:	Values of the HCS724I with line voltage sensing are transferred to all HCS724I modules
			1:	Values calculated in S7 are transferred to all HCS724I modules
WertNeL1	INPUT	BYTE	Correction value for L1 calculated in S7 (only when ArtNe = 1)	
WertNeL2	INPUT	BYTE	Correction value for L2 calculated in S7 (only when ArtNe = 1)	
WertNeL1	INPUT	BYTE	Correction value for L3 calculated in S7 (only when $ArtNe = 1$)	
RetVal	OUTPUT	WORD	Feedback regarding execution	
			The parameter supplies a fault code:	
			• 00	00 No fault
				e "Alarm, error and system messages > Error essages in the S7 environment" (Page 133)

7.4.4.4 FC_HS_BETRIEBSART

This function can be used to control the operating mode of the HCS724I. All the HCS724I modules are controlled at the same time. The new operating mode should not be selected until the previously selected operating mode has been acknowledged by all HCS724I modules.

The feedback must be evaluated by the user. The feedback signals can be found in the cyclical data (FB_HS_ZYKL).

Call interface

Parameter	Declaration	Data type	Description	
NrDbInit	INPUT	BLOCK_DB	Number of the data block which contains the configuration data.	
Betriebsart	INPUT	BYTE	Opera	ating mode to be selected:
			1:	Start-up
			2:	Heating Off
			4:	Standby mode
			5: Production with profile 1 mode	
			7: Production with profile 2 mode	
RetVal	OUTPUT	WORD	Feedback regarding execution	
			The parameter supplies a fault code:	
			• 00	000 No fault
			See "Alarm, error and system messages > Error messages in the S7 environment" (Page 133)	

7.4.4.5 FC_HS_RESET

This function can be used to reset the HCS724I modules. If interconnected HCS724I modules are operated as a group, they are all reset.

This function is only performed if a job is not currently being executed and the "Heating Off" mode has been activated. This function is preferably intended for commissioning.

Parameter	Declaration	Data type	Description	
Reset_Start	INPUT	BOOL	Start of function performance (possibly by means of a pulse edge)	
NrDbInit	INPUT	BLOCK_DB	Number of the data block which contains the configuration data.	
RetVal	OUTPUT	WORD	 Feedback regarding execution The parameter supplies a fault code: 0000 No fault See "Alarm, error and system messages > Error messages in the S7 environment" (Page 136) 	

7.4.4.6 FB_HS_ZYKL

This function block is responsible for actual control of the HCS724I modules. It processes the jobs or new data which are transferred with the functions described above.

Every time this function is started, the current status of each HCS724I is updated and reported to the user. The information "Reporting back of operating mode" as well as "fault indication" must be checked and evaluated by the user.

The FB must be cyclically started before the described functions in OB 1.

Parameter	Declaration	Data type	Description		
NrDbInit	INPUT	BLOCK_DB	Number of the data block which contains the configuration data.		
Neustart_ FehlerQuitt	IN/OUT	BOOL	Signal for initialization of the DB_HS_WORK data block		
renierQuitt			The signal must be activated by the user		
			after cold start/hot restart of the S7		
			for acknowledgement after a job fault		
			The signa	The signal is then reset by the respective function.	
HS724i_zust	IN/OUT	POINTER		Pointer to an area in which the cyclical input data of each HCS724I can be stored: 4 bytes per HCS724I	
			Byte 0: Status of the HCS724I modules (several feedback signals are possible at the same time)		
			Bits 7 to Fault indi	5: ication, diagnostic information available	
			0x80	Channel alarm signal (→ Job Read channel alarms)	
			0x40	Channel fault signal (→ Job Read channel faults)	
			0x20	General fault signal (→ Job Read general diagnosis)	
			Bits 4 to 2:		
			Feedback indicating operating mode		
			0x04	Feedback signal Start-up mode	
			0x08	Feedback signal Heating OFF mode	
			0x10	Feedback signal Standby mode	
			0x14	Feedback signal Production with profile 1 mode	
			0x1C	Feedback signal Production with profile 2 mode	
			0x00	Request for selection of a new mode	
			Bits 1 to 0: Feedback indicating initialization - for information purposes		
			0x00	HCS724I must be initialized	
			0x03	HCS724I has been initialized and is ready for operation	
			0x01	Serious fault when starting up the	
			0x02	HCS724I	
			Byte 1: Line volta	age correction value for L1	
			Byte 2 : Line volta	age correction value for L2	
			Byte 3:	age correction value for L3	
RetVal	OUTPUT	WORD	Feedbac	k regarding execution	

7.4.5 Generation of data blocks

7.4.5.1 Prerequisites

The configuration tool is a Microsoft® Excel® based macro.

It is in the file HCS724IConfigTooIV1.0.xls in the directory \S7ConfigTool on the supplied CD.

The file must be copied prior to execution to a write-enabled working directory.

The execution of macros must be permitted in the security settings of Microsoft® Excel®.

7.4.5.2 Function

The configuration tool supports the creation of data blocks which are necessary for communication between the S7 sample program and the heater controller.

After entering the setup information for the heater controller into the input screen of the configuration tool, STL sources of the following data blocks are generated in the current directory from which the tool was started:

- DB_HS_INIT (DB241.awl)
- DB_HS_KANAL (DB242.awl)
- DB_HS_FELD (DB243.awl)
- DB_HS_DIAG (DB244.awl)
- DB_HS_IBS (DB245.awl)

Data sources are generated for the STEP7 sample program Version V2.x and higher.

They include all the data that the S7 sample program needs in order to supply the ZA724I with the setup information and to communicate during normal operation. The basic structure of the data blocks is described in "Data blocks (Page 92)".

After entering the configuration data and generating the STL sources, these must be inserted as an external source in the example project ("Insert> External source") and then compiled in the data blocks ("Edit > Compile").

The entered data can be saved in the MS Excel® file on closing the application.

7.4.5.3 Description of the input fields

The input screen is divided into three areas:

- 1. ZA724I setup
- 2. Channel setup
- 3. Field setup

A setup Number of ZA724I	☐ LA724I	HP Rotation field test	
ZA number 1	- HŴ Confi	ig Config	ess from HW 0 el on ZA724I 24
Channel setup		Field setup	
Number of channels	24	Number of fields	1
Channel setpoint 1	0	Field factor production	0
Channel setpoint 2	0	Field factor standby	0
Channel setpoint startup	0		
	1.	Field number	1
Standard diagnostic	Advanced diagnostic	Field typ	0 💌
Deviation from rated	0	First channel	1
rated power	0	Last channel	24
	,		
Clear data		Generate	Exit

Figure 7-5 Input screen for configuration tool

First area: ZA724I setup

Data entered in this area is generated in the DB_HS_INIT that was described in "DB_HS_INIT" (Page 92).

Number of ZY7241

The number of ZA724I that should be controlled using the program. The configuration tool supports the input of data for a group of up to 24 HCS724I.

Note

A change in the number of ZA724I causes all other entries to be reset.

• LA724I HP

This check box is activated if only LA724I HP should be operated on the ZAs. In the case of a mixed configuration or exclusive operation of LA724I, the check box must not be activated.

• Rotation field test

Selection of the rotation field test for all the available LA724I xx power output modules.

ZA number

The ZA number is selected depending on the entry "Number of ZA7241". For each ZA number, the four following fields must be completed.

• Input address from HW Config

The hardware input address configured in HW Config is entered here and assigned to the ZA that is selected with "ZA number".

• Output address from HW Config

The hardware output address configured in HW Config is entered here and assigned to the ZA that is selected with "ZA number".

- First channel on ZA The first channel on the ZA is specified here.
- Last channel on ZA The last channel on the ZA is specified here.

Note

Channel numbering

The channel numbers must be specified in a grid of 24. The first channel of the first ZA must always be 1. The first channel of the following ZAs must follow the last channel of the previous ZA without a gap. The number of the last channel of a ZA must always be divisible by 24.

Example for two ZAs in the maximum configuration of 16 LAs each: Channel numbers 1 to 384 and 385 to 768

Second area: Channel setup

Data entered in this area is generated in the DB_HS_KANAL that was described in "DB_HS_KANAL" (Page 94).

• Number of channels

This field is only used for display purposes and is derived from the last configured ZA.

• Channel setpoint 1

The channel setpoint used for operating modes "Production profile 1" and "Standby" is specified here. The input is in the range from 0 to 100 % and is valid for all configured channels. Changes are possible via the PLC program.

Channel setpoint 2

The channel setpoint used for the operating mode "Production profile 2" is specified here. The input is in the range from 0 to 100 % and is valid for all configured channels. Changes are possible via the PLC program.

• Channel setpoint startup

The channel setpoint used for the operating mode "Startup" is specified here. The input is in the range from 0 to 100 % and is valid for all configured channels. Changes are possible via the PLC program.

• Standard diagnostic

When this option is selected, standard diagnostics is activated for all channels. if no selection is made here, diagnostics will not be performed.

• Advanced diagnostic

This option only appears after selection of the standard diagnostics. Selection of this option activates advanced diagnostics for all channels.

• Deviation from rated power

This input field only appears after selection of the advanced diagnostics. The maximum permissible power deviation is entered here. The power is entered in watts and is valid for all configured channels.

If emitters of different power ratings are operated on the channels, these values must be changed later in the generated data block.

• Rated power

This input field only appears after selection of the advanced diagnostics. The connected power is entered here. The power is entered in watts and is valid for all configured channels.

If emitters of different power ratings are operated on the channels, these values must be changed later in the generated data block.

Third area: Field setup

Data entered in this area is generated in the DB_HS_FELD that was described in "DB_HS_FELD" (Page 95).

• Number of fields

The number of fields to be used in setting up the heater controller is entered here.

• Field factor production

The field factor used for the operating modes "Production profile 1" and "Production profile 2" is entered here. The input is in the range from 0 to 100 %.

• Field factor standby

The field factor that is used for the operating mode "Standby" is entered here. The input is in the range from 0 to 100 %.

• Field number

Selection field for the field number; derived from the number of fields.

• Field type

Field type of the field selected by field number.

Note

When the check box "LA724I HP" is activated under "ZA setup", all fields with field type 1 are preset to ensure that no other selection is possible.

Note

Field type 2 is not supported. If this field type is used, the generated data blocks must be adapted manually.

- **First channel** The number of the first channel in the field.
- Last channel The number of the last channel in the field.

Note

Field configuration

First and last channel of a field must be within the same ZA.

Operator controls

• Clear data

Erases all the data you have entered.

• Generate

Checks the entered data for consistency and generates the STL sources for the data blocks. If errors occur in the configuration, a message is output with an error description.

Note

The generation process can take several minutes for configurations with more than 6 ZAs in maximum configuration. There is no progress display.

• Exit

Closes the application and saves the entered data.

7.5.1 PROFIBUS DP interface

The HCS724I is a DP slave which is described by means of a GSD file and can be operated from any DP master. Because the amount of data needed to operate the HCS724I exceeds the amount of data possible in the PROFIBUS DP, message frame transfer takes place on the basis of cyclical DP data. Because message frame transfer takes some time, some of the cyclica data is kept in the input/output area in order to transfer certain data quickly.

An input area and an output area, each of 32 bytes, is provided for the HCS724I. This area cannot be enlarged because the data must be read and written consistently by the DP master (due to message frame transfer)

I/O data

The division into four bytes of cyclical data and 28 bytes for message frame transfer applies to the input area and the output area in the same way.

In general, the following applies to the following lists: Input data are data which are transferred from the slave to the master; output data are data which are transferred from the master to the slave.

Table 7-3	Input/output area PROFIBUS DP
-----------	-------------------------------

Byte	Description
0-3	4 bytes of cyclical data
4-31	28 bytes of message frame data

7.5.2 Datagram data

The last 28 bytes in the DP data are reserved for message frame transfer between master and slave. Each message frame consists of a header of two bytes which contains the job code and of useful data in which the job data, including the total length of the job, are placed. The message frame data are described in "Message frame procedure" (Page 115).

	Byte	Bit	Meaning		
Message frame	0		Job code - is acknowledged by the HCS724I		
header	1	6-0	If a fault of	Sequence number - is acknowledged by the HCS724I. If a fault occurs during transfer, the fault number is entered here by the HCS724I.	
		7	Fault in the	e job, indicated by the HCS724I	
			0:	No fault	
			1:	Faults	
Useful data	2-3	Byte	the net dat The length	job (message frame with sequence number 0), a length of the whole job is entered here. of the whole job must not exceed 2000 bytes. h is applicable to storage of the word value.	
	4	Byte	Data 1		
	27	Byte			

Table 7-4 Message frame structure

7.5.3 Datagram sequence

The job in the reading direction is sent according to the same principle but the data are in the acknowledgement message frame of the HCS724I and are received and evaluated by the DP master.

Combined write/read jobs are handled in the same way: Here, both the job of the DP master and the acknowledgement response of the HCS724I contain useful data.

For purposes of detecting a new job, it is necessary in the HCS724I to cyclically scan and evaluate the first byte, which contains the job code. In quiescent mode, this byte is set to 0 by the DP master. A new job is initiated and processed as the result of a valid job code being entered. After acknowledgement of the last message frame of the job by the HCS724I, the DP master sets the job byte to 0 in quiescent mode. Two jobs are always separated from each other as a result of assumption of the quiescent mode between the DP master and the HCS724I. The remaining 27 bytes are irrelevant in quiescent mode.

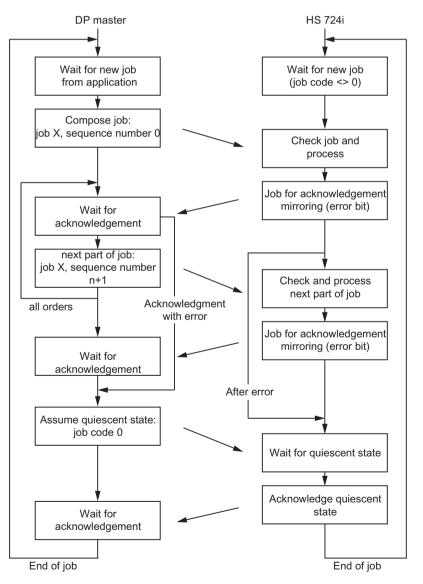


Figure 7-6 Message frame sequence

7.5.4 Cyclic data

In the cyclical data, information is transferred between the master and slave and should immediately lead to a reaction. These are data which exist once for each HCS724I. These cyclical data bytes are cyclically scanned and evaluated both in the DP master and the HCS724I.

These data are listed and explained in the tables below.

Byte	Bit	Meaning			
0	1-0	Initialization phase (information provided by the HCS724I)			
		00:	HCS724I is in the initialization phase		
		11:	Initialization phase ended, HCS724I is ready		
		01 or 10:	Initialization phase ended, HCS724I not ready		
	4-2	Feedback indic	ating the operating mode (response to preselection of the master)		
		001:	Start-up		
		010:	Heating Off		
		100:	Standby mode		
		101:	Production with profile 1 mode		
		111:	Production with profile 2 mode		
		Indication of a mode change by the HCS724I (after fault)			
		000:	Reselection of the mode is necessary		
	5	1:	General fault has occurred in the HCS724I.		
			s changes and remains until information is received via job 20: been generally collected		
	6	1:	Channel fault has occurred in the HCS724I.		
			es changes and remains until information is received via job 21: nannel has been collected		
	7	1:	Channel warning has occurred in the HCS724I.		
			s changes and remains until information is received via job 22: ling channel has been collected		
1	Byte	Line voltage correction value of the NE 724 for L1			
2	Byte	Line voltage co	rrection value of the NE 724 for L2		
3	Byte	Line voltage correction value of the NE 724 for L3			

Table 7-5 Meaning of the cyclical input data

Byte	Bit	Meaning		
0	1-0	Reserved		
	4-2	Preselectio	n of the mode (by the master)	
		001:	Start-up	
		010:	Heating Off	
		100:	Standby mode	
		101:	Production with profile 1 mode	
		111:	Production with profile 2 mode	
	7-5	Reserved		
1	Byte	Line voltage correction value from master for L1		
2	Byte	Line voltage correction value from master for L2		
3	Byte	Line voltage correction value from master for L3		

Table 7-6 Meaning of the	e cyclical output data
--------------------------	------------------------

Bits 2 to 4 in byte 0 of the cyclical data are master-control or slave-feedback bits which corresponding with each other.

7.5.5 Requests (datagram data)

Jobs in the data area of message frames are used to transfer large amounts of data between the DP master and the HCS724I when this amount of data cannot be exchanged cyclically in the input/output area of the PROFIBUS DP.

Jobs 01, 02 and 03 are initialization jobs. They must be transferred in this sequence. All other jobs can be transferred in any sequence with any number of jobs.

7.5.6 Request 01: Read module information

The purpose of this job is to read out the current status of the HCS724I during start-up and to evaluate it in the DP master application. It is a purely "reading" job.

Byte ¹		Meaning			
0	Information on the first module after the ZA 724 (first module tier)				
	0x00:	No module present			
	0x01:	LA 724I present			
	0x02 :	LA 724I HP present			
	0x10:	LA 724I SSR present			
	0xFF:	Old LA 724 found (fault)			
15	Information	n on the sixteenth module after the ZA 724 (second module tier)			
	0x00:	No module present			
	0x01:	LA 724I present			
	0x02 :	LA 724I HP present			
	0x10:	LA 724I SSR present			
	0xFF:	Old LA 724 found (fault)			
16	Information on the NE 724				
	0:	No module present			
	1:	NE 724 is present			
17	Information on the ZA 724				
	0:	Reserved			
18-23	Information on the HCS724I firmware (length 6 bytes) Version xx.yy Build zz				
begins at		g of this and all subsequent jobs relates to the message frame data area which nessage frame. In the first message frame of a job only at byte 6 because the ered here.			

Table 7-7 Read module information

7.5.7 Request 02: Download configuration parameters

This job is used to configure the HCS724I and, depending on this, corresponding initializations are carried out in the HCS724I firmware. This job is a purely "writing" job.

Byte		Meaning					
0, 1		Number of the first channel of the HCS724I modules, if an interconnected group of HCS724I modules are operated from one DP master					
2	Pulsing of	the channels in the event of a fault (PROFIBUS fault):					
	0:	None of the outputs are pulsed any more (setpoint 0%)					
	1:	The outputs retain the last value which was set					
3	Line voltag	Line voltage compensation function					
	0:	deactivated					
	1:	activated					
	This has a	n effect on all the HCS724I modules connected.					
4, 5	Nominal va	alue of the line voltage (e.g. 230 V) is used					
	• as the	normalizing value for line voltage compensation					
	• for pov	ver calculation without NE 724					
6	NE 724 int	egration time for line voltage compensation in multiples of 300 ms					
7	Configuration of diagnosis (1) Length of the pause between diagnostic cycles in multiples of the duration of one diagnostic cycle. If 255 is entered, the diagnostic cycle is switched off.						
8	Configuration of diagnosis (2) Length of the pause between tests of two channels in multiples of the duration of a channel test.						
9	Number of	repetitions until a fault is transferred to the DP master.					
	0:	Fault is detected and reported immediately					
	1 10:	Fault must have been detected in 1 to 10 successive diagnostic cycles.					
10	Selection f	or triggering the circuit-breakers					
	0:	Half-wave mode (time basis s)					
	1:	Full-wave mode (time basis 2 s)					
	2:	Half-wave mode, 0.5 % increments (time basis 2 s)					
	3:	Full-wave mode, 0.5 % increments (time basis 4 s)					
11	Selection of the operating mode for the connected heat emitters						
	0:	Operation with 230 V					
	1:	Operation with 400 V					
	Other necessary parameters or reserved for future additions (e.g. phase firing)						

Table 7-8 Load configuration parameters

7.5.8 Request 03: Execution of tests

With this job, certain tests can be triggered in the HCS724I. The result must then be evaluated in the DP master application. This job is therefore a writing and reading job. The job must be executed because, otherwise, the HCS724I cannot progress from the INIT state.

Byte	Meaning				
0	Line frequency test 1: Test is performed		Test result	of HCS724I	
			50:	50 Hz	
			60:	60 Hz	
1	Rotating fie	eld test	Test result of HCS724I		
	0: Test is not performed 1: Test is performed				
2,3	For setting the rotating field test for each LA 724I xx (there is one bit for each LA 724I module)			he rotating field test (there is one n LA 724I xx module)	
	Bit = 0:Do not perform testBit = 1:Perform test		Bit = 0:	Test without faults	
			Bit = 1:	Fault found during rotating-field test	

Table 7-9 Performance of tests

7.5.9 Requests 04, 05 and 06: Transfer of channel setpoint values

These jobs are used to transfer the setpoints for a channel. Depending on which operating mode is used, one or all jobs must be transferred to the HCS724I.

If, for example, the "start-up" or "profile 2" modes are not needed, it is sufficient to transfer the setpoints for production mode (profile 1) by means of job 04 (operating mode as in HCS724I).

Any of the setpoints can be overwritten at any time. As long as no setpoints have been transferred, the initialization value 0 % is applicable. The value range for the setpoint is from 0 to 100 (basis 1 %).

Setting bit 7 in the setpoint enables a lower-level setting of 0.5 % to be made.

Byte	Bit		Meaning of job 04	Meaning of job 05	Meaning of job 06
0, 1		Cha	nnel number		
2	6-0	Setpoint for standby and production mode with profile 1		Setpoint for production mode with profile 2	Setpoint for start-up
	7	0:	Setpoint 0		
		1: Setpoint 5			
3, 4		Cha	Channel number		

Table 7-10 Transfer of channel setpoints

7.5.10 Job 07: Field allocation

This job is used to put channels together in fields in order to change the setpoints of the channels by means of a common field factor.

There are three types of field:

- Indication of the first and last channel of a field with use of each channel
- Indication of the first and last channel of a field with use of every second channel
- Indication of all channels

A maximum of 127 fields can be defined, starting with number 1 (field 0 is reserved).

Byte	Meaning		
0	Field number		
1	Field type 0: All channels between the beginning and the end		
2, 3	Starting number, channel		
4, 5	End number, channel		
6	Field number		
7	Field type 1: Every second channel between the beginning and the end		
8, 9	Starting number, channel		
10, 11	End number, channel		
12	Field number		
13	Field type 2: List with channels		
14, 15	Number of subsequent channels		
16, 17	Number of channel a		
18, 19	Number of channel b		
18+x, 19+x	Number of channel z		

Table 7-11 Field allocation

7.5.11 Job 08: Field factor for production mode

In this job, the production value for each defined field is transferred. The value range for the production value is from 0 to 255 (basis factor 0.01). If configured, this value applies to both profiles of production mode.

If the value 100 % is exceeded when the channel setpoint and the field factor are multiplied, the value is set to 100 % and an alarm signal is sent to the DP master.

Table 7-12	Field factor for production mode
------------	----------------------------------

Byte	Meaning		
0	Field number x		
1	Production value for field x		

7.5.12 Job 09: Field factor for standby mode

In this job, the standby value for each defined field is transferred. The value range for the standby value is from 0 to 255 (basis factor 0.01).

If the value 100 % is exceeded when the channel setpoint and the field factor are multiplied, the value is set to 100 % and an alarm signal is sent to the DP master.

Byte	Meaning		
0	Field number x		
1	Standby value for field x		

Table 7-13 Field factor for standby mode

7.5.13 Request 10: Channel diagnostics

For each channel, it is possible to parameterize how the channel is to be tested. Here, a distinction is made between standard diagnosis and extended diagnosis with current measurement.

The latter is only useful for detecting heat emitters connected in parallel and, for each channel, two values are defined:

- The nominal power to be expected
- The maximum permissible deviation from this value

If there is no NE 724 in the system, the value of the parameter "Nominal value of line voltage" is used for the necessary power calculation.

After initialization, testing of a channel is always enabled. Higher-level control takes place by means of field diagnosis.

Byte	Meaning			
0, 1	Channel number x			
2	0:	Channel x is not tested		
n, n+1	Channel number y			
n+2	1:	Channel y is tested with standard diagnosis		
m, m+1	Channel number z			
m+2	2: Channel z is tested with extended diagnosis			
m+3, m+4	Rated power to be expected at a channel in [W] This parameter must have been assigned a valid value if extended diagnosis with current measurement is used.			
m+5, m+6	Permissible upward and downward deviation from the rated power in [W] This parameter must have been assigned a valid value if extended diagnosis with current measurement is used.			

Table 7-14 Channel diagnostics

7.5.14 Request 11: Field diagnostics

All fields have been blocked for diagnosis (default). For each field, diagnosis of all the channels belonging to the field can be enabled.

The type of diagnosis (standard diagnosis or diagnosis by means of current measurement) must be set separately for each channel. A channel is only tested if diagnosis has been enabled in both the channel description and the field description.

Byte		Meaning		
0	Field	Field number x		
1	Setting of diagnosis for field x:			
	0: None of the channels of field x are tested.			
	1:	1: All the channels of field x which have been enabled for the test are tested.		
		·		

Table 7-15 Field diagnosis

7.5.15 Request 20: General diagnosis

With this job, general faults can be read out of the fault buffer of the HCS724I. The job is to be triggered if a fault is indicated in the cyclical data. The fault buffer is not deleted when the fault is read out.

The job is always transferred with a fixed length and, if there is no fault, the contents of all fault bytes is "0".

Byte	Meaning			
0	Fault in	Fault in line voltage sensing for phase L1		
1	Fault in	Fault in line voltage sensing for phase L2		
2	Fault in	line voltage sensing for phase L3		
3	Error du	ring initialization of the HCS724I		
	0x01:	Old power output found		
	0x02 :	Power output module/load switching unit without ID found		
	0x04:	It was not possible to determine the frequency.		
	Several faults can be signaled at the same time.			
4	Fault on the first module (first module tier)			
	1:	Temperature warning threshold exceeded (LA 724I/LA 724I HP)		
	2:	Temperature trip threshold exceeded (LA 724I/LA 724I HP)		
	3	24 V supply voltage failed(LA 724I SSR)		
19	Fault on the first module (second module tier)			
	1: Temperature warning threshold exceeded (LA 724I/LA 724I HP)			
	2:	Temperature trip threshold exceeded (LA 724I/LA 724I HP)		
	3: 24 V supply voltage failed(LA 724I SSR)			

Table 7- 16General diagnosis

7.5.16 Request 21: Channel diagnostics

With this job, channel faults can be read out of the fault buffer of the HCS724I. The job is to be triggered if a fault is indicated in the cyclical data. The fault buffer is not deleted when the fault is read out. Only changes are transferred; a response of the length 0 means "No new information available".

Byte	Meaning			
0, 1	Chann	Channel number		
2	Chann	el fault		
	0:	Output is o.k.		
	1:	Fault type 1		
	2:	Fault type 2		
	3: Fault type 2, external 4: Fault type 3 5: Fault type 4			
	6: Fault type 5			
	(For types of fault, see "Cyclic monitoring of ZA 724I xx outputs" (Page 80))			
3, 4	Channel number			
5	Channel fault			

Table 7-17 Channel diagnostics

7.5.17 Request 22: Channel warning

With this job, alarms resulting from calculation of channel setpoints can be read out of the alarm buffer of the HCS724I. The job is to be triggered if an alarm is indicated in the cyclical data. The alarm buffer is not deleted when the alarm is read out. Only changes are transferred; a response of the length 0 means "No new information available".

Byte	Meaning			
0, 1	Channel nu	umber		
2	Channel al	larm		
	0:	0: Output is o.k.		
	1: Incorrect controller output due to setpoint x field value			
	2: Incorrect controller output due to line voltage compensation			
3, 4	Channel number			
5	Channel alarm			

Table 7-18 Channel alarm

7.5.18 Request 23: Initiate diagnostics cycle

With this job, a complete, one-off diagnostic cycle can be triggered for testing all channels. This is useful during commissioning or for heating processes which must not be affected cyclically by a diagnostic cycle. A diagnostic cycle triggered by means of this job can also be triggered if a diagnostic cycle has not been configured. The results of this cycle are not entered in the fault buffer of the HCS724I but are immediately transferred to the DP master application by means of response message frames.

The status of all channels of all power output modules detected during start-up is reported because the job does not know which channels are actually connected.

For feedback, see "Job 21: Channel diagnostics" (Page 125)

7.5.19 Request 30: Read the actual manipulated variable of the channel

Because the channel controller output is formed from the channel setpoint, the currently valid field factor and the correction value of line voltage compensation, the current value can be read out of the HCS724I.

The controller output is between 0 and 100 (basis 0.5 %).

The controller output for all channels of all the power output modules/load switching units detected during start-up is transferred.

Table 7-19 Read out current channel controller output

Byte	Bit	Meaning			
0, 1		Chan	Channel number x		
2	6-0	Controller output for channel x			
	7	0:	0: Controller output 0		
		1:	1: Controller output 5		

7.5.20 Job 31: Read out current actual channel values

This job is used to read the measured current and power values of the channel to which the job is addressed.

The measured channel values are only valid if the HCS724I has been initialized and an operating mode (production/standby; see previous section) has been activated. For the channel, extended diagnosis with current measurement must have been parameterized.

Table 7-20 Read out current actual channel values

Byte	Meaning	
0, 1 Channel number x		
2, 3	Measured current belonging to the currently measured nominal power in [10 ⁻² A]	
4, 5	Currently measured nominal power at the channel in [W]	

7.5.21 Request 32: Read actual temperature values

This job is used to read out the current measured temperature value at the LA 724I/LA 724I HP. A measured value for all detected power output modules/load switching units is transferred in each case. At the slots which are fitted with an LA 724I SSR, 0 is transferred.

If the upper temperature threshold is exceeded, the measured value is invalid.

Table 7-21 Read out current temperature values

Byte	Meaning		
0	Module numbers 1 to 16 (first and second tier)		
1, 2	Measured temperature value (0 SSR, 0xFFFF invalid)		

7.5.22 Request 40: Reset

With this job, the HCS724I restarts by carrying out a SW reset. The DP master has to reinitialize the HCS724I.

The job is acknowledged before the reset is carried out.

The job does not contain any data apart from the job code. It can always be executed.

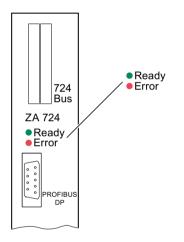
Alarm, error and system messages

8.1 Diagnostics with LED display

8.1.1 LED indications on the ZA 724

ZA 724

LED indications on the ZA 724:



8.1 Diagnostics with LED display

Status and faults indicated by LEDs on the ZA 724

The ZA 724 has 2 LEDs for indicating the current operating state:

- LED Ready (green)
- LED Error (red)

The following table shows the status and fault indications shown on the ZA 724.

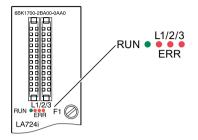
LED Error	LED Ready	Description		
On	Off	The firmware has detected a serious problem (FEPROM contents are not valid) or has received - via the serial interface - a request for a firmware update and is now in the Flash loader.		
		After establishment of the PROFIBUS connection, the HCS724I sends zeros in the cyclical data in order to show that initialization by the DP master is necessary. The DP master (S7 CPU) must send three initialization jobs. These are jobs 01, 02 and 03. These jobs are executed when the S7 software is used by the FC_INIT function.		
On	Flashing	Initialization of the hardware and firmware and the PROFIBUS connection The firmware waits until the DP master detects the HCS724I and has included it in the PROFIBUS cycle.		
On	On	Start-up of the HCS724I HCS724I has been detected by the DP master and is waiting for initialization jobs.		
Off	On	The initialization phase has ended. The HCS724I reports back the result in a cyclical bit. The HCS724I is now ready. Data exchange with the DP master is possible: Parameters/diagnosis by means of jobs, operating mode selection by means of the cyclical data.		
Off	Flashing	If communication with the DP master breaks down, the HCS724I assumes a safe status and waits for communication to be restarted. The data which have been configured and parameterized are retained. The DP master does not carry out an initialization after communication has restarted.		

Table 8-1 Status and fault indications on the ZA 724

8.1.2 LED indications on the LA 724I/LA 724I HP

LA 724I/LA 724I HP

LED indications on the LA 724I/LA 724I HP:



Status and fault indications by LEDs on the LA 724I/LA 724I HP

The LA 724I/LA 724I HP has 4 LEDs for indicating the current operating state:

- LED RUN (green)
- LEDs ERR L1 / L2 / L3 (red)

The following table shows the status and fault indications on the LA 724I/LA 724I HP.

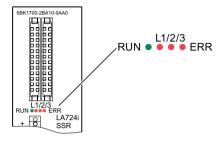
LED RUN	LED ERR L1	LED ERR L2	LED ERR L3	Meaning
Off	Off	Off	Off	Load switching unit is not operating It was not detected by the ZA during start-up
Off	x	x	x	The upper temperature threshold has been exceeded; power outputs are deactivated.
Flashing	x	x	x	Load switching unit is operating The temperature alarm threshold has been exceeded.
On	Off	Off	Off	Load switching unit is operating There are no channel faults
On	On	x	x	Load switching unit is operating At least 1 channel of phase L1 is defective
On	x	On	x	Loas switching unit is operating At least 1 channel of phase L2 is defective
On	x	x	On	Load switching unit is operating At least 1 channel of phase L3 is defective
x = Status not relevant				

Table 8- 2	Status and fault indications on the LA 724I/LA 724I HP

8.1.3 LED indications on the LA 724I SSR

LA 724I SSR

LED indications on the LA 724I SSR:



Status and fault indications on the LA 724I SSR

The LA 724I SSR has 4 LEDs for indicating the current operating state:

- LED RUN (green)
- LEDs ERR L1 / L2 / L3 (red)

The following table shows the status and fault indications on the LA 724I SSR.

LED RUN	LED ERR L1	LED ERR L2	LED ERR L3	Meaning
Off	Off	Off	Off	Load switching unit is not operating It was not detected by the ZA during start-up
Off	х	х	х	24 V supply voltage has failed
On	Off	Off	Off	Load switching unit is operating There are no channel faults
On	On	x	x	Load switching unit is operating At least 1 channel of phase L1 is defective
On	х	On	x	Load switching unit is operating At least 1 channel of phase L2 is defective
On	x	x	On	Load switching unit is operating At least 1 channel of phase L3 is defective
x = Status not relevant				

Table 8-3 Status and faults indicated by LEDs on the LA 724I SS

8.2 Error messages in the S7 environment

The following tables show the codes of all faults which are reported by means of the S7 software during communication with the HCS724I.

Error messages from the S7 software

Table 8-4 Error messages from the S7 software

Error code	Meaning		
System fault			
808x	System fault in respect of the external DP interface connection		
8090	 For the logical base address indicated, you have not configured a module, you have exceeded the maximum permissible length of the consistent data, or you have not entered the start address in the LADDR parameter in hexadecimal format. 		
8092	A type other than BYTE has been specified in the ANY reference.		
8093	No DP module from which you can read consistent data was found at the logical address declared at LADDR.		
80A0	The system has detected an I/O access fault (reading access).		
80A1	The system has detected an I/O access fault (writing access).		
80B0	Failure of a slave connected to the external DP interface connection		
80B1	The declared length of the target area is unequal to the useful data length configured with <i>STEP 7</i> .		
80B2	System fault in respect of the external DP interface connection		
80B3	System fault in respect of the external DP interface connection		
80C0	The data have not been read yet by the module		
80C1	The module has not yet processed the data of the previous write job.		
80C2	System fault in respect of the external DP interface connection		
80Fx	System fault in respect of the external DP interface connection		
85xy	System fault in respect of the external DP interface connection		
87xy	System fault in respect of the external DP interface connection		
Program	status/program error		
A000	Job is still being processed (This message does not have to be acknowledged.)		
A001	Invalid job code transferred to FC_HS_AUFTRAG		
A002	There are no channels or too few fields have been parameterized.		
A003	Channel number 0 is not permissible.		
A004	In the DB_HS_DIAG or DB_HS_IBS data block, an invalid number has been entered for the HCS724I.		
A005	In the DB_HS_DIAG or DB_HS_IBS data block, an incorrect channel number 0 has been entered.		
A007	FC_HS_RESET can only be started if the "Heating Off" mode has been activated and no job is being processed.		
Notice n	nessage		
AFFF	FC_HS_INIT is necessary, at least one HCS724I has not been initialized		

8.2 Error messages in the S7 environment

Error messages of the HCS724I

Error code	Meaning
A081	General: incorrect job code
A082	General: incorrect message frame header in the first message frame
A083	General: incorrect message frame header in the second message frame
A084	General: It is only permissible for the job to be executed during INIT
A085	General: Only reset job is permissible
A086	General: It is only permissible for the job to be executed after INIT
A08A	FC_HS_RESET job: Incorrect job length
A090	FC_HS_INIT job: incorrect job length of DP job 02
A091	FC_HS_INIT job: Error in the parameter of first channel number
A092	FC_HS_INIT job: Error in substitute values parameter
A093	FC_HS_INIT job: Error in pulsing mode parameter
A094	FC_HS_INIT job: Error in parameter for number of repeat diagnoses
A095	FC_HS_INIT job: Error in parameter for mains connection
A09A	FC_HS_INIT job: Incorrect job length of DP job 03
A09B	FC_HS_INIT job: Error in test setting
A0A0	Channel setpoint 1 job: Incorrect job length
A0A1	Channel setpoint 1 job: Incorrect channel number
A0A2	Channel setpoint 1 job: Incorrect setpoint (0.5 % setting is not permissible due to type of pulsing)
A0A3	Channel setpoint 1 job: Incorrect setpoint (> 100 %)
A0AA	Channel setpoint 2 job: Incorrect job length
A0AB	Channel setpoint 2 job: Incorrect channel number
A0AC	Channel setpoint 2 job: Incorrect setpoint (0.5 % setting is not permissible due to type of pulsing)
A0AD	Channel setpoint 2 job: Incorrect setpoint (> 100 %)
A0B0	Channel setpoint start-up job: Incorrect job length
A0B1	Channel setpoint start-up job: Incorrect channel number
A0B2	Channel setpoint start-up job: Incorrect setpoint (0.5 % setting is not permissible due to type of pulsing)
A0B3	Channel setpoint start-up job: Incorrect setpoint (> 100 %)
A0C0	Field definition job: Incorrect field number
A0C1	Field definition job: Incorrect field type
A0C2	Field definition job: Incorrect channel number
A0C3	Field definition job: First channel number is larger than the second channel number (field types 0 and 1)
A0CA	Field factor production job: Incorrect job length
A0CB	Field factor production job: Incorrect field number
A0DA	Field factor standby job: Incorrect job length
A0DB	Field factor standby job: Incorrect field number

Table 8-5 Error messages of the HCS724I

8.2 Error messages in the S7 environment

Error code	Meaning
A0BA	Diagnosis setting channel job: Incorrect job length
A0BB	Diagnosis setting channel job: Incorrect setting for the type of diagnosis
A0D0	Diagnosis setting channel job: Incorrect job length
A0D1	Diagnosis setting field job: Incorrect field number
A0D2	Diagnosis setting field job: Incorrect setting for the type of diagnosis

8.3 Error messages in the non-S7 environment

8.3 Error messages in the non-S7 environment

The following table lists the numbers of errors which can occur during the transfer of jobs. The error is indicated when the job is acknowledged as described in "Message frame data" (Page 114).

Error code	Meaning		
0x80	Everything o.k.		
0x81	Incorrect job code		
0x82	Incorrect message frame header in the first message frame		
0x83	incorrect message frame header in the following message frame		
0x84	It is only permissible for the job to be executed during INIT		
0x85	Only reset job is permissible		
0x86	It is only permissible for the job to be executed after INIT		
0x8A	Job 40: Incorrect job length		
0x90	Job 02: Incorrect job length		
0x91	Job 02: Error in the parameter of first channel number		
0x92	Job 02: Error in substitute values parameter		
0x93	Job 02: Error in pulsing mode parameter		
0x94	Job 02: Error in parameter for number of repeat diagnoses		
0x95	Job 02: Error in parameter for mains connection		
0x9A	Job 03: Incorrect job length		
0x9B	Job 03: Error in test setting		
0xA0	Job 04: Incorrect job length		
0xA1	Job 04: Incorrect channel number		
0xA2	Job 04: Incorrect setpoint (0.5 % setting is not permissible due to type of pulsing)		
0xA3	Job 04: Incorrect setpoint (> 100 %)		
0xAA	Job 05: Incorrect job length		
0xAB	Job 05: Incorrect channel number		
0xAC	Job 05: Incorrect setpoint (0.5 % setting is not permissible due to type of pulsing)		
0xAD	Job 05: Incorrect setpoint (> 100 %)		
0xB0	Job 06: Incorrect job length		
0xB1	Job 06: Incorrect channel number		
0xB2	Job 06: Incorrect setpoint (0.5 % setting is not permissible due to type of pulsing)		
0xB3	Job 06: Incorrect setpoint (> 100 %)		
0xC0	Job 07: Incorrect field number		
0xC1	Job 07: Incorrect field type		
0xC2	Job 07: Incorrect channel number		
0xC3	Job 07: First channel number is larger than the second channel number (field types 0 and 1)		
0xCA	Job 08: Incorrect job length		
0xCB	Job 08: Incorrect field number		

Table 8-6 Error messages from the HCS724I during transfer of jobs

8.3 Error messages in the non-S7 environment

Error code	Meaning
0xDA	Job 09: Incorrect job length
0xDB	Job 09: Incorrect field number
0xBA	Job 10: Incorrect channel number
0xBB	Job 10: Incorrect setting for the type of diagnosis
0xD0	Job 11: Incorrect job length
0xD1	Job 11: Incorrect field number
0xD2	Job 11: Incorrect setting for the type of diagnosis

8.4 Troubleshooting

Faults during operation

In the event of faults during operation, the heater controller behaves as indicated in the following table.

CAUTION

Damage to property if error messages are ignored

Many faults can result in significant damage to property. Identify the fault using the fault list below and respond via your application.

Faults	Response	Actions
Serious faults	Automatic hardware reset with restart of the ZA 724 (initialization)	Transfer all jobs again to the ZAs
Bus fault (timeout, e.g. due to defective bus cable or failure of the S7 CPU)	All the outputs are reset or retain their values depending on the parameterization	 Power down the machine if necessary Reactivate the operating mode
Channel fault (module fault, Triac short-circuit, external fault)	Signal sent to DP master	Switch off machineRectify faultRestart machine
Overtemperature; 1st stage (92 °C)	Signal sent to DP master	Find cause (e.g. check cooling system) and rectify
Overtemperature; 2nd stage (100 °C)	Power outputs are switched off	 Switch off machine Find cause (e.g. check cooling system) and rectify Restart machine
No 24 V supply voltage for the LA 724I SSR	Control outputs SSR are switched off	 Check 24 V power supply Reactivate the operating mode
Value error The controller output has exceeded the 100 % value.	Signal sent to S7 CPU Processing is then continued with 100 % controller output.	Test and adjust program

Table 8-7 Faults during operation

Overtemperature

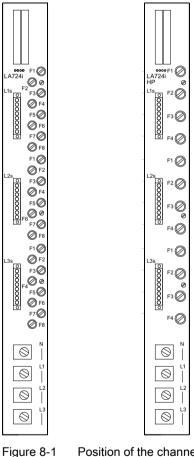
Overtemperature on an LA 724I / LA 724I HP power output module can occur if the ambient temperature or switching capacity is too high (see "Ambient conditions for all HCS724I components" (Page 150), "Technical data of the LA 724I" (Page 144) and "Technical data of the LA 724I HP" (Page 146)) or a fan has failed.

Fuse blown

Each channel of the LA 724I/LA 724I HP power output module has a 5 A quick-response/16 A T fuse which blows if there is a short-circuit at the output, for example.

These channel fuses are located directly on the front of the power output module (see illustration below).

The three phase leads are each protected with a 32/40 A fuse.





8.4 Troubleshooting

Replacing defective channel fuses

WARNING

Before changing a fuse, you must isolate the load circuit from the supply.

CAUTION

Use only the prescribed fuse types. If you use the LA 724I/LA 724I HP with fuses that are not permissible, the device could be destroyed.

- 1. Remove the cover of the fuse holder.
- 2. Replace the fuse with one of the same type.
- 3. Reattach the cover.

Note

The ordering data for the fuses can be found in "Order numbers > Accessories" (Page 153).

Defective phase fuses

If a phase fuse is defective, the LA 724I/LA 724I HP must be sent to the manufacturer for repair.

Reaction to interruption of the supply voltage

An interruption of the supply voltage for the ZA lasting longer than 20 ms triggers a restart of the HCS724I heater controller.

The outputs of the LA 724I xx power output modules/load switching units are reset after voltage recovery.

The HCS724I must be reparameterized (see "Initialization (start-up)" (Page 69)).

Maintenance and service

9.1 Loading the firmware for the HCS724I

As-delivered condition of the ZA 724 central interface module

When the ZA 724 central interface module is delivered, the current firmware has already been loaded on the module.

In the event of a fault or if an update is necessary, you can load the firmware by means of the HSSETUP.EXE program which is supplied with the product.

NOTICE

The ZA 724 is delivered with the current firmware version and is ready to switch on.

You only have to carry out the steps described below if the ZA 724 has to be updated with a different firmware version.

Prerequisite for loading the firmware

You need a null modem cable for loading the firmware. If you do not have such a cable, a cable with the following pin assignment is sufficient:

RxD 2-----3 TxD

TxD 3-----2 RxD

Gnd 5-----5 Gnd

Note

If you use a 25-pin connector, Pin 7 is to be used for Gnd instead of Pin 5 !

9.1 Loading the firmware for the HCS7241

To install the firmware, proceed as follows:

- 1. Switch off the ZA 724.
- 2. Connect the RS 232 serial interface of the ZA 724 to COM1 or COM2 on the PC, using the interface cable.
- 3. Start HSSETUP.EXE and enter the interface which is used on the PC (COM1 or COM2).
- 4. Switch the ZA 724 on.

All the remaining steps are carried out automatically. The progress of programming can be followed on the PC.

After the firmware has been downloaded, the ZA 724 carries out a restart.

Note

The load voltage must be disconnected when the firmware is being loaded.

Note

The Flash loader in the FEPROM of the ZA 724 is normally not overwritten. If the voltage supply or the serial connection is interrupted before the end of the loading process, the process can be repeated.

Technical specifications

10.1 Technical data ZA 724

Table 10-1 Technical specifications for the ZA 724

Supply voltage	230 VAC
Permitted range	187 V to 264 V
Rated frequency	50 / 60 Hz
Permitted range	47 Hz to 63 Hz
Non-periodic overvoltage (acc. to EN 60204, Part 1)	
Limit value	2 x U _{rated}
Duration	1.5 ms (single pulse)
Rise/fall time	500 ns to 500 μs
Momentary voltage interruption (initial conditions: Lower limit of rated voltage = 187 V)	
Interruption time	Max. 20 ms
Restoration time	minimum 1 s
Events per hour	Max. 10
Power consumption	Typically 35 W, maximum 46 W
Dimensions of the ZA 724 (W x H x D)	50 mm x 480 mm x 210 mm
Approx. weight	4.2 kg

10.2 Technical data for NE 724

Table 10-2 Technical data for NE 724

Voltage supply	230 V AC
Permitted range	187 V to 264 V
Rated frequency	50/60 Hz
Permitted range	47 Hz to 63 Hz

10.3 Technical data of the LA 7241

10.3 Technical data of the LA 724I

Outputs per power output module (LA 724I)	24
Galvanic isolation from control section	by means of opto-triac and optocoupler which are specified in acc. with VDE 0884
Insulating voltage	
• Opto-triac	5 kV
Optocoupler	5.3 kV (to EN60747-5-2)
Galvanic isolation of power outputs from each other	No
Load voltage (for star circuit)	
Nominal value	230 V AC
Permitted range	187 to 264 V (TN system)
Frequency	50 / 60 Hz (47 to 63 Hz)
Total current per phase and module	max. 32 A
Current per conductor rail	120 A, maximum
Output voltage	Full or half-waves switched during zero passage
Output current per channel	
Maximum value	5 A
Residual current	max. 7 mA
Power loss	Typ. P _V = 0.7 W / A • I + 0.18 W / A ² • I ²
	(I = control current in the channel)
Switching capacity (100 % simultaneity)	Max. 1150 W per channel at 230 V
	Note: The total current per phase of 32 A must not be exceeded. Min. 75 W per channel
Parallel connection of heat emitters to one channel	
• Number	Тур. 5
Minimum power per heat emitter	200 W
Total switching capacity per LA 724I (T $_{\rm U}$ = 40 °C)	
without forced ventilation	14.4 kW
with forced ventilation	22 kW
Load type	Resistive load with a maximum of 15 times the cold current. In the case of Flash emitters, this can lead to a reduction of the permissible switching capacity. These emitters can be measured at Siemens.
Overload	Five times the rated current for 20 ms

10.3 Technical data of the LA 724I

Thermal protection	Yes (by NTC thermistor)	
	92 °C ±3 °C:	Alarm to higher-level controller via PROFIBUS DP
	100 °C ±3 °C:	Deactivation of the power outputs
Short-circuit protection	One 5 A F/250	V fuse per output
Overvoltage protection	By Transil diod	es
Connecting cable	R _{max} = 14 Ω (this ensures s	hort-circuit protection)
Dimensions of the LA 724 (W x H x D)	50 mm x 480 m	nm x 210 mm
Approx. weight	5.3 kg	

10.4 Technical data of the LA 724I HP

10.4 Technical data of the LA 724I HP

Table 10- 4	Technical data	of the LA 724I HP

Outputs per power output module (LA 724I HP)	12	
Galvanic isolation from control section	by means of opto-triac and optocoupler which are specified in acc. with VDE 0884	
Insulating voltage		
Opto-triac	5 kV	
Optocoupler	5.3 kV (to EN60747-5-2)	
Galvanic isolation of power outputs from each other	No	
Load voltage (for star and delta circuit configuration)		
Nominal value	230 V / 400 V AC	
Permitted range	187 V to 264 V / 340 V to 460 V (TN system)	
• Frequency	50 / 60 Hz (47 to 63 Hz)	
Total current per phase and module	max. 40 A	
Current per conductor rail	120 A, maximum	
Output voltage	Full or half-waves switched during zero passage	
Output current per channel		
Maximum value	10 A Note:	
	16 A T/500 V fuses are used for fuse protection	
	These connecting cable must be appropriately dimensioned.	
Residual current	max. 7 mA	
Power loss	Typ. P _V = 0.7 W / A • I + 0.16 W / A ² • I ²	
	(I = control current in the channel)	
Switching capacity (100 % simultaneity)	Max. 2300 W per channel at 230 V	
	Max. 4000 W per channel at 400 V	
	Note: The total current per phase of 40 A must not	
	be exceeded.	
	Min. 75 W per channel	
Parallel connection of heat emitters to one channel		
Number	Тур. 5	
Minimum power per heat emitter	200 W	
Total switching capacity per LA 724I HP (TU = 40 °C)		
Total switching power of the delta connection		
without forced ventilation	• 22.6 kW	
with forced ventilation	• 36.5 kW	

10.4 Technical data of the LA 724I HP

Total switching power of the star connection		
without forced ventilation	• 13 kW	
with forced ventilation	• 21 kW	
Load type	Resistive loads current	with max. 15 times the cold
Overload	Five times the rated current for 20 ms	
Thermal protection	Yes (by NTC thermistor)	
	92 °C ±3 °C:	Alarm to higher-level controller via PROFIBUS DP
	100 °C ±3 °C:	Deactivation of the power outputs
Short-circuit protection	Per output: One 16 A T/500 V fuse	
	Note:	
		permissible output current is tection is implemented by A fuse.
Overvoltage protection	By Transil diodes	
Connecting cable	R_{max} = 14 Ω (this ensures short-circuit protection)	
Dimensions of the LA 724I HP (W x H x D)	50 mm x 480 m	nm x 210 mm
Approx. weight	5.3 kg	

10.5 Technical data of the LA 724I SSR

10.5 Technical data of the LA 724I SSR

Outputs per load switching unit (LA 724I SSR)	24
Galvanic isolation from control section	by means of opto-couplers which are specified in acc. with VDE 0884
Insulation voltage of the optocouplers	5.3 kV (to EN60747-5-2)
Galvanic isolation of diagnostic inputs from each other	No
Diagnosis voltage (for star and delta circuit configuration)	
Nominal value	230 V / 400 V AC
Permitted range	187 V to 264 V / 340 V to 460 V
Frequency	50 / 60 Hz (47 to 63 Hz)
Total current per phase and module	See "SM 724I current measuring module" (Page 38)
Current per conductor rail	120 A, maximum
24 V supply voltage for pulsing the SSR	
Nominal value	24 V
Permitted range	20.4 V to 28.8 V
• Fuse	1.5 A/250 V fuse link (external)
Triggering voltage for the SSR	
at rated supply voltage	Typ. 23.3 V min. 22 V
Triggering current	Max. 50 mA (per control output)
Length of cable	
Control cable for the SSR	30 m, maximum
SM 724I connecting cable	30 m, maximum
24 V supply voltage	10 m, maximum Note: Cables not to be laid outside buildings
Dimensions of the LA 724I SSR (W x H x D)	50 mm x 480 mm x 210 mm
Approx. weight	3.3 kg

Note

Cables carrying low voltage must be laid separated from cables carrying mains voltage (e.g. in a separate cable duct).

As an alternative, shielded cables are possible for low-voltage connections. All cables can then be laid in a shared cable duct.

Note

The ordering data for the recommended solid state relays can be found in "Order numbers > Accessories" (Page 153).

10.6 Technical data of the LM 724

Table 10- 6	Technical data of the LM 724
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Installation	1 fan module for every 2 modules (2 x LA 724l xx or 1 x ZA 724 and 1 x 724l xx)
Supply voltage	
Nominal value	230 VAC
Permitted range	187 V to 264 V
Frequency	50 / 60 Hz (47 to 63 Hz)
Power consumption	6 W
Volumetric rate of air flow	45 m³ / h
Dimensions of the LM 724 (W x H x D)	100 mm x 50 mm x 162 mm
Approx. weight	0.8 kg

10.7 Technical data of the SM 724I

Table 10-7 Technical data of the SM 724I

Rated current	
• primary	3 x 400 A
• secondary	3 x 200 mA
Precision	approx. 1 %
Frequency band	50 Hz to 400 Hz
Cable entry openings	Ø 22 mm
Dimensions of the SM 724I (W x H x D)	150 mm x 77.5 mm x 115 mm
Approx. weight	1.25 kg

10.8 Ambient conditions for all HCS724I components

10.8 Ambient conditions for all HCS724I components

Table 10-8 Clim	itic ambient	conditions
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Operating temperature	
Permitted range	0 °C to 55 °C
Relative humidity at 25 °C	95 %
Temperature gradient	≤ 10 K/h
Storage temperature	
Permitted range	-40 °C to +70°C
Relative humidity at 25 °C	95 %
Temperature gradient	≤ 20 K/h
Air pressure during operation	
• Minimum	860 hPa (= 1500 m above sea-level) (reduced cooling performance at lower air pressure)
• Maximum	1080 hPa
Air pressure during storage	
• Minimum	660 hPa (= 3500 m above sea-level)
Maximum	1080 hPa
Ventilation	Separate or forced ventilation

Table 10-9 Mechanical ambient conditions

Vibration during operation (stationary use)	EN 60068-2-6 Test Fc (10 cycles per axis)
• 10 Hz to 58 Hz	0.075 mm amplitude
• 58 Hz to 150 Hz	9.8 m/s ² (= 1 g constant acceleration)
Vibration during transport/storage (in delivery packaging)	EN 60068-2-6 Test Fc (10 cycles per axis)
• 5 Hz to 9 Hz	3.5 mm amplitude
• 9 Hz to 500 Hz	9.8 m/s ² (= 1 g constant acceleration)
Shock during operation (stationary use)	IEC 60068-2-27 test, Ea
	150 m/s ² ≈ 15 g, half-sine
	11 ms duration
	3 shocks per axis and direction
Shock during transport/storage	EN 60068-2-29 test, Eb
(in delivery packaging)	250 m/s ² ≈ 25 g, half-sine
	6 ms duration
	1000 shocks per axis and direction

10.8 Ambient conditions for all HCS724I components

The HCS724I is installed in the switching cabinet	
Radio interference suppression (emitted interference)	Limit value class A in accordance with EN 55011 Group 1
Immunity to conducted interference (burst)	according to EN 61000-4-4
AC voltage supply cables	2 kV with switching network
Signal lines that exit the device	2 kV with clamp
Immunity to conducted interference (HF-irradiation)	acc. to EN 61000-4-6 10 V (0.15 MHz to 80 MHz)
Interference immunity against static electricity (ESD)	according to EN 61000-4-2
Contact discharge	4 kV
Air discharge	8 kV
Immunity to RF interference	EN 61000-4-3 3 V/m (1.4 GHz to 2.0 GHz) 1 V/m (2.0 GHz to 2.7 GHz)
Immunity to high-energy pulses (surge)	according to EN 61000-4-5
 Mains supply cables symmetric asymmetric 	1 kV 2 kV
PROFIBUS cable - asymmetric	1 kV

Table 10- 10	Electromagnetic compatibility
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10.8 Ambient conditions for all HCS724I components

Order numbers

11.1 Components of the HCS724I

Table 11-1 Order numbers of the components of the HCS724I

Components	Order No.:
ZA 724 central interface module	6BK1700-2BA30-0AA0
LA 724I power output module	6BK1700-2BA00-0AA0
LA 724I HP power output module	6BK1700-4BA70-0AA0 1)
LA 724I SSR load switching unit	6BK1700-2BA10-0AA0
NE 724 line-voltage sensing submodule	6ES7171-1XX00-6AA0
LM 724 fan module	6ES7171-3AA00-0AA0
SM 724I current measuring module	6BK1700-2BA40-0AA0

¹⁾ Replaces 6BK1700-2BA20-0AA0

11.2 Accessories

Table 11-2	Order numbers of the accessories for the HS 724i

Accessories	Order No.:	
ZA 724		
Heater controller flat ribbon cable for connection of 2nd tier	6ES7171-1XX00–5AA0	
LA 724I/LA 724I HP		
Mating connector for connecting heat emitters (three connectors: L1s, L2s, L3s) Made by Phönix, IC 2.5/8STF-5.08	Siemens I IA CE: 40018384 Phönix: 1825378	
Replacement fuses for LA724I (for 6BK1700-2BA00-0AA0)	Siemens I IA CE: 200021116 Littlefuse: 216005.MA000	
5 A quick-response / 250 V Ceramic housing 5 x 20 mm		
Replacement fuses for LA 724I HP (for 6BK1700-4BA70-0AA0) 16 A T / 500 V	Siemens I IA CE: A5E01204540 SIBA: 189140.16SA	
Ceramic housing 6.3 x 32 mm		
Replacement fuses for LA 724I HP (for 6BK1700-2BA20-0AA0)	Siemens I IA CE: A5E02183242 SIBA: 7006584.16	
16 A gRL/400 V		
Ceramic housing 6.3 x 32 mm Busbar for connecting components	6ES7171-2XX00-6DA0	

11.2 Accessories

Accessories	Order No.:
LA 724I SSR	
Mating connector for 24 V supply (one connector) Made by Weidmüller, BL 3.5/2F	Siemens I IA CE: A5E00210675 Weidmüller: 160664
Mating connector for connecting the SSR (three connectors: SSR L1, SSR L2, SSR L3) Made by Weidmüller, BL 3.5/8	Siemens I IA CE: A5E00043661 Weidmüller: 159742
Mating connector for connecting the SM 724I current measuring module (Current Sense) (one connector)	Siemens I IA CE: A5E00210670 Weidmüller: 159740
Made by Weidmüller, BL 3.5/6	
Mating connector for voltage monitoring of the phase Lx (three connectors: L1d, L2d, L3d)	Siemens I IA CE: 40018384 Phönix: 1825378
Made by Phönix, IC 2.5/8STF-5.08	SIDILIS SC appricanduator relay/contactor
Solid State Relay (SSR)	SIRIUS SC semiconductor relay/contactor e.g. 3RF2350-1AA02: semiconductor contactor 50 A, 40 °C, control voltage 24 V, screw-type connection
Busbar for connecting components	6ES7171-2XX00-6DA0

Note

The mating connnectors are not included in the scope of supply. You have to order these separately.

Appendix



A.1 Recycling and disposal

The HCS724I can be recycled owing to its low pollutant content. For ecologically compatible recycling and disposal of your old device, contact a certificated disposal service for electronic scrap.

A.2 Service & Support

Contacts

Please talk to your Siemens contact (<u>http://www.siemens.com/automation/partner</u>) at one of our agencies or local offices if you have any questions about the products described here and do not find the answers in this manual.

Technical Support

You can access technical support for all IA/DT projects via the following:

- Phone: + 49 (0) 911 895 7222
 (€ 0.14 /min. from the German landline network, deviating mobile communications prices are possible)
- Fax: + 49 (0) 911 895 7223
 (€ 0.14 /min. from the German landline network, deviating mobile communications prices are possible)
- E-mail (mailto:support.automation@siemens.com)
- Internet: Online support request form: (<u>http://www.siemens.com/automation/support-request</u>)

Appendix

A.2 Service & Support

Industrial Automation and Drive Technologies Service & Support

You can find various services on the Support homepage (http://www.siemens.com/automation/service&support) of IA/DT on the Internet.

There you will find the following information, for example:

- Our newsletter containing up-to-date information on your products.
- Relevant documentation for your application, which you can access via the search function in "Product Support".
- A forum for global information exchange among users and specialists.
- Your local contact for IA/DT on site.
- Information about on-site service, repairs, and spare parts. Much more can be found under "Our service offer".

Heater controller homepage

For general information about the Siemens AG heater controllers, visit Homepage (www.siemens.com/hcs).

Online catalog and ordering system

The online catalog and the online ordering system can also be found on the Industry Mall Homepage (http://www.siemens.com/industrymall).

Training center

We offer appropriate courses to get you started. Please contact your local Training Center or the Central Training Center in

D-90327 Nuremberg.

Phone: +49 (0) 180 523 56 11 (\in 0.14 /min. from the German landline network, deviating mobile communications prices are possible)

For information about courses, see the SITRAIN homepage (http://www.sitrain.com).

FAQs

You can find the answers to frequently asked questions on the Internet FAQs (http://support.automation.siemens.com/WW/view/en/10807371/133000).

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