Movement is executed in dead man operation : The robot only moves if the key is pressed. In order to move several axes at the same time, several axes can be pressed at the same time.

Speed of the movement can be changed with the override regulator also during movement.

➪

7.5.2 Movement with the mouse

The 6D-mouse allows intuitive movement of the robot into any direction. The 6D-mouse, however, cannot completely replace movement of the robot via teach pendant keys.

Nothing changes with input of space points into a user program, consequently no contours are stored.

The robot can only be moved in the cartesian movement modes by means of the 6D-mouse.

By blocking the corresponding movement mode (either translatory or rotatory) an unintended change of the orientation angles or of the TCP coordinates during movement via 6D-mouse can be prevented. There are two menu items for this purpose: Mouse Trans and Mouse Rotat under the PHG-key„ Coord'.

For movement via the mouse, the same requirements must be met as for movement via “POSITION CONTROL”:

- Robot synchronous.
- Drives switched on.
- Cartesian movement mode selected.

➪ Move mouse into the desired direction

7.5.3 Change/enter positions

7.5.3.1 Edit position

➪ 

<Pos edit>

➪ 

1 TABLE OF CONTENTS

2 DESCRIPTION

8 Selection menus for function keys
9 Function keys
10 General keyboard (LED's of active keys light)
11 Special keys (call macro)

3 QUALIFICATION OF THE PERSONNEL

4 GENERAL SAFETY INSTRUCTIONS

Tab. 4-2: List of graphical symbols

	Shearing off		Inflammable
	Ear protection		Hot surface
	Electrical current		Laser
	Entanglement		Squeezing
	Eye protection		General danger

4.1.4 Skilled personnel

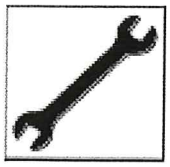

Fig. 4-1: Symbol for skilled personnel

This symbol identifies works which must only be executed by skilled personnel.

4.2 INSTRUCTIONS CONCERNING SAFETY REGULATIONS

We are not liable for damgage and failures in operation resulting from disregard of the operating manual.

6. When purchasing lubricants, the corresponding safety data sheets have to be requested from the lubricant manufacturer.

   These safety data sheets contain the complete information about handling, use and waste disposal of the lubricants.

4.2.2.2 Special safety instructions for the insured

1. Prior to repair or maintenance works in the production cells, switch off all drives and controls.
2. Prior to works at the machine, switch off the main switch and secure it against unauthorized switch-on!
3. The insured also must take care that only authorized persons work at the machine.
4. Any method of working which impairs the safety at the machine must be omitted, particularly the safe functioning of components of the
   - Mechanics
   - Hydraulics / Pneumatics
   - Electrics
5. The insured must inform the user immediately of changes at the machine which impair safety.
6. Never dismount or disable safety equipment.

   If safety devices are disabled while the machine is in a production cycle, the insured or third person is no longer sufficiently protected against operation dangers. The insured or third person is threatened by severe, in the extreme case lethal, risk of injury.
7. Prior to dismounting safety equipment for repair or maintenance works the machine must be switched off. The safety equipment must be remounted immediately after completion of the repair or maintenance works.
8. Works at the electric unit must only be executed by skilled personnel as a matter of principle. For all works at the electric unit observe the national safety regulations!
9. If hydraulic medium escapes under pressure there is risk of injury.
10. For operation of machines equipped with HFC hydraulic units (hydraulic oil) there is risk of fire breaking out if there are flames close to the machine.

5 PREREQUISITES FOR OPERATION OF THE ROBOT INSTALLATION

6 INSTALLATION

6.1 ENERGY SUPPLY

Establish energy supply acc. to the information on the type plate mounted on the control cabinet, resp. acc. to the information given in the circuit diagrams.

6.2 START-UP

6.2.1 Connect installation

➪ Connect the robot/the peripheral units with the delivered cables via the plug connections of the control cabinet.

➪ Connect teach pendant.

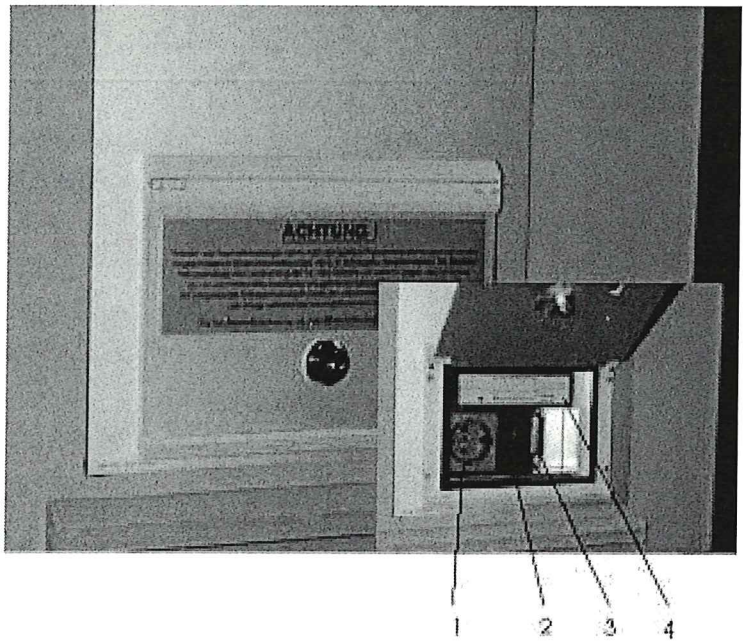

Fig. 6-1: Plug connections control cabinet - front side

1 Voltage supply for laptop (230 V)
2 DNC connection
3 PHG connection
4 disk drive

For further information about start-up of your installation please refer to the operating manuals of the robot and of the corresponding peripheral equipment.

7 OPERATION

7.1.2 Keyboard of the PHG (teach pendant)

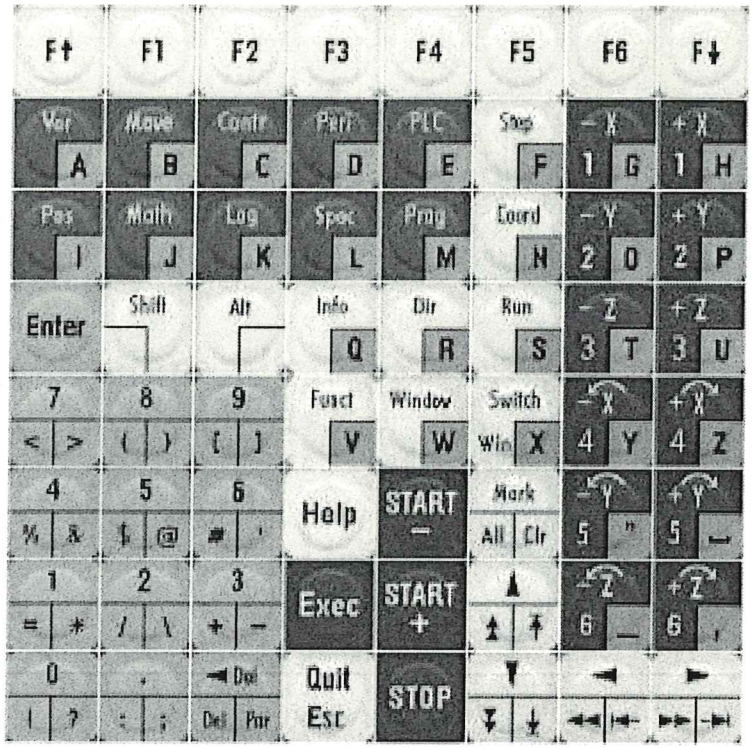

Fig. 7-1: Keyboard of the portable teach pendant

7.1.3 Change contrast of the display

The adjusted and acknowledged value is stored in the control.

- 
- 
-  “Contrast”

  Message: „Adjust the contrast at the override regulator and terminate with QUIT'
- Adjust contrast
- 

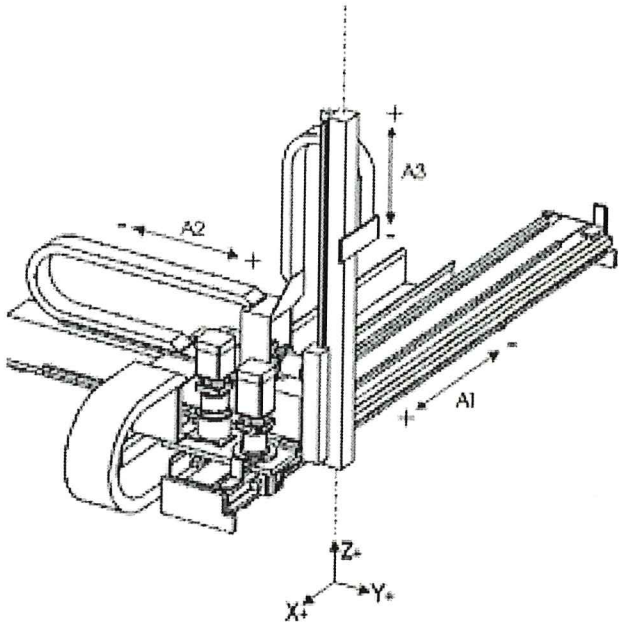

Fig. 7-4: RL series

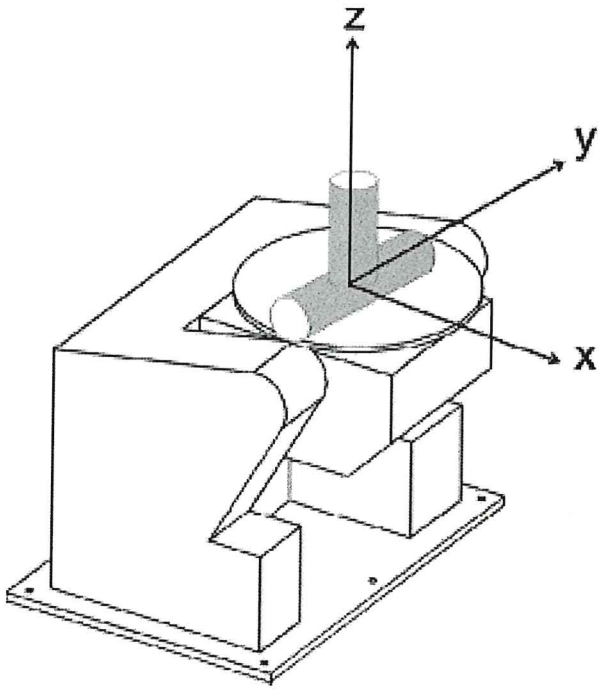

Fig. 7-5: table coordinate system

7.3 ACCESS AUTHORIZATIONS

The ROBOTstarV allows generation and administration of access authorizations for various user groups. The users are divided in four classes (levels) with different utilization rights each:

The **login name** must at least consist of one character and may have 10 characters at maximum.

The personal **password** always consists of 8 characters.

For the login name and for the password all characters available on the PHG are allowed.

7.4 OPERATING MODES OF THE CONTROL

7.4.1 Display of the PHG

In the menu window in the last but one line the current operating mode of the control is displayed. In the various operating modes there are different possibilities for operation (see Chapter 11.1, Synoptical tables of the operating modes).

The two main modes are the DIR and the EDIT mode.

7.4.2 Activation of DIR mode

Selection of the possible operating functions is made by means of the function keys under the display. The arrow keys serve for switching-over between the menu levels.

Tab. 7-5: DIR mode / 1st menu

Prog new	Generate new program or subdirectory.
Prog mark	Mark program or directory next to the cursor or cancel its marking.
Prog del	Deletion of programs and / or directories. Directories to be deleted must be empty! By entering another name (perhaps with indication of path), an arbitrary other program can be deleted.
Prog copy	Copy programs. Directories cannot be copied! Marked programs (not directories!) can be copied into another directory or on disk.

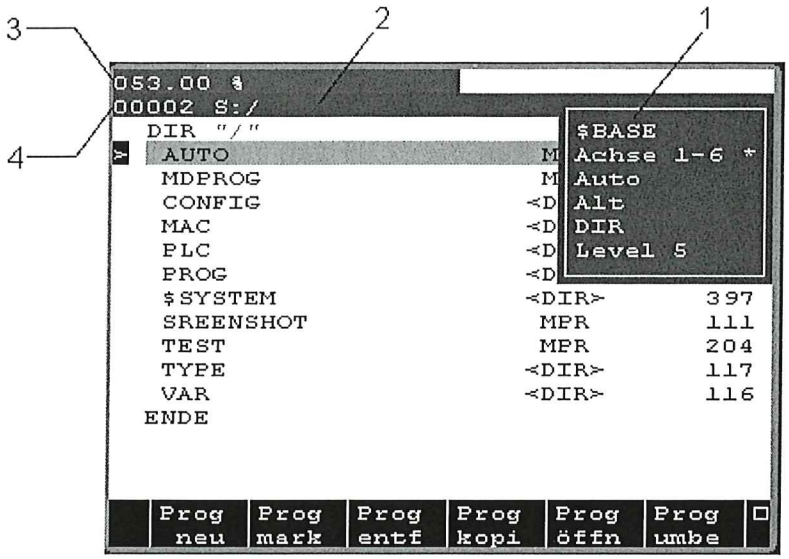

Fig. 7-6: Display in DIR mode

1 Status window with status indications

Display of manual operating mode and type of program treatment

2 Current path

3 Current override value (numerical and as bar)

4 Current step number

7.5 MOVE ROBOT

The robot can be moved via the keyboard, the function 'Position Control' or via the 6D-mouse being available as an option.

7.5.1 Movement via the keyboard

Robot and additional axes are moved via the teach pendant keyboard. Besides this, linear movement of the tool within the selected coordinate system is possible as well as rotation around the coordinates. This requires knowledge of the directions of the three coordinates in the selected system.

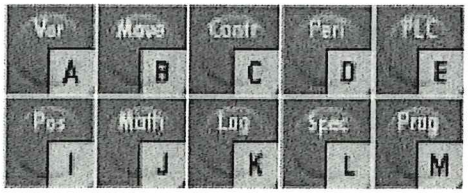

Fig. 7-7: Movement keys

2. Select calibration program.
   a. 
   b.  'Cal'
   c.  "Mouse"
   d. Select the desired calibration: 'Cal mouse 1', 'Cal mouse 2' or "Cal PHG mouse" .
3. 
4.  Select operating mode TEST2.
5. Fix 6D-mouse on the tool.
6. Set override to approx. 30 %.
7. Switch on drives with the permission key.
8. 
   Calibration program starts
9. Execute the offset measurement if this hasn't been done yet. During the offset measurement the 6D-mouse must not be touched; see instructions on the teach pendant display.
10. Bring back the 6D-mouse into zero position (let go shortly and then detain again).
11. Repeat the last two items for each movement direction.

7.6.4 Calibration at the PHG

The 6D-mouse is calibrated via the program MAUSPHG at the PHG.

This program is structured so that one movement each will be executed one after the other into the following directions respectively:

- Linear movement into world-X direction
- Linear movement into world-Y direction
- Linear movement into world-Z direction
- Rotation around the hand-X axis
- Rotation around the hand-Y axis
- Rotation around the hand-Z axis

14. Do the reference measurement for the recalibration.
    a. Select an arbitrary space direction and set the marking of the override regulator parallel to the selected space direction.
    b. 

7.6.5 Call calibration data

After having run one of the the calibration programs the corresponding calibration is activated automatically.

As long as the contents of the vector variable are still preserved, a simple call of the calibration data once determined is sufficient.

1. 

   COORD menu appears.
2. Select menu item 'PHG Mouse', 'Tool1 Mouse' or 'Tool2 Mouse' in the third function key menu.

   A macro belongs to each of these menu items that will be executed after selection of the menu item.

7.6.6 Recalibration of the 6D-mouse

If the 6D-mouse is fixed on the PHG, the robot even with correct calibration only moves into the correct direction if the PHG with reference to the reference direction is held exactly in the same way as it had been held during the calibration.

The control cannot automatically recognize a twist of the PHG and thus, of the 6D-mouse. In this case, calibration must be corrected as follows.

⇨ Set override regulator parallel to the reference direction

⇨ 

⇨ 

'Recal Mouse'

Message: „'Recalibration finished'

8 PROGRAMMING

Menu of the operating modes is opened.

3. F2 "#LINEAR"
4. Approach point and define it as normal position.

8.2.1.2 Adjustment of movement mode #CIRC

For programming of circular movements the movement mode '#CIRC' (circular interpolation) is entered.

An auxiliary position on the circular path (circular auxiliary point) has to be entered after the command '#CIRC'.

After the auxiliary position the end point of the circular path is entered. Several circular segments can be programmed directly one after the other. After switch-on of the circular interpolation always an even number of positions must have been programmed before switching-over the movement mode.

After '#CIRC' the control interprets each first, third, fifth etc. position as circular auxiliary point, each second, fourth, sixth etc. position as end point of a circular path and simultaneously as start point of the next circular segment, until the movement mode will be switched over.

Tab. 8-1: Example for programming of a circular interpolation

Step	Command	Points and movement modes
S1	MPR	MOVEMENT
S2	TOOL	T
...	...	
S9	POSITION	A
S10	POSITION	B
S11	INTERPOL	#LINEAR
S12	POSITION	C
S13	INTERPOL	#CIRC
S14	POSITION	D
S15	POSITION	E
S16	POSITION	F
S17	POSITION	G
S18	INTERPOL	#PTP
S19	POSITION	H

If no movement mode is programmed at the beginning of a program, all following positions will be approached with the default adjustment #PTP.

4. 

   The movement mode is programmed.

8.2.2 Storage of position

In order to enter a position, the TCP is moved to the desired position with one of the operating modes in the menu 'COORD'.

The position is entered with the following program steps:

1. Move TCP to the desired position.
2. 
3. 

   The position is taken over into the program as normal position in Frame 0.

8.3 CONTROL OF THE PERIPHERAL EQUIPMENT

The peripheral equipment and the robot control communicate with each other via digital signals.

User inputs provide the control with information about the peripheral conditions (e. g. finish message of a processing machine, rotary table in correct position, clamping device closed, deposit free etc.).

User outputs give information to the peripheral equipment and execute commutations (e. g. signal to a processing machine that the robot is moving into the operating range of the machine, switching on or off a conveyor, switching on a spindle, open/close gripper, feed out pallet etc.).

Also direct voltages coming from peripheral units can be interrogated in the user program.

8.3.1 Switching of digital outputs

Digital outputs are switched on and off by setting (level 1) or resetting (level 0) a bit. The corresponding CAN node switches the output corresponding to the programmed bit.

Programming is made with the command WRITE_BIT (write bit) from the command group LOG.

8.3.1.1 Switch on output

Example: Set output 0.1 (e.g. in order to start a conveyor belt)

WRITE_BIT #OUTPUT, level: 1, Byte: 0, Bit: 1

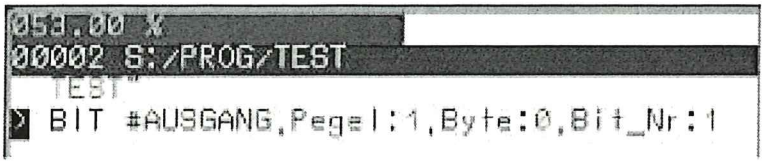

Fig. 8-4: Display of the command line

8.3.1.2 Switch off output

As example, the a. m. belt shall be stopped. For programming proceed as above, only a 0 has to be entered for the level.

1. 

   LOG menu appears.

2.  "WRITE_BIT"

   Selection menu appears.

3.  "#OUTPUT"

4. 

5. 

6. 

7. 

8. 

9. 

   Subsequently the command is contained in the program as follows:

   WRITE_BIT #OUTPUT, level: 0, Byte: 0, Bit: 6

8.3.2 Inquiry of digital input signals

The input signals are treated in the same manner like the output signals. Bits are set or reset via CAN-bus according to the node number. If 24 Volt are applied on a connection on the hardware side, the corresponding bit will be set, if 0 Volt is applied, it will be reset.

c. 

8. Label: <X>

Subsequently the command is contained in the program as follows:

WAIT_BIT INPUT, level: 1, Byte: 0, Bit_Nr: 5, Max_Zeit: 0.0, Label: X

8.3.2.2 Input signal as branch condition

Program branches can be programmed which will only be executed if level 1 or level 0 is applied to an input.

This branch is realized with the command TEST_BIT. Conditions for the branch are as follows:

#=0: the branch will be executed if 0 Volt is applied to the input.

#=1: the branch will be executed if 24 Volt is applied to the input.

If the branch condition is not fulfilled, processing of the program will be continued with the next step.

Example: Programming with a branch condition.

The subprogram CLEANING will be executed if 24 Volt are not applied to input 0.6. If 24 V are applied, the subprogram call will be skipped.

1.  'Contr'

   CONTR menu appears.

2. 

"TEST_BIT"

   Selection menu appears.

3. 

"#INPUT"

4. 

Branch condition: "#=1"

5. Byte: <0>

6. 

7. Bit: <6>

6. Enter

8.3.4 Inquiry of analog inputs

The analog voltage applied to an analog input can be filed in a real variable for further treatment.

The command ANA_INP is selected from the function group PERI. After selection, first of all the number of the analog input has to be indicated from which the analog voltage shall be taken over, then the name of the variable where the voltage value will be stored.

1. 'Peri'

   PERI menu appears.

2. F2 "ANA_INP"
3. Channel: <number of the analog input>
4. Enter
5. Variable: <name of the destination variable>
6. Enter

Tab. 8-2: Example for a program with inquiry of analog inputs

Step	Commands	Inputs
S1	MPR	ANALOG_TEST
S2	LOC_VAR	RDRUCK
S...		
S14	POSITION	
S15	WRITE_BIT	#OUTPUT, 1, 0, 4
S16	LABEL	REPEAT
S17	ANA_INP	2,RDRUCK
S18	TEST	VARIABLE,RDRUCK,#<,5.0,REPEAT
S19	CALL	COAT
S...		
S39	END	

In step 16 a dosing system is switched on via output 0.4 which gradually builds up the required operating pressure for coating. The current pressure is signalized to analog input 2 via an analog signal.

When this command is processed in automatic or test mode, program treatment will be continued at the branch label with the same name.

If no label with the same name exists in the program, an error message will be displayed.

Input of command sequence for an absolute branch:

1.  'Contr'

   CONTR menu appears.

2.  "BRANCH"
3. <name of branch destination>
4. 

8.4.4 Input of a conditional branch

Contrary to the absolute branches, with the command for a conditional branch decision is made whether the branch will be executed or whether processing of the program is continued with the next step. The condition may be the status of a single bit or the content of a byte or of a variable.

⇨  'Contr'

CONTR menu appears.

⇨  "TEST_BIT"

⇨ select operand

⇨ select conditons of branch

⇨ insert number of byte or variable

⇨ 

⇨ insert number of bit

⇨ 

⇨ <name of branch destination>

⇨ 

8.5.2 subprogram (SPR)

After selection of the command CALL from the command group PROG the name of the subprogram you want to branch to has to be entered. In automatic or test operation a branch to step 1 of the indicated subprogram will be made during processing. This subprogram is processed. After the last step of the subprogram, the calling program will be returned to. Program treatment here is continued with the command following the subprogram call.

8.5.2.1 Call of a subprogram

1.  'Prog'

   PROG menu appears.

2.  "CALL"
3. <name of subprogram>
4. 

8.5.3 macro (MAC)

A macro must not contain a position!

In a macro it is possible to call further macros and subprograms (up to nesting depth 12!).

8.5.3.1 Call of a macro

➪ see separate documentation about RobAssist

9 USER-ORIENTED DOCUMENTATIONS

10 ERROR MESSAGES RSV

Error number	Message	Cause	Remedy
S56	No valid station marker recognized	There is more than one PLC marker bit set for station monitoring.	Examine the PLC program and make sure that a maximum of one single station is monitored.
S58	Movement range exceeded	The axes indicated in the message were displaced too much. The admissible range from _RFMOT_LIM_P and _RFMOT_LIM_N was exceeded.	Check the admissible range in the system variables _RFMOT_LIM_P and RFMOT_LIM_N and adapt, if necessary. Limit the way of displacement.
S61	PLC error		
S67	SPLINE neighbor point after step xx in the program not found	In the SPLINE movement mode the previous and the following point must be available for the path interpolation. The following point cannot be determined definitely, because a branch command follows (e. g. TEST_...-command).	Remove branch command or select other movement mode.
S100	Operating error	10.1.2 S100 / operating error	
S104	The command AXIS is only allowed in INTERPOL #PTP!	Wrong INTERPOL is active, e. g. #LIN	Change program. Insert the command INTERPOL #PTP before the command AXIS.
S108	A TOOL change can only be executed in INTERPOL #PTP.	At the moment of the TOOL command the movement mode PTP is not active.	Insert PTP mode.
S111	Programming error	10.1.3 S111 / Programming errors	
S112	Wrong device or wrong path	Selection of a program which doesn't exist	Enter correct program name

Error number	Message	Cause	Remedy
S129	Maximum number of pulses already active!	The control is already processing eight pulses and cannot start another pulse.	Change program structure.
S137	Program doesn't exist	Access to a program which doesn't exist	Read-in program
S138	Program name invalid	Faulty program name	Correction of name
S140	Program memory is full	No storage location for programs available	Delete all programs which are not needed any more
S143	Wrong program types	Access to programs with faulty type indication	Correction of program type
S144	Definition already exists	Multiple definitions	Check definitions
S145	Program exists already	Transfer of a program to the control which exists already	Delete the old program
S155	Step not defined	Structure error in the user command. Either the AXIS command or a variable used in it is concerned.	Delete the defective step and program anew.
S156	No access authorization	Program or variable in the program memory is protected	Check access authorization and change, if necessary
S163	Process controller error arc doesn't ignite!	The acknowledge message „Welding on" has not been given within the requested time	Check weld source Set correct input/output ports
S164	Process controller error arc doesn't extinguish!	The acknowledge message „Welding off" has not been given within the requested time	Check weld source, set correct input/output ports

Error number	Message	Cause	Remedy
S190	Program doesn't exist	Access to a program which doesn't exist	Read-in program, check path
S197	Index variable not found	The array index was programmed with an integer variable. This integer variable, however, is not defined.	Define integer variable
S198	Index variable not initialized	The array index variable is not correctly initialized.	Initialize array index variable
S199	Index too big or too small	The array index used in the COPY command has the value zero or exceeds the value indicated in the variable definition	Adapt array index to the definition
S200	Definition is no array	The variable name used in the COPY command contains an array indication. The variable definition, however, doesn't represent an array.	Adapt the variable access accordingly
S201	Definition is an array	The variable name used in the COPY command doesn't contain any array indication. The variable, however, is defined as an array	Change-over variable access to array
S202	No storage location available	Program memory is full	Delete all programs which are not needed any more
S211	Program not inserted	Error in the program code, program defective	Check program code, perhaps store anew

Error number	Message	Cause	Remedy
S291	Sensor recording mode: File name in the system variable _SSENFILE wrong or too long	Entry in _SSENFILE faulty.	Adapt system variable _SSENFILE.
S292	Wrong sensor mode in the system variable _ISENSPEC.	The sensor operation was incorrectly initialized.	Use one of the values 0 (standard), 1 (recording mode) or 2 (playback mode) for the system variable
S326	Function not implemented	Inadmissible variable types were programmed in the source/destination variable. The control word contains a not defined transformation mode.	Only VECTOR and POSITION are allowed as source variable types. A system variable of POSITION type must be used as destination variable type. Set the value of the control variable to the correct transformation mode.
S349	Robot is asynchronous		Synchronize robot
S364	Wrong OCS fine mode	The system variable _IOSC_SUBMOD was incorrectly programmed.	Select one of the following values: - 0: binormal= neg. Z-axis of the tool frame) - 1: binormal= neg. X-axis of the tool frame) - 2: binormal= neg. Y-axis of the tool frame)

Error number	Message	Cause	Remedy
S389	Control not ready for reception	Program memory processing is active if a program shall be read-in via DNC	Repeat program transmission
S412	Conveyor error: Jump-on/-off only allowed in movement mode PTP and LINEAR.	For conveyor jump-on the programming of movement mode CIRC or SPLINE is useless, because anyway an interpolation matched for the conveyor movement and based on the LINEAR move mode is executed.	Program INTERPOL #PTP or #LINEAR prior to conveyor jump-on or jump-off.
S413	Conveyor error: Counter of conveyor axis was not reset.	A jump-on shall be executed without the synchronization pulse being given once since the last control start.	Release synchronization pulse before executing a conveyor jump-on.
S427	Physical connection disturbed	Timeout during data communication due to lack of connection	Check hardware components (cables, converters, ...) and correct, if necessary
S437	Backup could not be established	Defective program memory	Storage of the individual programs on disk Program memory must be completely restaured
S438	There hasn't been established any backup yet	Access to R: Device before a bakkup was established for the first time	Establish backup via Menu (Funct)
S439	Not sufficient memory available to establish a backup.	A CPU60 with 4MB dynamic RAM was used	Backup is only possible with use of a CPU60 with 32 MB DRAM
S443	Marking not possible	Attempt to mark program start, program end, „.“ and/or „..“ steps	These steps must not be marked.

Error number	Message	Cause	Remedy
S510	Internal calculation error XXX XXX= 508 XXX= 518 XXX= 519	Central point of the sphere cannot be calculated Error in transformation	Error during programming of the calibration positions: one or several of the positions 1 - 4 was programmed too inexactly

10.1.2 S100 / operating error

Error number	Message	Cause	Remedy
S100,4016	Operating error	Step preselection to„Search"-step is not allowed.	Step preselection to a position preceding the corresponding step or to the next step. Step preselection is only finished if a position in the program was approached.
S100,4018	Operating error	In the operating modes AUTO, TEST2, TEST3, TEST4 a step preselection to an oscillation auxiliary point or into a CIRC bracket is not allowed.	Approach of the position with step preselection is only possible in TEST1.
S100,4019	Operating error	In TEST1 more than one step backward was moved while oscillation is active, or the oscillation auxiliary point is not defined.	Start with step preselection to the first position before the oscillation auxiliary point.

Error number	Message	Cause	Remedy
S100,4129	Operating error	Operating errors in conjunction with a laser camera calibration (see separate documentation 'LS_CALIB')	
S100,4130	Operating error	Operating errors in conjunction with a laser camera calibration (see separate documentation 'LS_CALIB')	
S100,4131	Operating error	Operating errors in conjunction with a laser camera calibration (see separate documentation 'LS_CALIB')	
S100,4132	Operating error	Operating errors in conjunction with a laser camera calibration (see separate documentation 'LS_CALIB')	
S100,4133	Operating error	Operating errors in conjunction with a laser camera calibration (see separate documentation 'LS_CALIB')	
S100,4134	Operating error	The command LS_SERVICE 0,7 doesn't work correctly (see separate documentation 'LS_SERVICE')	Check whether the processing edge has been programmed correctly- Check that the processing edge is situated in the shooting field of the laser camera.

Error number	Message	Cause	Remedy
S111, 4002	Programming error	Double key word	The code words for the PAGA function indicated in the (technology data) subprogram occur several times, however, the use is only permitted once according to the operating manual.
S111, 4003	Programming error	Invalid code word	A code word for the PAGA function indicated in the (technology data) subprogram is not known here, only code words acc. to the operating manual are allowed.
S111, 4004	Programming error	Inadmissible AWP_step in the (technology data) subprogram	A user command programmed in the (technology data) subprogram for the PAGA-function must not be used here. Only the commands acc. to operating manual are allowed.
S111, 4005	Programming error	(Technology data) subprogram is no subprogram	The program indicated in the 'OSC_PATTERN_E' command for execution of the 'oscillation amplitude controlled parameter output' (PAGA) must be a subprogram.
S111, 4006	Programming error	Output number is no number found	In the output commands of the (technology data) subprogram all indications must be registered as number constants, variables are not allowed here.

Error number	Message	Cause	Remedy
S111, 5011	Programming error	Nesting depth 12 for subprograms is reached.	Change program structure in such way that the nesting depth doesn't exceed 12
S111, 5012	Programming error	'SEN'-step or 'PEN'-step recognized, the oscillation plane not being defined.	Program oscillation auxiliary point.
S111, 5013	Programming error	Additional axes were moved during CP operation.	Program movement steps anew without moving additional axes. In software versions >V0805 the error message can only be given if the machine data or the user program don't belong to the robot.
S111, 5014	Programming error	No oscillation pattern defined.	
S111, 5015	Programming error	Inadmissible control step between a position and the oscillation auxiliary point resp. oscillation parameter.	Find out the inadmissible control step by means of the operating manual and remove it.
S111, 5017	Programming error	Switch-over to PTP while the sensor is active.	Switch off sensor.
S111, 5018	Programming error	More than one sensor control step is programmed between two positions.	Remove one sensor control step.
S111, 5040	Programming error	The user command AXIS... is in a CIRC bracket.	Select control mode PTP or CP_LIN before the command AXIS...
S111, 5041	Programming error	Between the commands AXIS#PASSIVE and AXIS#ACITIVE there is a position step.	Delete position step.

Error number	Message	Cause	Remedy
S111,5075	Programming error	A path movement mode is still active when leaving the root subprogram. Only PTP must be active.	
S111,5078	Programming error	When leaving the root subprogram the sensor functino must not be in recording mode. Also after 'SENSOR OFF' the sensor may still be active if the sensor offset couldn't be established yet.	
S111,5081	Programming error	The output text of the INPUT resp. OUTPUT field doesn't fit into the window.	
S111,5082	Programming error	Wrong format designator indicated for the INPUT or OUTPUT command!	
S111,5083	Programming error	Wrong format parameter indicated for the INPUT or OUTPUT command!	
S111,5101	Programming error	Tool change step is not allowed while dynamic corrections are active.	Switch off sensor, oscillation prior to tool change step.
S111,5103	Programming error	Search function is not allowed while dynamic corrections are active.	Prior to 'SEARCH' step sensor oscillation and conveyor.
S111,5106	Programming error	Tool change step is not allowed during control mode CP.	Remove tool change step or switchover to control mode PTP.
S111,5120	Programming error	The sample program was not found.	

Error number	Message	Cause	Remedy
S111,5132	Programming error	The recorded data are not suitable for the root layer program. Modifications were made in the root layer program after recording of data.	The root must be moved along anew.
S111,5133	Programming error	The root layer program contains position variables (command VAR_POS). Transformation is impossible.	Replace position variables by POSITION steps.
S111,5134	Programming error	The transformations TDW or TKR were terminated with an error.	
S111,5135	Programming error	When reaching the END command in the root layer, path or circular movement was active. .	Only the PTP movement mode must be active when leaving the root
S111,5136	Programming error	The positions in the sample program must all be of the same type.	
S111,5137	Programming error	The positions in the root layer program must be of the same type as those of the sample program.	
S111,5138	Programming error	When reaching the END command in the root layer subprogram, the ROOTLAYER command recognized that the sensor function is in recording mode.	Only either an active sensor or a playback sensor may be selected.
S111,5139	Programming error	The TOPLAYER command recognized that the sensor function is in recording mode.	Only either an active sensor or a playback sensor may be activated.

Error number	Message	Cause	Remedy
S111,5157	Programming error	Transformation error in the displaced position (working range exceeded)	
S111,5158	Programming error	One of the selected programs contains a tool change command the variable of which was not found.	
S111,5159	Programming error	One of the selected programs contains a tool change command the variable of which is invalid.	
S111,5200	Programming error	A PLC command was inserted in a robot program.	PLC commands must only be used in PLC programs.
S111,5300	Programming error	Division by 0 in operation 'DIV'	
S111,5308	Programming error	The program change from a subprogram into another program is not allowed.	

10.1.4 S597 / Storage errors

S597,1	Storage error File wasn't stored Error: 1	Reading from disk not possible	Insert disk, read-in directory anew
S597,2	Storage error File wasn't stored Error: 2	Writing on disk not possible	Remove write protection, insert disk

S597,10	Storage error File wasn't stored Error: 10	Disk is full	Use new disk or delete files on the disk which are no longer needed
S597,11	Storage error File wasn't stored Error: 11	Disk access error (semaphore error)	Reset disk driver software via <Order><reset>
S597,12	Storage error File wasn't stored Error: 12	Disk access error (read error on disk)	Reset disk driver software via <Order><reset>
S597,13	Storage error File wasn't stored Error: 13	Disk access error (write error on disk)	Reset disk driver software via <Order><reset>

11 APPENDIX

Tab. 11-7:RUN–mode– menu 1/2

	Test 1	Test 2	Test 3	Test 4	Test 5	AUTO	
							

Tab. 11-8:RUN–mode– menu 2/2

	Cal Sync	Ref Pos	Sync Pos	Start PLC	Test PLC	Test 6	
							

Tab. 11-9:COORD–mode– menu 1/3

	Robot Axis	Cart Base	Cart Tool	Cart Frame	Frame Chose	Peri Axis	
							

Tab. 11-10:COORD–mode– menu 2/3

	Mouse trans	Mouse rotat		Cart ETool	Peri Mode	Axis Chose	
							

Tab. 11-11:COORD–mode– menu 3/3

	PHG Mouse	Tool1 Mouse	Tool2 Mouse				
							

Tab. 11-12:INFO–mode– menu 1/5

	Axis actv	Cart actv	Incr actv	Vari able	Err enab	Chng stat	

	Con–trast	Date Time	DNC Reset	Order Reset	Quit SC		
							

	CONTR	LOG	MATH	MOVE	PERI	PLC	POS	PROG	SPEC	VAR
F6						DH				
F1						XO				
F2						XON				
F3						XO(				
F4						ST				
F5										
F6										

12 EXPLANATION OF TERMS

A

additional axes

In addition to the 6 robot axes the control is able to administrate up to 18 further axes. Additional axes and robot axes can be moved at the same time or separately.

With multi-axes transformation being active the additional and robot axes are moved in the path movement modes in such way that overlapping of the movements of both systems will result in the path determined before (straight line, spline or circular path).

Path contour, path speed of the TCP and orientation of the tool are maintained with reference to the table coordinate system.

analog output

In the user program the analog outputs can be supplied by a direct voltage in the range from - 10 V to + 10. Peripheral units can be controlled with these direct voltages.

Example: Control of a connected weld power source or having influence on the pressure of a dosing system

analog input

It is possible to apply direct voltages to analog inputs of peripheral units. The max. admissible voltage range is between -10 and +10 V. These direct voltages can be further processed in the user program. Thus, e.g. the activated sensor function reacts on voltage modifications on the analog inputs and moves the TCP accordingly.

approximation

For PTP-movements (path approximation):

Programmed auxiliary positions, e.g. moving around an obstacle, are not exactly approached and with the corresponding position of the auxiliary positions the TCP traverses the programmed path distance without stop.

For path movements (speed approximation):

Two successive path movements are coinciding at an intermediate destination point without reduction of speed.

archival storage

Recording of programs resp. data from the memory of the robot control on floppy disk for data back-up.

I

increment

The signals of the path measuring systems are prepared by the control and further processed as increments. The increments indicate the position actual value of an axis. They are transferred to the coordinate system for display and are converted to the units 'millimeter' and 'degree'.

Vice-versa, when processing a movement program, position and orientation values of the TCP are converted into position NOMINAL values of the unit 'increments'.

The corresponding conversion factors are defined in the machine data.

interface

Connecting point via which the data exchange between two separated systems is performed, e.g.:

control ROBOTstar - computer with corresponding software

control ROBOTstar - diecasting machine

control ROBOTstar - disk drive etc.

interlinkage

Signal exchange between robot control and peripheral equipment - e. g. lathe, casting machine etc.

Interlinkage is performed via user inputs and outputs.

interpolation

Definition how the TCP will approach the programmed position (see movement mode).

interpolation cycle

Time distance during which the control calculates support points for the TCP with path movement programmed.

M

machine data

The machine data describe the mechanic and electric configuration of the robot system. They are adapted during start-up of the system and are secured against user access.

movement mode

In the user program it is determined how the robot executes programmed movements. The following movement modes can be programmed:

#LINEAR

The TCP moves to the next position on a straight line.

#CIRC

binormal - stands square to the programmed path and square to the processing plane.

tangent - lies in the programmed path in the processing plane.

normal - lies in the processing plane square to the programmed path. It represents the oscillation direction.

The a.m. positions of the oscillation coordinates are valid for a not turned OCS and only for correctly programmed auxiliary point.

P

path control

The TCP is moved from the initial point to the destination point on a mathematically defined path (straight line, arc of a circle or spline movement). During CP movement there is continuously performed an orientation change of the tool.

peripheral equipment

The peripheral equipment includes all devices and machines which form a compound system together with the robot and which are connected with the robot control: weld power sources, casting machines, conveyors, lathes etc.

PHG

portable teach pendant

Portable operating panel that is connected with the control cabinet of the robot via a cable. The teach pendant is the interface between operator and robot control. The robot can be operated via keyboard of the teach pendant and the display shows operating states, error messages and requests for the necessary operations.

In dialogue between operator and control, it is possible to generate, modify and delete programs with the teach pendant.

position regulation cycle

Time distance during which the servo amplifiers are calculating position NOMINAL values for the robot and peripheral axes.

programmed limit switch

see software limit switch

PTP - movement

Point-to-Point Movement (PTP)

The robot and additional axes simultaneously start in the initial point and simultaneously reach their destination point, each axis moving on its shortest path. The axis with the longest movement path (control axis or guide axis) moves with programmed speed. The speeds of the other axes are calculated in such manner that the running times are the same for all axes.

T

TCP

Tool Center Point = operating point of the tool

The positions stored in a program include the destination coordinates of the TCP.

teach in

In the manual movement modes, positions and orientations of the TCP are approached with the movement keys and adopted into the user program as movement step (destination position).

tool data

The tool data define the position of theTCP referring to the tool flange (axis 6 for robots of the RH and RV series). They determine the operating point of the robot.

Tool data steps are stored in the tool variables.

tracking distance

Deviation of the position ACTUAL value from the position NOMINAL value during an axis movement.

Deviations are admissible in defined limits. The admissible limit values are defined in the machine data.

If the tracking distance exceeds the admissible value during a movement, the drives switch off and a corresponding error message will be given in the display of the portable teach pendant.

traversing range

Each axis has a defined traversing range. The center of the movement range is the so-called zero point of the axis (exception: axis 2 of the RV series robots). In the regular case the movement ranges in negative and positive direction are identical. The movement ranges are limited by the software limit switches.

U

user input

Binary (digital) signals from peripheral equipment can be put on user inputs and switch them to level 1 (the input is applied with + 24V) or to level 0 (the input is applied with 0V). Depending on the switched condition, program interruptions or conditional branches can be programmed in the user program.

user output

A user output consists of a contact that is closed (level 1) or opened (level 0) by programmed commands in the user program.

user program

The operation sequence of the robot system is defined in the user program. The user program describes movement sequences, administrates interface signals between the robot control and the peripheral units and contains control-internal operations (e. g. program branches, mathematical operations, logical operations etc.).

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