

CNC 6 USER MANUAL

This manual provides the information necessary to properly install, operate and service Wittmann Robot Systems, and ensure correct and safe operation of our equipment.

Our robots must be installed and operated in accordance with these instructions by authorized and qualified personnel only.



Improper installation and operation may result in injury to personnel and/or damage to equipment.

Before installation, please read this manual completely, paying special attention to the **Safety Warnings** marked

To ensure optimal use of our equipment, we recommend that you attend the training courses regularly offered at our Service Centers.



Proper function of the equipment can be ensured only if maintenance is performed according to the instructions given in this manual.

The descriptions in this manual refer to the robot and equipment according to the specification sheet. These specifications are subject to change without notice.

This manual is for the sole use of the user of the robot and may not be distributed to unauthorized persons. No part of this manual may be copied or reproduced without our written consent.



Compliance with the Following Directives:

Number: 89/336/EEC
Text: Council Directive of May 3, 1989 for Harmonization of the Legal Regulations of Member States on Electromagnetic Compatibility

Number: 89/392/EEC
Text: Council Directive of June 14, 1989 for Harmonization of the Legal Regulations of Member States for Machines

The noise emission of this device does not exceed 70 dB(A).



Before starting up the robot for the first time, please review this manual thoroughly and familiarize yourself with the operation of the robot. Improper use may injure personnel and/or damage the robot, mold or molding machine.

Table of Contents

1 SAFETY	10
1.1 SAFETY STANDARDS	10
1.2 SAFETY FEATURES	11
1.2.1 Safeguarding	11
1.2.2 Emergency STOP Buttons	11
1.2.3 Permit Key on Teachbox.....	11
2 INSTALLATION	12
2.1 MECHANICAL INSTALLATION	12
2.1.1 Dimensional Drawing – Adapter Unit.....	12
2.1.2 Mounting of the Robot	12
2.2 PNEUMATICS	13
2.2.1 Compressed Air Connection	13
2.2.2 Hoerbiger Axis	14
2.2.3 Schunk Axis	15
2.3 ELECTRICAL CONNECTIONS.....	16
2.3.1 Power Supply.....	16
2.3.1.1 Fault Current Safety Switch.....	16
2.3.2 Interface with Injection Molding Machine.....	17
2.3.3 Mold Safety Switches S5/S6.....	18
2.3.4 Test Procedure for Mold Safety Switches S5 / S6	18
2.3.5 Vacuum switch SMC.....	19
2.3.5.1 Initial Settings.....	19
2.3.5.2 Pressure Setting.....	20
2.3.5.2.1 Evaluation of the set value (n1) and of the hysteresis (H)	20
2.3.5.2.2 Setting the set value (n1) and the hysteresis (H) at the sensor	20
2.3.5.2.3 Setting a value	21
2.3.6 Vacuum switch SUNX.....	22
2.3.6.1 Switching to Desired Mode.....	22
2.3.6.2 Setting Zero Point.....	22
2.3.6.3 Determining and Setting Switch Points	22
2.3.6.4 Checking Function.....	22
2.4 INITIALIZING SAFETY AREAS.....	23
2.4.1 General	23
2.4.2 Initial Reference Travel.....	24
2.4.3 REF in Manual	24
2.4.4 Initializing Safety Area Switch Points.....	25
2.4.4.1 Finding Switch Points	25
2.4.4.2 Finding All Axis Switch Points	25
2.4.4.3 Initializing All Axis Positions	26
2.4.4.4 Aborting Initialization	26
2.4.5 Beispiel: IMM-transom	27

2.4.6 Monitoring Safety Area	28
2.5 SAFETY PACKAGE/SAFEGUARDING	29
2.5.1 INTERNAL Safety Package	29
2.5.2 EXTERNAL Safety Package for Safety Door or Access Hatch	30
2.5.3 Safety Guarding	32
2.6 ELECTRICAL INTERFACE	33
2.6.1 Injection Molding Machine (IMM) Signals	34
2.6.2 Robot Signals	35
3 OPERATING INSTRUCTIONS FOR CNC 6 CONTROL	36
3.1 INTRODUCTION	36
3.1.1 Robot Axes	36
3.1.2 Features of the CNC 6 Control	37
3.2 HARDWARE	38
3.2.1 Control Cabinet	38
3.2.2 Teachbox	39
3.2.3 Robot	39
3.3 STARTUP	40
3.3.1 Basic Settings (INIT)	40
3.3.2 Establishing Connection when Teachbox is OFFLINE	41
3.4 USER MANAGEMENT AND PASSWORDS	43
3.4.1 Activating/Deactivating User Management	44
3.4.2 Log-on Procedure	45
3.4.3 Log-Off Procedure	45
3.4.4 User (Create, Change, Delete)	46
3.4.5 User Profiles	47
3.4.5.1 Dependencies among Authorizations	48
3.5 BASIC OPERATION OF TEACHBOX	49
3.5.1 Display	49
3.5.2 Keypad	50
3.5.2.1 Function Keys	51
3.5.2.1.1 Axis Selection	51
3.5.2.1.2 Vacuum and Gripper	51
3.5.2.1.3 Time, Sub, More, Injection Molding Machine (IMM)	51
3.5.2.1.4 Peripheral Equipment and Conveyor Belts	51
3.5.2.1.5 Counters	51
3.5.2.1.6 Placing Programs	51
3.5.3 Operating Modes of the Robot	52
3.5.4 Reference	53
3.5.4.1 Reference Travel in Operating Mode NO REF	53
3.5.4.2 Reference Travel in MANUAL Operating Mode	53
3.5.4.3 Standard Reference Travel for Robot	54
3.5.4.4 Taught Reference Travels for Robot and Peripheral Equipment	54
3.5.5 Manual Functions	55
3.5.5.1 Numerical Axes A, C, X, Y and Z	55
3.5.5.1.1 Optional digital, motorised B Axis	55
3.5.5.2 Pneumatic Axes A, B and C	56
3.5.5.3 Gripper, Vacuum, Belt and Peripheral Equipment Functions	56
3.5.5.4 Clearing Placing Counters	57
3.5.6 Counters	58

3.5.7 Override	59
3.5.8 Menu Functions	60
3.5.9 INFO Menu	61
3.5.9.1 Axis Positions	61
3.5.9.2 Alarms	61
3.5.9.3 Operating Data	62
3.5.9.4 Inputs	62
3.5.9.5 Outputs	63
3.5.9.6 Counters	63
3.5.9.7 Placing Counters	64
3.5.9.8 Stopwatch	64
3.5.9.9 Program Info	64
3.5.9.10 Error Buffer	65
3.5.9.11 Command Buffer	65
3.5.9.12 Operating Systems	66
3.5.9.13 DIAS Diagnosis	66
3.5.10 INIT Menu	67
3.5.10.1 Stroke Limits	67
3.5.10.2 Lubrication Intervals	68
3.5.10.3 Setup	69
3.5.10.3.1 Language	69
3.5.10.3.2 Date and Time	69
3.5.10.3.3 Display	69
3.5.10.3.4 Printer	70
3.5.10.3.5 Service Signal	70
3.5.10.3.6 PO in Editor on	70
3.5.10.3.7 User Profiles	70
3.5.10.3.8 Clear Counters	70
3.5.10.3.9 Step Speed	71
3.5.10.3.10 Central Lubrication	71
3.5.10.3.11 Offset	71
3.5.10.4 Program „ALL MODES“ Start/Stop	71
3.5.11 Disk Functions	72
3.5.11.1 Disk (Contents, Formatting, Deleting a File)	72
3.5.11.2 Loading a Teach Program (IN TEACH MODE ONLY)	72
3.5.11.3 Storing a Teach Program (IN TEACH MODE ONLY)	73
3.5.12 Print	74
3.5.12.1 Abort Printing	74
3.6 TEACH MODE	75
3.6.1 Partial Programs, ALL MODES Program	75
3.6.2 Online Teaching	76
3.6.3 Offline Teaching during Automatic Operation	76
3.6.3.1 Online Conversion	76
3.6.4 Operation of Editor	77
3.6.4.1 Calling Up Text Editor	77
3.6.4.2 Display in the Text Editor	77
3.6.4.3 Edit Functions	77
3.6.4.4 Macro Functions	78
3.6.4.4.1 Highlighting a Macro	78
3.6.4.4.2 Deleting a Macro	78
3.6.4.4.3 Shifting a Macro	78
3.6.4.4.4 Copying a Macro	78
3.6.4.4.5 Storing a Macro on Disk	79
3.6.4.4.6 Loading a Macro from Disk	79
3.6.4.4.7 Compatibility of Macros	80
3.6.4.5 New Teach Program	81
3.6.4.6 Teach Program Name	82
3.6.4.7 Loading Teach Program from CPU	82

3.6.4.8 Exiting the Editor	83
3.6.5 Adapting Positions, Times and Speeds in AUTOMATIC Mode	84
3.6.6 Adapting Positions, Times and Speeds in BLOCK STOP Mode	84
3.6.7 Step Operation.....	85
3.6.7.1 Step Operation in Block Stop Mode	85
3.6.7.2 Step Operation in Reference and Manual Modes	85
3.6.8 Settings in the Teach Mode / INIT Menu	86
3.6.8.1 Online / Offline Editor	86
3.6.8.2 Counter Names	86
3.6.8.3 PI Names.....	87
3.6.8.4 PO Names.....	87
3.6.8.5 Cylinders	88
3.6.8.5.1 Applying cylinders in a teachprogram.....	89
3.6.8.6 Positions.....	90
3.6.8.6.1 Changing or Redefining a Position	91
3.6.8.7 Gripper Reference Positions	92
3.6.8.8 Vacuum Referencing.....	92
3.7 DIRECT INSTRUCTIONS AND FUNCTIONS IN TEACH MODE	93
3.7.1 Axes	93
3.7.1.1 Absolute Motion.....	93
3.7.1.2 Relative Motion.....	93
3.7.1.3 Parallel Motion.....	94
3.7.1.4 Curve.....	96
3.7.1.5 Stop Function	96
3.7.1.6 Stack Sensor	97
3.7.1.7 Ejector Synchronization (optional).....	98
3.7.1.8 Maximum Speed (Vmax).....	99
3.7.1.9 Absolute Speed (Vabs)	99
3.7.1.10 Absolute Acceleration (Aabs).....	99
3.7.2 WAIT SYNC	100
3.7.2.1 WAIT PATH-SYNC.....	100
3.7.3 3D Motions.....	101
3.7.3.1 3D Parameters V3D, R3D	101
3.7.3.2 3D Absolute Motion	102
3.7.3.3 3D Relative Motion	102
3.7.3.4 3D Curve Motion	103
3.7.4 Vacuum and Gripper.....	104
3.7.5 Peripheral Outputs and Conveyor Belts.....	104
3.7.6 Alternative Sequence with "Piece Lost"	105
3.7.7 Signals to the Injection Molding Machine (IMM)	109
3.7.7.1 CLOSE MOLD, FULL MOLD OPENING	110
3.7.7.2 EJ FORWARD/BACK, CP PULL/SET	111
3.7.7.3 EJ/CP ANTIVALENCE	111
3.7.7.4 EJ/CP WAIT	111
3.7.8 Time Function TIME.....	112
3.7.9 Placing Programs	112
3.7.9.1 Editing or Creating a Placing Program.....	113
3.7.9.2 Adjustable Parameters in the Placing Program.....	114
3.7.9.2.1 Name	114
3.7.9.2.2 Approach.....	114
3.7.9.2.3 First Placing Position	114
3.7.9.2.4 Axis Sequence.....	114
3.7.9.2.5 Placing Order.....	114
3.7.9.2.6 Stack Sensor.....	115
3.7.9.2.7 Placing Pattern.....	115

3.7.9.2.8 Box Height (for 3D Motions Only)	116
3.7.10 Label	117
3.7.11 Jump Instruction (JMP)	117
3.7.11.1 Jump Address (Label)	118
3.7.11.2 Jump Conditions.....	118
3.7.11.2.1 Absolute	118
3.7.11.2.2 IMM - Inputs	118
3.7.11.2.3 PI – Peripheral Input	118
3.7.11.2.4 CNT – Counter	119
3.7.11.2.5 Placing Counter	119
3.7.11.2.6 Piece Counter	119
3.7.11.2.7 VACUUM	120
3.7.11.2.8 PROGS – Partial Program	120
3.7.11.2.9 PLACING AREA	120
3.7.11.2.10 MOLD AREA	120
3.7.11.2.11 MODE (only available in an ALL MODES program)	121
3.7.11.2.12 NOT RDY - Not Ready.....	121
3.7.11.2.13 STACK SENSOR.....	121
3.7.11.2.14 START	121
3.7.12 Subroutines.....	122
3.7.13 Program Branching with IF ... ELSE ... END IF	123
3.7.14 AND / OR.....	124
3.7.15 WAIT Function (WAIT).....	125
3.7.16 Peripherals Teach Program	125
3.7.16.1 Peripheral program ALL MODES	126
3.7.17 Counter Function	127
3.7.17.1 Counters (CNT).....	127
3.7.17.1.1 Value	127
3.7.17.1.2 Counter	128
3.7.17.1.3 Stopwatch	128
3.7.17.1.4 Example	128
3.7.17.2 Placing Counters (Placing and Piece Counters)	129
3.7.18 Remarks	129
3.7.19 Locking/Unlocking Block Stop.....	130
3.7.20 Cycle End	130
3.7.21 Stopwatch	131
3.7.22 End Instruction	132
3.8 GRAPHICS EDITOR	133
3.8.1 Callup of Graphics Editor	134
3.8.2 Main Menu	134
3.8.2.1 Menu File.....	135
3.8.2.1.1 New Grahicprogram	135
3.8.2.1.2 Delete Grahicprogram.....	135
3.8.2.1.3 Create Teachprogram.....	135
3.8.2.1.4 Teachprogram name.....	135
3.8.2.1.5 Reference Program.....	136
3.8.2.1.6 Load program from CPU.....	136
3.8.2.1.7 Transfer program to CPU.....	136
3.8.2.1.8 Load program from disk.....	136
3.8.2.1.9 Store program to disk.....	136
3.8.3 Select Program Sequences	138
3.8.3.1 Injection molding machine.....	138
3.8.3.2 Placement	138
3.8.3.3 Reject Part.....	138
3.8.3.4 Sprue Cutter	139
3.8.3.5 Placement of Sprue.....	139
3.8.3.6 Quality Control.....	139
3.8.4 Teaching a robot program.....	139
3.8.4.1 Travelling axes	139

3.8.4.2 Action Points	140
3.8.4.3 Sequence	142
3.8.4.3.1 Start-Routine	142
3.8.4.3.2 Removal	143
3.8.4.3.3 Reject Part	144
3.8.4.3.4 Sprue Cutter	144
3.8.4.3.5 Placement of Sprue	145
3.8.4.3.6 Quality control	145
3.8.4.3.7 Placement	146
3.8.4.4 Finish programming, transfer the program, exit the editor	147
3.9 SAFETY SYSTEM	148
3.9.1 Startup with Safety System	148
3.9.1.1 Manual Setup Mode	148
3.9.1.2 Automatic Mode, Stepping Mode, Reference Travel	148
3.9.2 Selection of Operating Modes	148
3.9.2.1 Manual Setup Mode	148
3.9.2.2 Automatic Mode, Stepping Mode, Reference	148
3.9.3 Monitoring of Safety Gate	149
3.9.4 Error Effect Analysis	149
4 HOW TO TEACH A PROGRAM	150
4.1 PROGRAMMING THE ROBOT	150
4.1.1 Creating a New Program in the Teach Editor	150
4.1.2 Verifying Your Program Using STEP Mode	151
4.1.3 Storing Your Program on Disk	151
4.2 PROGRAM EXAMPLE	152
4.2.1 Function of Program	152
4.2.2 Sequence	152
4.2.3 Sketch of Depositing Program	153
4.2.4 Robot Arm	153
4.2.5 Reference Positioning of Robot	153
4.2.6 Robot Teach Program	154
4.2.6.1 Placing Program PLCPRG01	155
4.2.7 Reference Program for Robot (Robot REF Program)	155
5 TROUBLESHOOTING	156
5.1 SYSTEM ERRORS	156
5.2 TEACHBOX MESSAGES	160
5.3 OPERATING ERRORS	166
5.3.1 Operating Errors in Plain Text Messages	167
5.3.1.1 Axis Errors	167
5.3.1.2 Vacuum Errors	169
5.3.1.3 Gripper Errors	169
5.3.1.4 Peripheral Equipment Output Messages	170
5.3.1.5 If Messages	170
5.3.1.6 Conveyor Belt Messages	170
5.3.1.7 Call Messages	171
5.3.1.8 General Error Messages from Master	171
5.3.1.9 Protocol Error Messages	173
5.3.1.10 System Error Messages	173
5.4 USING THE BOOT DISK	174

6 MAINTENANCE	175
6.1 GENERAL	175
6.2 LUBRICATION INSTRUCTIONS FOR LINEAR GUIDES AND GEAR RACKS	176
6.2.1 Lubrication Intervals for Standard Robots.....	176
6.2.2 Lubrication Procedures	176
6.2.3 Grease Specification.....	176
6.3 MAINTENANCE SCHEDULE	177
6.4 AUTOMATIC LUBRICATION	178
6.4.1 Automatic Lubrication Standard-version 2001	178
6.4.1.1 Description:	178
6.4.1.2 System Maintenance:.....	179
6.4.1.2.1 Lubrication System Maintenance Procedure:	179
6.4.1.2.2 Suitable greases	179
6.4.2 Automatic Lubrication Standard.....	179
6.4.3 Automatic Lubrication USA.....	180
6.5 BUFFER BATTERIES OF MASTER CPU AND OF TEACHBOX CPU.....	181
6.5.1 Battery Replacement in Teachbox.....	181
6.5.2 Battery Replacement in Master CPU	181
7 KEY TERMS	182
8 INDEX	183

1 Safety



Wittmann Robots can be operated at high speeds so as to allow short removal and cycle times. In order to minimize the risk of injury to personnel, the robot and automation equipment must always be operated with the proper safeguards, in accordance with legal regulations.

1.1 Safety Standards

In many countries the obligation of robot vendors to supply systems meeting applicable safety regulations and the responsibility of the operator of these devices are governed by law or by safety standards of professional associations as follows:

In the U.S.A. :

- When a robot is used in conjunction with an injection molding machine, the resulting system must be guarded and interlocked in accordance with the requirements of ANSI/SPI B151.27.

In Germany:

- Machine Safety Act of June 24, 1968 (Version of February 18, 1986)
- VDI 2853:
Safety Requirements for Handling Machines and Industrial Robots
-
- VDI 2854:
Safety Requirements for Automated Production Systems
-
- DIN 31000:
General Principles for Safe Design of Technical Products
-
- DIN 31001:
Safety Standards
(this Standard governs the design of safeguards)
-
- EN 294:
Safety Limits for Reaching into Hazardous Areas with the Upper Extremities

In Switzerland:

SUVA (Swiss Safety Institute) directives apply.

E.g., Bulletin:

- Safety Objectives for Construction and Use of Industrial Robots
- Safety Switches and Safety Circuits, Safety Panels

In Austria:

- ÖNORM Z-1590:
Safety Requirements for Program-Controlled Motion Devices

1.2 Safety Features

1.2.1 Safeguarding

The safeguarding required for operation of the robot is not included in our standard scope of supply, since adaptation to specific site conditions is required. If such safeguarding is provided by you, please note that it must be installed **prior** to startup of the equipment in order to be included in the safety circuit of the system upon startup. See Chapter 2.5. Safety Package/Safeguarding.



The user bears the legal responsibility for following safety regulations.

1.2.2 Emergency STOP Buttons

One emergency stop button is located on the control cabinet.
One emergency stop button is located on the teachbox.

When an emergency stop button is pressed, the power is turned off. The gripper and vacuum valves and the vacuum pump are not disconnected, to avoid dropping parts from the gripper. In addition, the controls and the teachbox will remain under power to allow indication of error messages.

The emergency stop button can be released by turning it clockwise.

The emergency stop circuits of the robot and of the injection molding machine are connected by the E12 interface. Therefore when the emergency stop button on the molding machine is pressed the robot will also go into emergency stop and vice versa.

1.2.3 Permit Key on Teachbox

This key must be depressed for setting up for manual operation in order to be able to carry out travel motions with the robot. For more precise operation, see Chapter 3.9. Should this permit key be released during setup, the safety functions will interrupt all travel motion of the robot.

2 Installation



Installation and startup shall be performed by authorized personnel only, in order to avoid injury to personnel or damage to equipment.

Our trained service engineers are available to assist you.

2.1 Mechanical Installation

2.1.1 Dimensional Drawing – Adapter Unit

Please see the accompanying drawing for the dimensions of the robot with the dimensions for attachment of the gripper.

The robot is normally mounted on the fixed platen of the injection molding machine by means of an adapter unit in accordance with VDMA 24466 or FHK-85-12-22.

If the adapter is supplied by us, a drawing for installation on the machine is enclosed.

2.1.2 Mounting of the Robot

The weight of the robot is shown on the robot identification plate on the Z beam. Smaller robots up to type W 633 are equipped with lifting eyes on the main beam (Z axis). Larger robots from W 641 on up have machined slots for lifting with a fork lift (e.g., in low bays) or for slings or chains with a crane. Robots W 455 and W 510 are also equipped with holes for the use of lifting rods.



Before lifting the transport pallet, the main carriage (Z axis) and kick stroke (X axis) must be put into a balanced position:

Motor drives with posi stop motor or frequency converter:

1. Remove cooling fan cover of Z- and X-axis motor.
2. Move the carriage by turning the cooling fan until the



marks on the carriage and beam are aligned.

Robots with servo drives:

The main carriage and kick stroke can only be moved by applying voltage from an external power supply in the X and Y axes. Because of the high accelerations of servo drives, this operation is hazardous and therefore should be performed only by our trained service engineers.



Before lifting the robot, the vertical axis must be secured against tipping.

When lifting with a fork lift, secure the robot against slipping.

2.2 Pneumatics

2.2.1 Compressed Air Connection

This connection is made on the service unit with a 1/2" hose. A shutoff valve (ball cock or quick connection coupling) should be installed at the point of connection of the main compressed air line.

Required air pressure: 90 psi (6 bar)

The air-pressure switch will shut off the robot at 50 psi (3.5 bar).

Air consumption per robot cycle:

The air consumption depends on the optional equipment installed on your robot.

Air consumption of the robot may be calculated from the following table:

Robot	Consumption per stroke *		Cons. per sec. **
	C axis	A axis	Vacuum per circuit
W621 CNC	0.3	0.2	0.5
W631 CNC	0.3	0.2	0.5
W632 CNC	1.1	0.4	0.5
W633 CNC	1.1	0.4	0.5
W641 CNC	1.1	1.3	0.5
W650 CNC	6.4	8.3	0.5
W660 CNC	6.4	8.3	0.5
W670 CNC ¹	6.6	4.5	0.5

*: In ft³ at 90 psi (6 bar)

** : For venturi vacuum circuits only

Example of calculation of compressed air consumption:

W633CNC: with X , Y, Z axes motor driven
 A and C axes pneumatic
 2 vacuum circuits, operated 10 sec. each

1)	A axis:		
	moved twice per cycle:	2 x 0.4 =	0.8 ft ³
2)	C axis:		
	moved twice per cycle:	2 x 1.1 =	2.2 ft ³
3)	2 vacuum circuits:		
	each one operated for 10 sec./cycle:	2 x (10 x 0.5) =	10.0 ft ³
4)	<u>Total consumption:</u>	0.8 + 2.2 + 10 =	<u>13.0 ft³</u>

¹ for CNC6 robots only

2.2.2 Hoerbiger Axis

This description applies to all three-position Hoerbiger rotary units used for A and B axes.

The three-position drive consists of two rack-and-pinion gears moved by two cylinders. The first cylinder uses the "A" and "B" connections and moves the drive clockwise and counter clockwise. The second cylinder uses the "C" and "D" connections and moves two pistons that prevent rotation beyond 90°. The two cylinders are actuated by separate valves.

In applications where only two positions are used, only the valve for connections "A" and "B" are installed on the robot. In this case a direct compressed air line may be placed on the "C" or "D" connection in order to select a 90° stop. Without a connection to "C" or "D" the unit rotates from 0 to 180°. Unused connections must be protected against fouling.

Summary of connections and their functions:

Motion	Connection			
	A	B	C	D
undef. -> 0°	1	0	0	-
undef. -> 180°	0	1	-	0
0° -> 90°	0	1	-	1
180° -> 90°	1	0	1	-

- 1 ... acted on by compressed air
- 0 ... compressed air discharged
- ... undef. condition

Regulation of speed:

A flow control is located before each connection of the rotary unit. The following table shows how the rotary unit is adjusted by means of these flow controls. Generally, the connection last actuated and the connection for the target position must always be comparable. The flow control at whose connection the air is discharged (exhaust air control) must always be adjusted.

Last position	Present position	Next position	Connection for regulation of speed
any	0°	90°	A
any	0°	180°	A
any	180°	90°	B
any	180°	0°	B
0°	90°	180°	D
180°	90°	180°	A
180°	90°	0°	C
0°	90°	0°	B

2.2.3 Schunk Axis

This description applies to all three-position Schunk rotary units that are used for A und B axes.

The three-position drive consists of a rack-and-pinion gear moved by two cylinders and two short-stroke cylinders for the 90° positions. The first cylinder uses the "A" connection and moves the drive clockwise. The second cylinder uses the "B" connection and moves the drive counter clockwise. The "C" connection is used for the short-stroke cylinders that prevent rotation beyond 90°.

In applications where only two positions are used, only the valve for the "A" and "B" connections are installed on the robot. In this case the 90° and 180° positions can be adjusted by adjusting screws.

Summary of connections and their functions:

Motion	Connection		
	A	B	C
undef. -> 0°	0	1	0
undef. -> 180°	1	0	-
0° -> 90°	1	0	1
180° -> 90°	0	1	1

- 1 ... acted on by compressed air
- 0 ... compressed air is discharged
- ... undef. condition

Regulation of speed:

A flow control is located before every connection of the rotary unit. The following table shows how the rotary unit is adjusted by means of these flow controls. Generally, the connection last actuated and the connection for the target position must always be comparable. The flow control at whose connection the air is discharged (exhaust air control) must always be adjusted.

Last position	Present position	Next position	Connection for regulation of speed
any	0°	90°	B
any	0°	180°	B
any	180°	90°	A
any	180°	0°	A
0°	90°	180°	B
180°	90°	180°	B
180°	90°	0°	A
0°	90°	0°	A

2.3 Electrical Connections

2.3.1 Power Supply

The required electrical voltage and power supply are indicated on the identification plate of the robot. Power connection normally is made with cables and CEE plugs.



The power connection must be made by a qualified electrician in accordance with federal, state and local regulations.

For personnel safety, proper installation of the earth ground must be verified.

After connection to the power supply, the direction of rotation must be checked (e.g., on the vacuum pump). The phasing must be clockwise.

2.3.1.1 Fault Current Safety Switch



Fault current (old: FI, new: RCD) safety switches may be used only **under certain conditions** in conjunction with frequency converters:

- In frequency converters with 3-phase input voltage, in the event of a ground leak a part of the fault current may **prevent release of an FI / RCD safety switch**.
- Parasitic capacities in the converter can in principle cause leakage currents, which may result in **false trippings**.

Alternative safety measures are for example grounding or isolation.

If a fault current safety switch is used in robots with 3-phase converters, it must be a new RCD TYPE B or RCMA .

If a fault current safety switch is used in robots with single-phase converters, it must be a new RCD TYPE B or RCD TYPE A .

2.3.2 Interface with Injection Molding Machine

The robot is equipped with standard electrical interfaces (plug type HAN 32A) in accordance with VDMA 24465 (Euronorm E12). In robots supplied as integrated systems, molding machines are equipped with CAN-BUS controls and safety signals are executed by an emergency stop. See wiring diagram at the end of this chapter and pin description (Section 2.6).



Connection of the interface plug to the machine and testing of all signals must be done by a specialist in injection molding machines and robots. Preferably, this should be done by a Wittmann service engineer together with a qualified service engineer for injection molding machines.

The interface signal functions must be carefully tested, as improper operation may cause malfunction or damage to the robot.



In particular, the functions of the safety circuits must be thoroughly checked:

- Emergency stop signals from and to the IMM
- Function of mold safety interlock switches S5/S6
- External safety circuits for access door to the protected area

2.3.3 Mold Safety Switches S5/S6



Proper adjustment of the cams for roller switches S5 and S6 is extremely important, since they determine the closing and opening motions of the IMM. These roller switch signals are independent of the mold closing and opening signals of the robot program and are directly wired through the electrical interface to the IMM (redundant safety).

Function and Adjustment of Roller Switch S5:

The roller switch S5 is mounted on the vertical axis and is operated by the cam on the vertical axis. Only when S5 is actuated is the closing/opening motion released. Adjust the cam of S5 so that it actuates the switch only when the gripper and part are at a safe position above the mold.

Function and Adjustment of Roller Switch S6:

The S6 switch is mounted to the main traversing carriage and is operated by the cam on the Z beam. S6 overrides the function of S5, so that the robot arm can move down outside the machine without interrupting closing or opening of the IMM.

Adjust the cam so that S6 is actuated only while providing a sufficient safe distance outside the protective grating of the machine (with the largest part on the gripper!).



After proper adjustment of the cams, double-check the function of the safety switches S5 and S6. If neither switch is actuated (robot arm inside mold) check that even with a closing signal from the robot the closing and opening motion of the IMM is interrupted and impossible!

2.3.4 Test Procedure for Mold Safety Switches S5 / S6

Switch to operation without robot (robot LED key does not light).

Close mold slightly (Mold Open signal must be off).

Now try to travel into the mold with the Y axis.

Move the Y axis only until leaving S5.

The error message "Mold monitoring" must be displayed on the robot.

Acknowledge message with ESC.

Now try to close and open the mold.

This should not be possible and an error message must appear on the IMM.

Now raise the Y axis.

If this description does not exactly apply, please contact our Service Center.

2.3.5 Vacuum switch SMC

2.3.5.1 Initial Settings

The basic settings normally only have to be carried out on a new pressure switch. When a new robot is delivered, the basic settings have already been made. Anyway, if you should encounter problems during operation, or if the switch was renewed, the initial settings should be done as described.

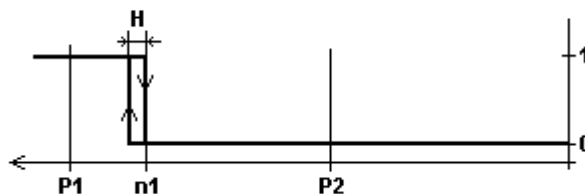
<p>Press and hold the SET key longer than 2 seconds to activate the initial settings mode.</p>	
<p>Use the UP/DOWN keys to set the unit to bar. Confirm by pressing the SET key.</p>	
<p>Use the UP/DOWN keys to set the display color to "switch on green". Confirm by pressing the SET key.</p>	
<p>Use the UP/DOWN keys to set the operating mode to "hysteresis". Confirm by pressing the SET key.</p>	
<p>Use the UP/DOWN keys to set the output type to "normally closed". Confirm by pressing the SET key.</p>	
<p>Use the UP/DOWN keys to set the response time to 2,5 ms. Confirm by pressing the SET key.</p>	
<p>Use the UP/DOWN keys to set auto preset to "manual". Confirm by pressing the SET key. The vacuum switch will return to the measuring mode.</p>	

2.3.5.2 Pressure Setting

The set value for the pressure should be adapted with each change of the EOAT or the product.

2.3.5.2.1 Evaluation of the set value (n1) and of the hysteresis (H)

- Switch on the vacuum circuit.
- Place all parts on all suction caps of the vacuum circuit.
- The display of the vacuum switch will toggle to green if set correctly. The value displayed equals P1 in the drawing below (take a note).
- Remove one part from one suction cap of the vacuum circuit.
- The display of the vacuum switch will toggle to red if set correctly. The value displayed equals P2 in the drawing below (take a note).

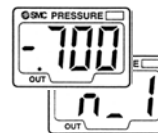


The set value (n1) has to be set between P1 and P2. It should be chosen as close to P1 as it still toggles safely with the set hysteresis (H). The hysteresis should be chosen as small as possible.

Factory settings are -0,700 bar for the set value and 0,004 bar for the hysteresis.

2.3.5.2.2 Setting the set value (n1) and the hysteresis (H) at the sensor

Press the SET key (shortly) to enter the pressure settings mode. n1 and the current value for the set value flash alternately.



By pressing one of the UP/DOWN keys you enter the mode to change the set value n1. See also „Setting a value“.

After you have set n1, press the SET key (shortly). H and the current value for the hysteresis flash alternately.



By pressing one of the UP/DOWN keys you enter the mode to change the hysteresis H. See also „Setting a value“.

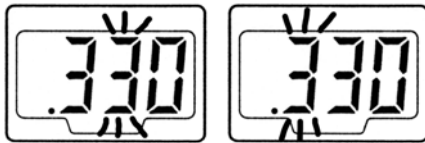
Press the SET key (shortly) to return to the measurement mode.

2.3.5.2.3 Setting a value

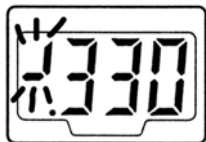
- After having pressed an UP/DOWN key in the pressure setting mode, the first digit of the displayed value will start flashing:



- Using the UP/DOWN keys it is now possible to change the flashing digit.
- By (shortly) pressing the SET key, you can switch to the next digit:



The following settings are possible at the leftmost digit:



- ! for a positive value
- ! for a negative value
- ! for +1
- ! for -1

- Press and hold the SET key longer than one second to confirm the value set, and to return to the previous display.

2.3.6 Vacuum switch SUNX

2.3.6.1 Switching to Desired Mode

Depress the ▲ and **MODE** keys simultaneously.

Using the ▲ key, select a setting.

Use the ▼ key to change the function of the selected setting.

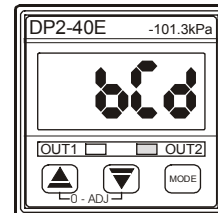
Set " **b C d** :"

b stands for display of negative pressure in [bar].

C stands for window function activated.

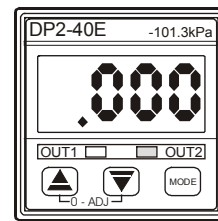
d stands for display is digital.

Exit menu by depressing **MODE**.



2.3.6.2 Setting Zero Point

With the vacuum circuit turned off, depress the ▲ and ▼ keys until **000** appears on the display.



2.3.6.3 Determining and Setting Switch Points

Turn on the vacuum circuit and produce the condition under which the vacuum monitoring system should react (e.g., removing one of the parts from the gripper), and note the value displayed on the vacuum switch as **switch point 1**.

Now put all the parts properly on the gripper and note the value shown on the vacuum switch as **switch point 2**.

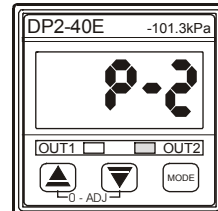
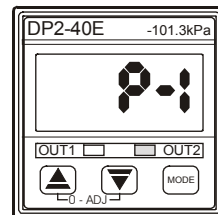
Depress the **MODE** key until **P-1** flashes.

Using the ▲ and ▼ keys, set the value of **switch point 1**.

Depress the **MODE** key until **P-2** flashes.

Using the ▲ and ▼ keys, set a value greater than **switch point 1**.

Exit menu by pressing **MODE**.



2.3.6.4 Checking Function

Check the correct function by means of the LED on the vacuum switch:

All parts on gripper: **OUT 1** (orange) lights - **OUT 2** (green) does not light.

Remove part from gripper: **OUT 1** (orange) goes out - **OUT 2** (green) lights.

2.4 Initializing Safety Areas

2.4.1 General

The following forms of safety areas may be monitored:

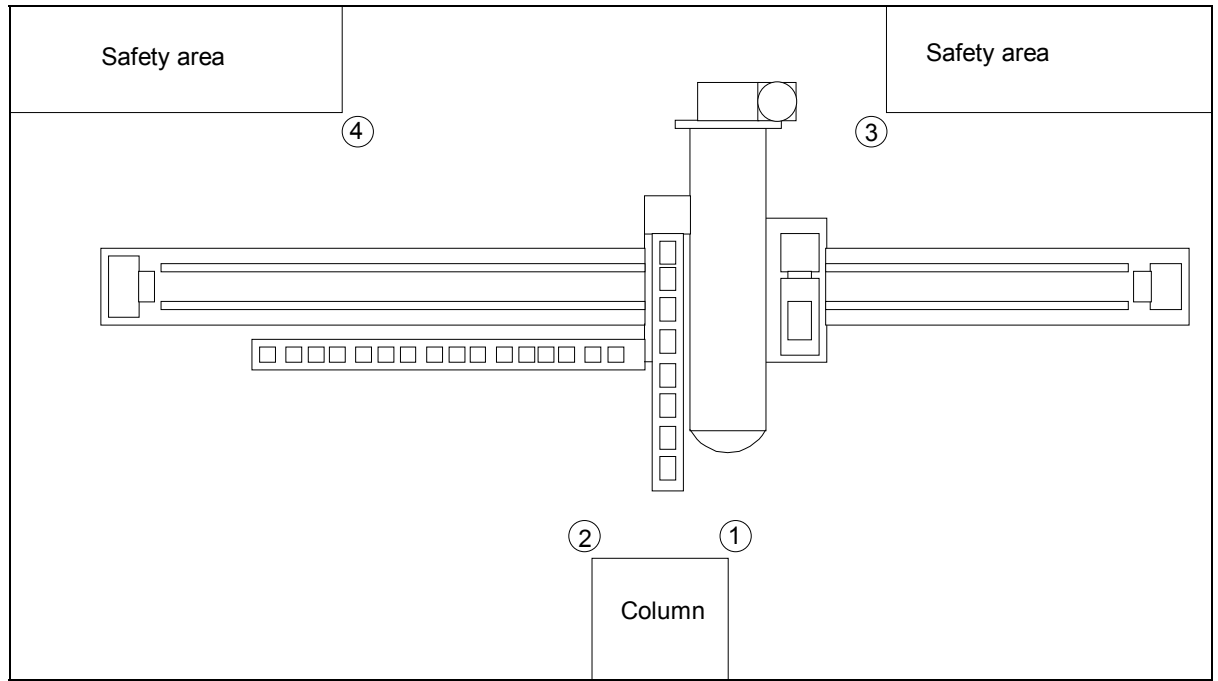






Fig. 9.1

-  The switch strip cams of the safety areas must be set so that the switch strip is approached about 10 cm before the obstacle.
-  The number of safety area switch points must be configured on site.
-  Safety areas are not monitored in the NO_REFERENCE mode. The safety area switches are ignored, because the safety areas have not yet been initialized.
-  Safety areas can only be deleted by an initial initialization.

2.4.2 Initial Reference Travel

- Carefully move all axes in the direction of reference position.

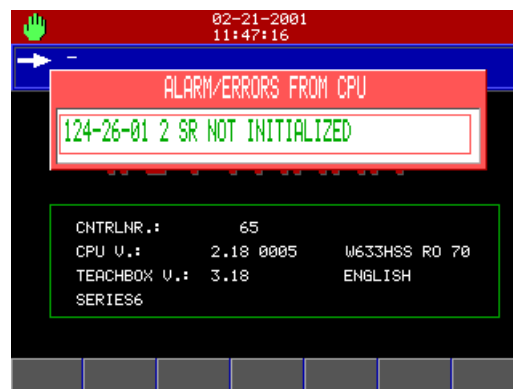


Safety areas are not monitored in the NO_REFERENCE mode. The safety area switches are ignored because the safety areas have not yet been initialized.

- Perform the initial reference using the reference key.
- Operating mode will switch to MANUAL.

2.4.3 REF in Manual

- If the safety areas have not yet been initialized, the REFERENCE operating mode will not be entered after reference travel, and the following error message will be displayed:



The number of safety area switch points to be initialized will be shown.

2.4.4 Initializing Safety Area Switch Points

To initialize safety area switch points, proceed as follows.

2.4.4.1 Finding Switch Points

- Move any desired axis (normally the Z axis) in the direction of a switch point.
- When the switch point is recognized, the axis will stop.
The following error message will appear:



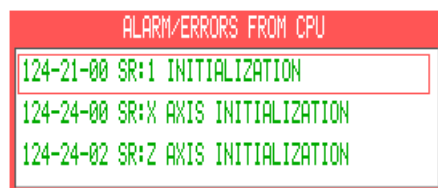
- Closing the window with "ESC" only will make it possible to see all messages for initialization later.



An axis that has several switch points at the same position can only be used for finding a switch point if an already initialized safety area will not be violated.

2.4.4.2 Finding All Axis Switch Points

- Move all axes that are monitored in a safety area in the direction of the switch point.
- When the switch strip cam is reached, the axis will stop with an error message and will be accepted for initialization.



An axis that is already on a switch strip cam must first be moved away from it. The axis will only be accepted for initialization when the switch strip is approached again.

2.4.4.3 Initializing All Axis Positions

- In order to initialize the switch point and store the axis positions, all axes must now be moved away from the switch strips again.



At this point in initialization, the axes can still be moved in both directions.
RISK OF COLLISION!

- If all axes have been moved away from the switch strips, the safety area will be recognized and immediately monitored.

```
ALARM/ERRORS FROM CPU
124-21-00 SR:1 INITIALIZATION
124-23-00 SR:1 IS INITIALIZED
124-24-00 SR:X AXIS INITIALIZATION
124-24-02 SR:Z AXIS INITIALIZATION
124-25-00 SR:X AXIS IS INITIALIZED
```

- If one safety area switch point has been initialized, the operation must be continued until all switch points have been initialized.
- Only then can the robot be put into the REFERENCE mode.

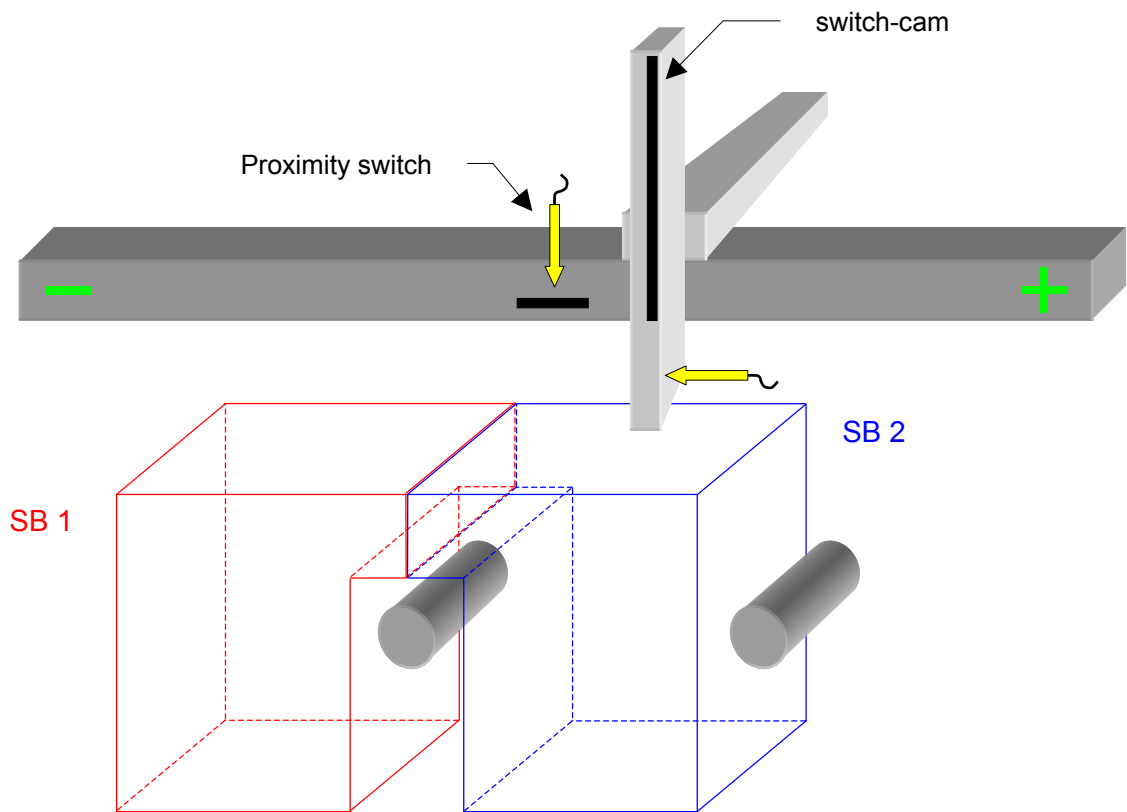
2.4.4.4 Aborting Initialization

If during initialization it is found that an axis is not to be monitored in this safety area after all, initialization may be aborted.

An axis that has already been initialized must be moved back to the switch strip again in order to abort initialization. The following error message will appear:

```
ALARM/ERRORS FROM CPU
124-20-00 SR:1 VIOLATED
124-22-01 SR:2 INIT ABORTED
```

2.4.5 Beispiel: IMM-transom



If the obstacle shown above is to be defined as a safety area, proceed as follows (All axis movements executed using medium manual speed):

initialize SR1 :

Z +	until	"SR1 initialization"	and	"Z-axis initialization"
Y +	until	"Y-axis initialization"		
Y -	until	"Y-axis is initialized"		
Z -	until	"Z- axis is initialized"	and	"SR1 is initialized"

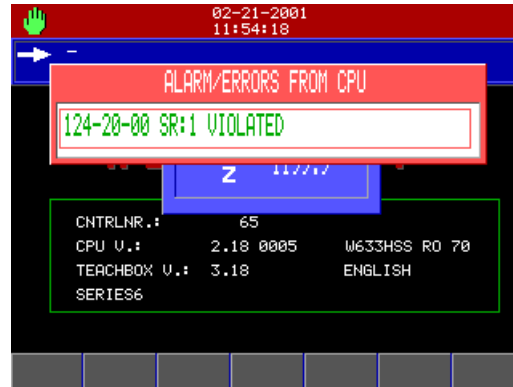
Y -	until	~0.0mm (Careful, no minus-value!)
Z -	until	clear of SR1
Z +	until	the travelled around the obstacle (SR2)


initialize SR2:

Z -	until	"SR2 initialization"	and	"Z-axis initialization"
Y +	until	"Y-axis initialization"		
Y -	until	"Y-axis is initialized"		
Z +	until	"Z- axis is initialized"	and	"SR2 is initialized"

2.4.6 Monitoring Safety Area

If a safety area is violated in manual travel or in automatic operation, the robot will stop with the following error message.



 After a safety area violation only the axis that has violated the safety area can be moved. If the axis is on the switch strip at the time, it can only be moved away from the strip.

2.5 Safety Package/Safeguarding

As outlined in Chapter 1, the work envelope of the robot must be properly safeguarded in accordance with legal regulations.

2.5.1 INTERNAL Safety Package

Our robots with CNC-6 controls are equipped as a standard with the INTERNAL safety package in the control cabinet or, in integrated systems, on the control panel.

The **INTERNAL safety package** includes:

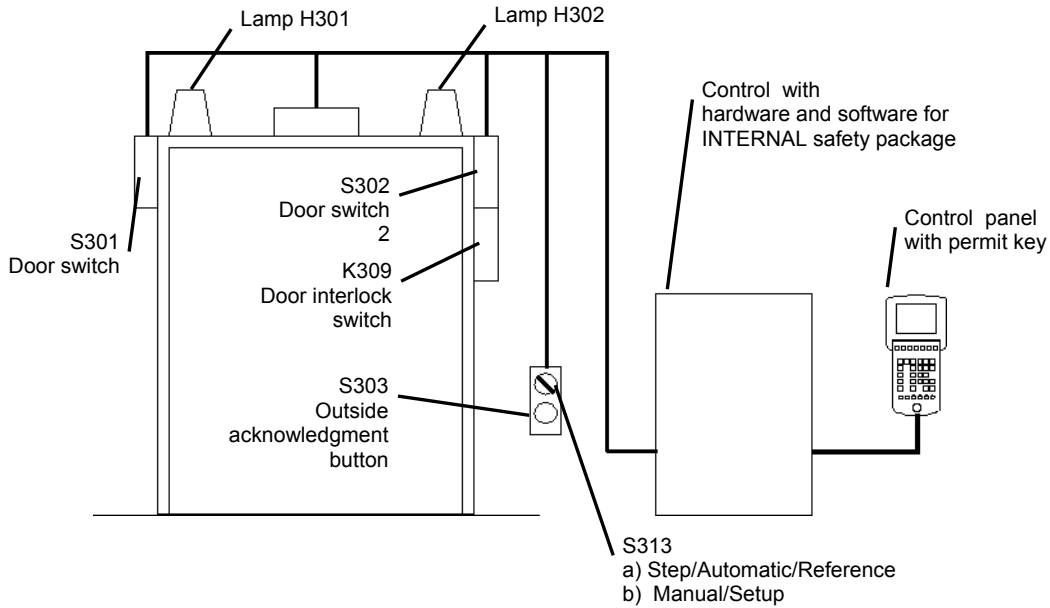
- Emergency Stop Disconnect Unit with two channels
- Safety contactor(s) for hardware shutoff of the axis drive when the safety door (hatch) is opened. In addition, the software monitors these contactors for proper operation (redundant safety).
- Remote control with 2 permit keys
- Software safety package (monitoring of inputs and outputs)
- Cable with HAN 25 plug for ease of connection of all necessary switching and display elements for mounting on an access door or hatch



The robot can be operated only if all safety requirements have been met, i.e., all protective devices have been properly installed **prior** to startup of the robot.

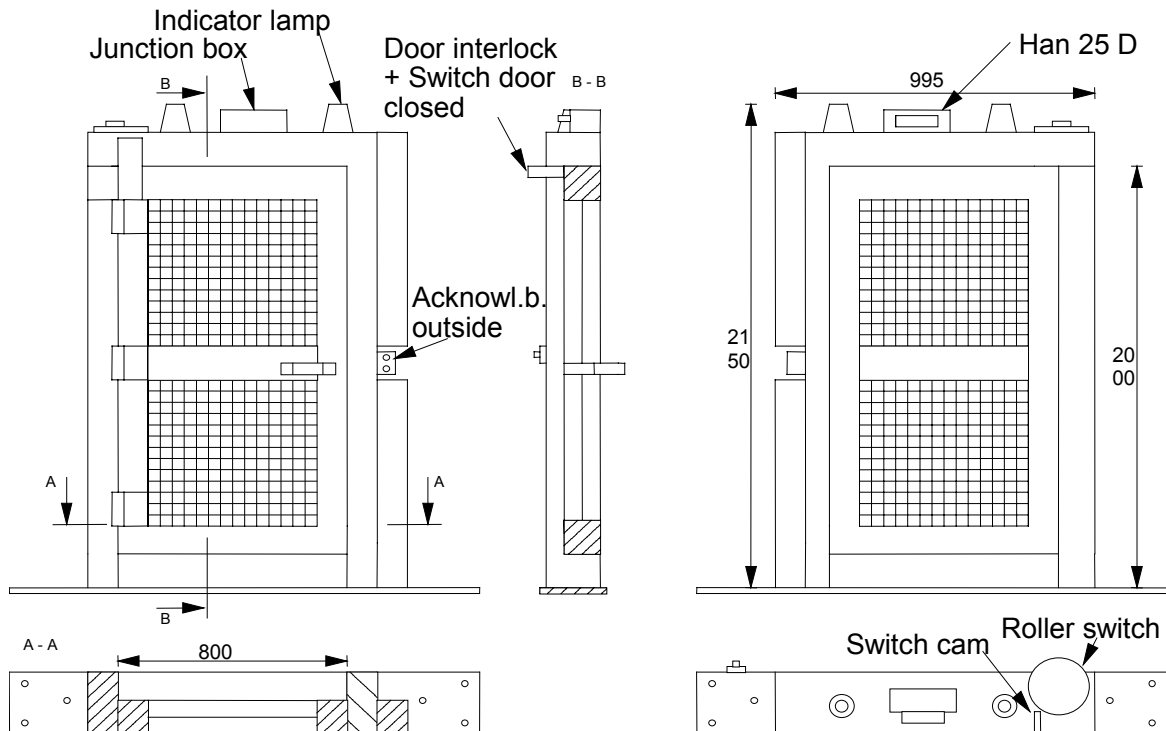
For a detailed description of the function of the safety package see Section 3.9.

2.5.2 EXTERNAL Safety Package for Safety Door or Access Hatch



External safety package includes:

- Door monitoring switch „Safety Door Open“ (S301)
- Door interlock with contact for software monitoring of function
The door can be opened only when the robot motions have come to a complete stop (K309).
- Door opening contact with roller switch and cam for confirmation of position:
Door open/closed (S301/S302)
- Outside acknowledgment button (S304)
- Selector switch for manual/automatic operation (S313)
- Mounting panel with junction box, plug and 2 indicator lamps:
(H301): robot enabled (automatic operation possible) (H302): robot disabled



These parts are required in order to confirm the function of the safety door in the safety circuit of the robot program and are obtainable, as an option, with or without safety door.

Before starting up the robot, check the safety circuits as follows:

- 1) Install the complete safety package
- 2) Check K24V/X100:
If you can measure 24V between K24V/X100 and 0V/X100 the emergency stop circuit is enabled.
- 3) Check of A24V on terminal X100 (robot disabled):
If a measurement between terminals A24V/X100 and 0V/X100 indicates 0V, the circuit is working properly.
- 4) Open the safety door.
- 5) Close the safety door.
- 6) Press the outside acknowledgment button (lamp H302 lights).
- 7) Turn the selector switch to „Auto“ setting (lamp H301 lights).
- 8) Check A24V/X100 (robot enabled):
If a measurement between terminals A24V/X100 and 0V/X100 indicates 24V, the circuit is working properly.
- 9) Turn the selector switch to „Manual“ (lamp H301 lights).
- 10) Check of both permit keys for remote control:
When one of the two permit keys is pressed in, the lamp H302 lights and operation of the robot with safety door open is possible.
- 11) Turn selector switch to „Auto“ position (lamp H302 lights).
- 12) Teach the robot a „blank“ program and start automatic cycle:
It must not be possible to open the safety door during automatic operation.

Function of Safety Package:

- A) Interruption of cycle in automatic operation**
The selector switch is in the **AUTO/STEP/REFERENCE** position.
- 1) Pressing the „**Block Stop**“ key (on the teachbox) allows the robot to complete the last motion, then the door interlock magnet is released and the safety door can be opened.
The safety package immediately interrupts the motion in both the hardware and software upon forcible opening of the safety door.
 - 2) To resume operation:
 - Close doors
 - Press outside acknowledgment button
 - Press automatic start key. Cycle will resume with the next instruction in the teach program.
- B) Manual or setup operation**
- 1) Set selector switch to **MANUAL/SETUP**.
 - 2) The door interlock magnet will be released, the door can be opened, and the safety area can be entered.
 - 3) All motions can be performed by remote control by simultaneously pressing the permit keys and the function keys. Before every new motion, the permit key must be released **one time** and then pressed again.
A maximum drive speed of 250 mm/sec is possible In *Manual/Setup Operation*.
 - 4) To resume operation in automatic mode:
 - Close doors
 - Press outside acknowledgment button
 - Set selector switch to automatic operation

- Press automatic start key; this ensures that the system cannot inadvertently be started by a third party if an operator is still in the protected area.

Note:

According to applicable safety regulations, slow motions of the robot axes (max. of 250 mm/sec or 10 in/sec) are not sufficient to allow access to the work envelope of the robot and to avoid accidents. Access is allowed **only** if the automatic mode is **completely** interrupted and this condition is secured by hardware contactors that prevent any motion.

2.5.3 Safety Guarding

This consists of safety door and safety guarding elements.

These safety guarding elements are available as an option in the following sizes (width * height):

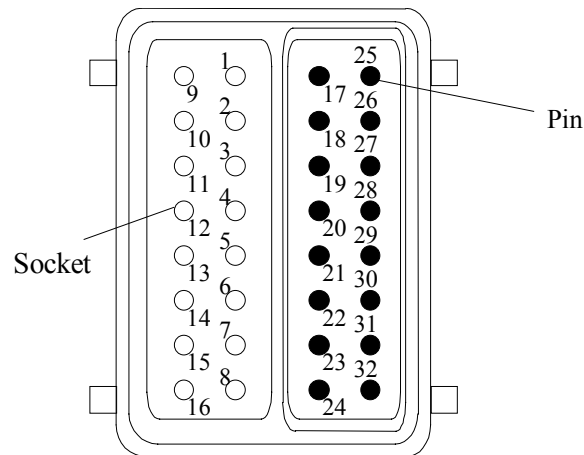
- 1000 mm * 2000 mm
- 500 mm * 2000 mm

These provide complete safety guarding of the work envelope of the robot and/or the entire automated system.

2.6 Electrical Interface

This section is applicable only to robots with an integrated system, since here the signals are transmitted to the injection molding machine via a CAN-BUS interface. Only the safety signals, such as the EMERGENCY STOP circuits and the mold safety signals, are connected by means of the following layout.

The interface consists of the plug connection between the injection molding machine and the robot :



The robot-injection molding machine interface is designed according to the directives of VDMA 24465, and/or according to Euromap 12, which state:

Unless otherwise noted, the signals are maintained during the described function and should not be shorter than 0.5 sec.

2.6.1 Injection Molding Machine (IMM) Signals

Pin contact No.	Function
1, 9	Emergency Stop The emergency stop switch of the injection molding machine is used to interrupt the emergency stop circuit of the robot.
2	Mold open The signal is produced by closing the switch. Signal must be interlocked so that it can be produced only when the minimum tool opening for insertion is reached.
3, 11	Safety system active For protecting against hazardous motions of the robot. The switch is closed when the safety system of the injection molding machine is active.
4	Ejector back Switch is closed when the ejector is back, regardless of the position of the movable tool plate. The signal acknowledges "ejector back enabled" (see pin contact No. 21).
5	Ejector forward Switch is closed when the ejector is forward. The signal acknowledges "ejector forward enabled" (see pin contact No. 22). The signal may be an impulse.
6	Core pullers free for robot to travel in Switch is closed when the core pullers, regardless of the position of the movable tool plate, are in position for free travel-in of the robot.
7	Core pullers in position for removal of injection moldings Switch is closed when the core pullers are in position for removal of the injection molding. The signal may be an impulse.
8	Reject Switch is closed when the molded piece is a reject. The switch must be closed when the tool is open and must remain closed at least until "close tool enabled" (see pin contact No. 17).
10	Fully automatic mode injection molding machine Switch is closed when the operating mode selector switch is on "fully automatic mode."
11	Reserved for SUVA Safety Package: IMM safety door closed +24V
12	Mold closed Switch is closed when tool closing has been completed; the signal "close tool enabled" is no longer necessary (see pin contact No. 17).
13	Free
14	Mold at intermediate position Switch is closed when the IMM has reached the specified intermediate position and remains closed until the IMM is completely open. The signal may be used in two ways: 1.) The mold stops in the intermediate position, whereupon a signal is sent to the robot. Complete opening of the IMM takes place through the signal "complete mold opening enabled" (see pin 28). 2.) The IMM transmits the signal, but does not remain in the intermediate position. Switch is open when the intermediate position is not used. (Option: Reserved for SUVA Safety Package: IMM safety door closed Channel 2)
15	No part available
16	Reference potential of molding machine


2.6.2 Robot Signals

Pin contact No.	Function
17	<p>Close tool enabled</p> <p>Switch closes when the robot is far enough out of the tool that it can be closed and when other robot control systems enable closing of the tool. The switch is closed for the duration of the tool-closing operation. In the event of contact release due to a disturbance, the tool-closing motion must be aborted.</p> <p>Note: The signal "close tool enabled" may not be linked with other OR signals in any operating mode.</p>
18, 26	<p>Tool area free</p> <p>Signalling is effected by the limit switch at the travel-in rail. The switch is opened when the travel-in rail, in the region of the injection molding machine, leaves its starting position before it is moved into the tool area. If the switch is open, neither a closing nor opening motion of the tool may take place.</p> <p>Even when the control system of the robot is shut off, the switch must work as described.</p>
19, 27	<p>Emergency stop of robot</p> <p>Opening of the switch contacts of the robot must shut off the control system of the molding machine.</p>
20	<p>Operation with robot</p> <p>With the robot in operation the switch is open.</p>
21	<p>Ejector back enabled</p> <p>Switch closes when the removal operation has been performed far enough for the motion "ejector back" to be carried out. The switch is closed for the duration of the motion "ejector back". The signal must be maintained at least until the signal "ejector back" from the molding machine (see pin contact No. 5).</p>
22	<p>Ejector forward enabled</p> <p>Switch closes when the removal operation has been performed far enough for the motion "ejector forward" to be carried out. The switch is closed for the duration of the motion "ejector forward." The signal must be maintained at least until the signal "ejector forward" from the molding machine (see pin contact No. 5).</p>
23	<p>Enable motion of core pullers for removal of injection moldings</p> <p>Switch is closed when the motion of the core pullers is enabled.</p>
24	<p>Enable motion for free travel-in of robot</p>
25	<p>Option: Reserved for SUVA Safety Package: Robot safety door acknowledged outside 1st channel</p>
28	<p>Complete mold opening enabled</p> <p>Switch is closed when the robot has removed the piece from the mold and permits further opening of the mold. The contact must remain closed until the IMM gives the signal "mold open." If the contact is not used, it must remain open. (Option: Reserved for SUVA Safety Package: Robot safety door acknowledged outside Channel 2)</p>
29	reserved for future EUROMAP signal
30,31	free
32	Reference potential of robot

3 Operating Instructions for CNC 6 Control

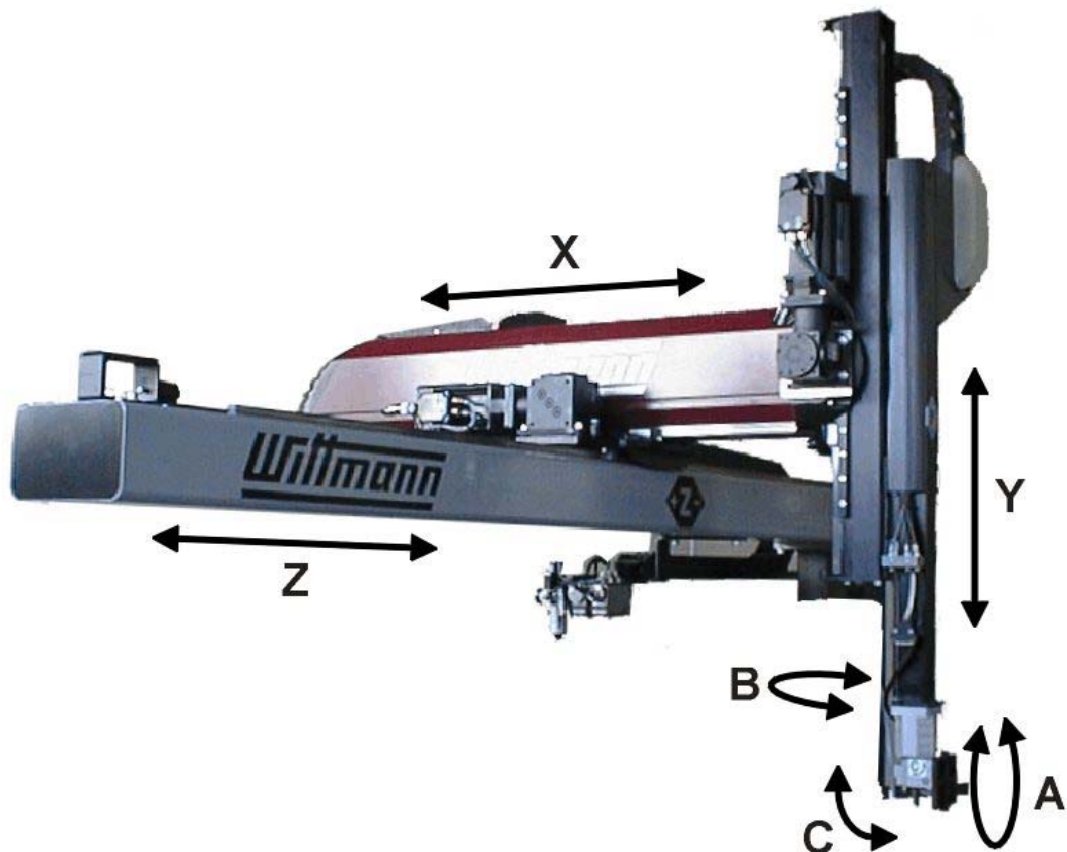
3.1 Introduction

The Wittmann CNC 6 control is a high-performance control system with a teach-in programming interface for the robot and peripheral equipment.

 Improper use or programming may result in injury to personnel and damage to the robot, gripper, mold or injection molding machine. Programming of the robot must be carried out only by trained personnel who are fully familiar with the operation of the robot.

We offer training sessions at our service centers. Please contact us.

3.1.1 Robot Axes



3.1.2 Features of the CNC 6 Control

The Wittmann CNC 6 control has the following features:

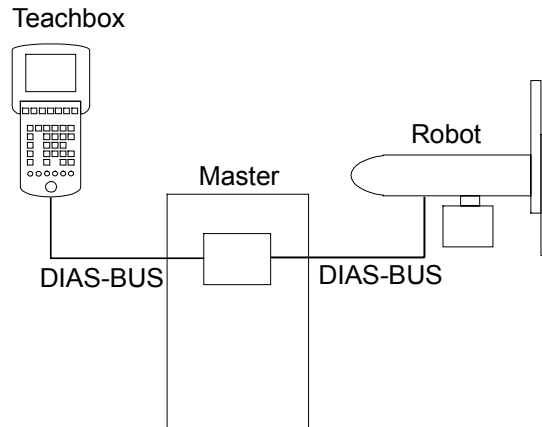
- Freely programmable teach-in control
- Most up-to-date control concept, with a guaranteed future
- Decentralized arrangement of microprocessors and electronics provides peak computer performance and fewer cables
- Maximum positioning accuracy by smooth regulation of accelerating and braking ramps
- Disk LW 3.5": Storage, loading and management of user programs in IBM-compatible format. Loading and update of CPU system programs
- In addition to the robot TEACH program, up to 13 peripheral teach programs can be run in parallel
- Freely teachable reference travel for robot and peripheral equipment
- Offline text program creation during automatic operation
- 16 palletizing programs, including in 3D operation in robots with 3D positioning motions
- Plain text display: Program steps, remarks, path positions, status display of inputs/outputs in plain text, error display, service and lubrication intervals, removal and total cycle time, hours of operation, etc.
- In robots with 3D positioning motions, offset of axes over a definable radius
- Definition of up to 8 cylinders for simple automated motions through user inputs and outputs
- Cycle end function
- Teach-in method with logical operations, including for alternative programs and subroutines. Relative motions programmable
- Alphanumeric program designations and designation of peripheral inputs/outputs, counters, various positions, partial programs, macros
- User management with configurable rights of access to control
- Instruction and error buffers for identification of causes of failure

3.2 Hardware

The Wittmann CNC 6 consists of several independent control systems communicating through a 6-wire bus line (DIAS BUS).

The Wittmann CNC 6 is composed of:

- Control cabinet: master control (CPU)
- Manual control: teachbox
- Robot: robot control electronics



3.2.1 Control Cabinet

The numerical axes are driven by controlled three-phase asynchronous motors or servo motors, which are controlled by frequency converters and servo modules, respectively.

The control cabinet includes as a standard a single frequency converter shared by three numerical axes. Up to six servo converters can be installed as an option. This permits interpolated 3D motion of the 3 main numerical axes (X,Y,Z) with additional simultaneous motion of the up to 3 swiveling numerical axes (3D offset and parallel motion).

In addition, the control cabinet includes the safety circuits, a 24V power supply, various switching and overload protection components, and the CPU control unit (MASTER).

In its standard configuration the MASTER includes:

CNC 6 Master

Power supply module

CPU module

Controller for disk drive
printer interface
serial interface

Hybrid module with 8 inputs and 8 outputs

Axis counting card for 3 axes (for servo only)

Analog output card for 3 axes (for servo only)

3.2.2 Teachbox

The teachbox of the Wittman DIAS CNC system is used for both manual control of the robot and for creating sequential programs in the teach mode. It is an independent control unit and includes a DIAS BUS interface for communication with the master control unit.

The TEACHBOX consists of the following components:

- The upper portion of the housing contains a color graphics LCD screen with a resolution of 320x240 pixels (1/4 VGA). It is used to display all data and control sections.
- Below the screen is a keypad with 31 short-stroke keys. These keys are used to input all entries, for programming and for manual control of the robot.
- At the front of this keypad – set off in color – are an EMERGENCY STOP button and 6 keys for switching the operating mode of the robot.



Under no circumstances attach or detach the teachbox under power!
This may be done only when the main robot switch is turned off.

3.2.3 Robot

Another control system is located beneath the robot carriage hood, in the transverse structure of the robot, consisting of:

CNC 6 Robot

I/O card: DIAS bus to master
32 inputs
24 outputs

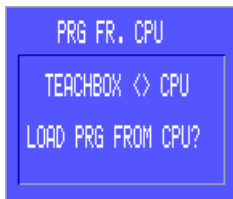
Counting card for 3 axes (for asynchronous only)


3.3 Startup

Upon activation or connection of the teachbox a hardware check is run in the manual control unit. If no connection to the other control units was established, a waiting time of 20 seconds will elapse until a connection is made. (This waiting time may be aborted at any time by striking **ESC**.)

Then the normal operating image will appear on the display and, in the upper left-hand section, the operating status "no reference."

If the teach programs in the teachbox and the master CPU are different, the following window will appear:



Pressing  will load the program from the master control into the teachbox. The previous program in the teachbox will then be irretrievably deleted.

Pressing  keeps the program stored in the teachbox intact.

The message "no reference" means that a reference travel (Chapter 3.5.4) needs to be carried out in order to start automatic operation or to teach a program.

3.3.1 Basic Settings (INIT)

Upon the first execution of reference travel (operating modes *Reference* or *Manual*), the basic settings in the INIT menu should be carried out.

See:

Chapter 3.5.10 INIT Menu
Chapter 3.6.5 Settings in Teach Mode.

3.3.2 Establishing Connection when Teachbox is OFFLINE



If the ONLINE connection to the master CPU is lost in active operation (for any reason at all), the teachbox switches to OFFLINE operation, and a warning message appears:




In addition, the operating mode icon  is displayed in the status line.

After acknowledgment of the warning message, only the offline editor is available (see also Chapter 3.6.3).

In order to reestablish the connection, call up the only function of the INIT menu available in this operating mode, "Online with CPU" (key sequence as above).


If the connection has been established, the following window will appear:




Pressing the soft key  will close the window and normal operation of the robot will again be possible.

If the connection fails again, this window will be displayed:



The soft key  can be used to try to establish the connection to the CPU.

If after several attempts and a waiting time of about 1 minute it is still not possible to establish a connection, switch the robot off and on again, and press the soft key  "SETUP" during the hardware check of the teachbox.

Review and correct the following values:

CAN STATION: 19
BAUD RATE: 00

 Never change the values for PROGSEG and PICSEG!

Here the soft keys have the following functions:

F1 (-) ... reduces the selected value

F2 (+) ... increases the selected value

F6 (EXIT) ... exits the menu

F7 (NEXT) ... sets the selection arrow to the next value

After exit from the Setup menu, the teachbox will again try to establish a connection with the master CPU.

This operation may take up to one minute.

If you are still unable to establish a connection after this, please contact our Customer Service Department.

3.4 User Management and Passwords

User management makes it possible to assign different rights of access to seven different users for operation of the robot. For example, operators may be authorized only for robot operation, shift supervisors for manual functions as well, while machine programmers could also be allowed to load programs and make ONLINE corrections, and so forth.

User's rights may be freely specified in 6 different user profiles. The seventh profile (profile 0) is permanently defined and is reserved for the administrator (Admin) of the system. The administrator is assigned all rights; as sole user authorized to do so, he may also create profiles and change passwords. Each user receives a personal password and is assigned one of the six user profiles.



Note the passwords, especially the administrator's password, and store them in a secure place.



If the administrator's password is lost, the functions reserved to the administrator (changes in user management) will no longer be accessible. In this case, please contact our nearest office.

3.4.1 Activating/Deactivating User Management





In order to permit the management of users with their rights and passwords, the User Profiles function in the INIT/SETUP menu has to be activated.

After calling up the menu, use the cursor keys to select the function USER PROFILES.

Press  to activate (and/or deactivate) the function.


Upon activation, a message window will appear with the checkback inquiry "ACTIVATE USER PROFILES? ARE YOU SURE?".

Answer this query using the soft keys  / .


If YES is selected, you will be prompted to enter the administrator's name and password:



Enter these using the soft keys and the numeric keypad.


 aborts the function.


Upon delivery, the administrator's name is preset to "ADMIN" at the factory, and the password is "1234."


 is used to transfer the entries.


If an incorrect name or password is entered, the function will be aborted with a warning message.

If the entries are correct, the teachbox will switch to the logged-off state. To make additional settings in User Management, the user must now log on as administrator.

 When activating user profiles for the first time, be sure to change the administrator's password in order to prevent unauthorized access.

 After activation of User Management, only the keys for changing operating mode and LOG-ON function are available. To obtain access to other functions the user must log on.

 After activation of User Management, user and user profiles must be created in order to permit operation of the robot.

 To deactivate User Management, the user must be logged on as administrator.

3.4.2 Log-on Procedure




When User Management is activated in the logged-off state (e.g., after the robot is switched on), only the keys for changing the operating mode and the LOG-ON functions are accessible. If it is attempted to access another function, a warning message appears and access is denied.

Every user must log on with name and password in order to obtain access to the functions for which he is authorized.

When the LOG-ON function is called up, the following message window will appear:



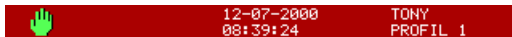
Entry is made using the soft keys and the numeric keypad.

Pressing  aborts the function.

Pressing  transfers the entries.

When an incorrect name or password is entered, the function will be aborted with a warning message.

If the entries are correct, the teachbox will switch to the logged-on state, in which the functions for which the user is authorized are available. Name and profile of the user are displayed at the upper right in the status line of the display:



Every user should log off when he leaves the robot. Only in this way can unauthorized access by third parties to the functions assigned to the user be prevented. If no entry is made in the teachbox, the user will automatically be logged off.

3.4.3 Log-Off Procedure



In order to lock out the functions assigned to him, the user must log off after ending work on the robot.

Upon callup of the function a message window will appear with the checkback query "LOG OFF USER? ARE YOU SURE?".

Use the soft keys  /  to answer this question.

If YES is selected, the teachbox will switch into the logged-off state, in which only the keys for changing the operating mode and the LOG-ON function are available. In order to obtain access to other functions, the log-on procedure must be repeated.



3.4.4 User (Create, Change, Delete)




In order to be able to create, change or delete users, you must be logged on as administrator.

When the function is called up, a menu will appear with the users already created:

USERS			
NAME	PASSWORD	PROFILE	
ADMIN	****	PROF.	0
TONY	***	PROF.	1
DAVE	***	PROF.	2
CHRIS	***	PROF.	3

The cursor keys   can be used to leaf through the list line by line or to select a user.

A selected user can be deleted by pressing  .
The administrator cannot be deleted.

 can be used to create a new user,  can be used to change an existing user.

In both cases the following window appears:

USER

NAME:

PASSWORD:

CONFIRM:

PROFILENR.:


— User's log-on name



— User's password


— Confirmation of user password
(Enter password again)


— Number of user profile assigned to user

Entries are made with soft keys and the numeric keypad.

Press  to transfer the respective entry and jump to the next entry field.

If necessary, the cursor keys   may also be used to switch between entry fields, but without transfer of entries.

Use  to abort the function, without storing changes.

Use  to store a changed/new user.



3.4.5 User Profiles




In order to be able to modify user profiles you must be logged on as administrator.

When the function is called up a menu appears with 1-6 freely definable profiles. Profile 0 (administrator) cannot be changed.



The cursor keys   are used to leaf through the list line by line and to select a profile.


Pressing  opens the profile selected for modification.

Pressing  exits the menu.


If a profile is opened for modification, a window appears with the modifiable authorizations:




 Function/Menu is enabled (reading and writing).


 Function/Menu is enabled for reading only.

 Function/Menu is locked out (not available).

A menu (or a function) is selected with the cursor keys  .

The authorization for the particular menu (or function) selected is set with the soft keys as follows:

 locks out the menu (function) for this profile (access denied).

 enables reading rights for the menu (function) (viewing, but not changing).

 enables the menu (function) (reading and writing).

 is used to store changes and to exit the menu.

 is used to abort the function, without storing changes.

3.4.5.1 Dependencies among Authorizations

Modification of one authorization (left-hand column) has the following effect on the others:

		INFO	INIT	INIT A. SETUP	FILE	TEXT EDITOR	DESIGNATIONS	ONL. EDITOR
INIT	X		X				X	
	R		R	X				
	W		W	X				
INIT A. SETUP	X			X			X	
	R		X	R				
	W		X	W				
TEXT EDITOR	X					X	X	X
	R	R	{R}	{R}	{R}	R		
	W	R	W	W	W	W		
DESIGNATIONS	X						X	
	R		{R}	{R}			R	
	W		W	W			W	

Explanations:

- X Authorization is automatically set to X
- R Authorization is automatically set to R
- W Authorization is automatically set to W
- {R} Authorization is set to R only when authorization previously was X
(when authorization previously was W, it remains unchanged)

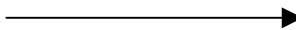
Remarks:

The authorizations for MANUAL FUNCTIONS and ONLINE EDITOR POSSIBLE can only assume the status X or W. The authorization for MENU INFO can only be X or R. The corresponding soft keys are superimposed or hidden in the authorization menu.

Example:

MANUAL FUNCTIONS	W
MENU INFO	X
MENU INIT	W
MENU INIT EXCEPT SETUP	X
MENU FILE	X
TEXT EDITOR	X
DESIGNATIONS	X
ONLINE EDITOR POSSIBLE	X

Setting TEXT EDITOR authorization to R

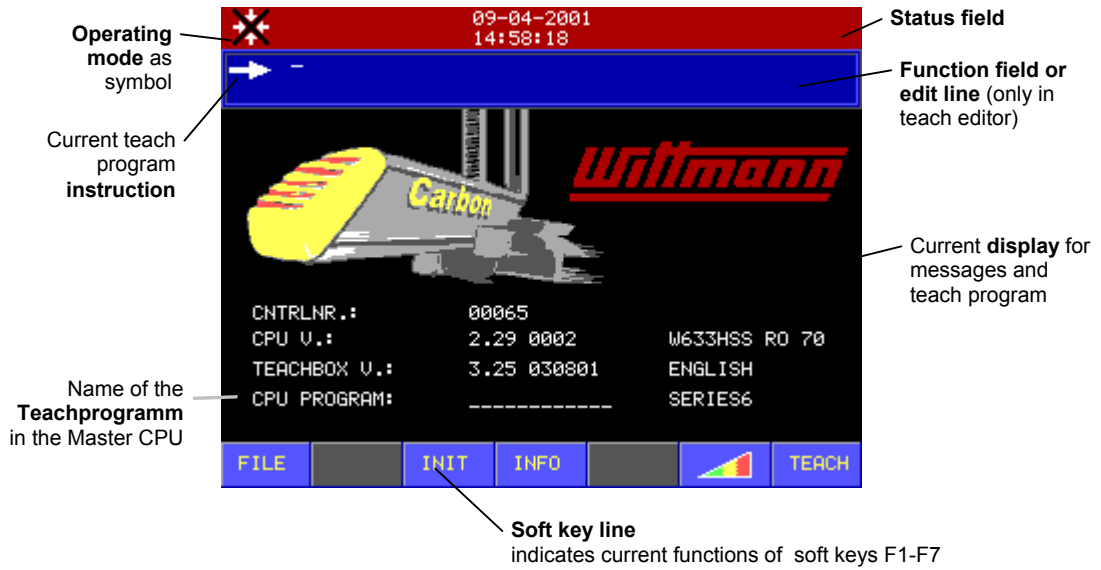


MANUAL FUNCTIONS	W
MENU INFO	R
MENU INIT	W
MENU INIT EXCEPT SETUP	X
MENU FILE	R
TEXT EDITOR	R
DESIGNATIONS	R
ONLINE EDITOR POSSIBLE	X

3.5 Basic Operation of Teachbox

3.5.1 Display

The teachbox is equipped with a color graphics LCD display. When it is activated, the following image is displayed:



The contrast of the display may be individually adjusted in the INIT menu SETUP. See Chapter 3.5.10.3 .

3.5.2 Keypad

Soft keys F1 - F7
The current function assignment is displayed in the soft key line of the screen.

Function keys with fixed functions assigned, which are described below in detail.

Cursor keys for moving left/right in entry fields. (in teach mode)

Menu
For calling up menu functions. (soft keys)

Secondary functions (Shift)
When depressed simultaneously activates the secondary function of the respective key.

Help
Not used at this time

Escape (Esc)
For exiting menus and recalling entries.

Step
For carrying out and testing a new teach program in separate steps

Automatic Start
Start of automatic operation. The robot must be in reference position and operation with robot must be activated.

Function stop
Ends automatic operation after complete performance of currently processed instruction or group of instructions. Automatic operation may be continued by pressing the Automatic Start key again.

EMERGENCY STOP
Causes the robot to stop immediately. All outputs are disabled through hardware, the EMERGENCY STOP circuit to the IMM is interrupted and the LED of the key lights. The error message EMERGENCY STOP appears in the display.

Manual operation/ Stop
Causes immediate stop and switch to manual operation.

Reference travel:
Performance of reference travel. Possible in mold area only when a reference travel has been taught.

Cursor keys up/down
Used for line scrolling. Shift can be used for leaving.

Enter
For selecting menu items and confirming entries.

Operation with robot:
Permits operation of IMM with robot. In shut-off state the IMM may be operated without robot.

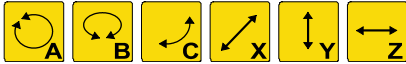
Permit keys:
With safety package only: When safety door is open the axes can be moved only by additional actuation of a permit key in manual operation; this applies to all manual functions.

Integrated numeric keypad for numerical entries.

3.5.2.1 Function Keys

The assignment of function keys is described briefly below. A detailed description of the functions is given in the relevant chapters.

3.5.2.1.1 Axis Selection



These keys are used to call up the functions of each particular axis. In manual operation and in the teach mode the selected axis can be moved by the soft keys. If the respective key is pressed twice in a row, the functions of the second axis (when configured) will become accessible. If an axis (depending upon the design of the robot) is not present, an error message will appear.


3.5.2.1.2 Vacuum and Gripper



These keys are used to select the vacuum and gripper functions. A menu for selection of the desired circuit appears.

3.5.2.1.3 Time, Sub, More, Injection Molding Machine (IMM)



In the teach mode these keys are used to call up menus for selection of the corresponding instructions. When the  key is briefly pressed twice in a row, the selection for a second IMM (when configured) will be displayed.

3.5.2.1.4 Peripheral Equipment and Conveyor Belts



This key is used to call up the functions for the control of peripheral devices and conveyor belts.

3.5.2.1.5 Counters



This key is used to call up counter functions. A menu with the available counters appears.

3.5.2.1.6 Placing Programs



This key is used to call up the placing programs function. A menu for the selection of one of the 16 placing programs is displayed.

3.5.3 Operating Modes of the Robot

Operation of the robot requires a knowledge of the various operating modes of the robot.

These are as follows:

" No reference" mode:



Status of control after activation. All manual functions are possible, but the numerical positions shown on the teachbox display are invalid. In order to be able to use all functions of the robot, the reference travel must be performed.

See Chapter 3.5.4

" Reference" mode:



All axes, vacuum and gripper circuits are in their respective starting positions. Switchover to automatic operation is possible (LED on key lights).

" Manual" mode:



All functions of the robot are available.

" Automatic" mode:



The teach program stored in the memory is processed (LED on key lights).

" Function Stop" mode:




End of automatic operation after complete performance of the currently processed instruction or group of instructions. Automatic operation can be continued from the next program line by pressing the Automatic Start key. This operating mode is signaled by flashing of the LED on the key.

3.5.4 Reference




Reference travel brings the robot and any peripheral equipment present into a defined basic position in order to permit the *AUTOMATIC* operating mode. The reference position of the gripper and vacuum circuits is selectable (see "Settings in Teach Mode").

When all axes have reached their reference point, this is shown by the icon  at the upper left in the display. As long as the reference point has not been approached after activation of the robot, only the *NO REF.* operating mode is possible.



3.5.4.1 Reference Travel in Operating Mode NO REF.

In the No Reference mode no reference travel can be carried out in the mold area. The axes first have to be moved out of the tool area in manual function, and the B axis (if present) must be brought into 0 position.

Holding down the  key starts the standard reference travel for the robot.

The numerical axes are moved in the sequence Y-X-Z-C-A to the 0-position limit switch, and in the case of asynchronous drives are then moved to the reference mark of the incremental encoder. After that the relevant axis moves to its configured reference position. In the standard configuration this is 10.0 mm (0.04") in plus direction from the 0 position limit switch. After reaching this reference position the relevant numerical position is set to zero. If the key is released before the reference point is reached, the motion stops. After renewed actuation of the reference key the cycle starts over again with the Y axis.

When all axes have reached their reference position, a switch is made to the *MANUAL* mode.

The ICON  is shown at the upper left in the display; the LED of the  key lights.


If no corresponding reference travel is taught (ROBOT-REF), the grippers should now be brought into their defined reference position (see Chapter 3.6.8.7). Then reference travel is carried out in the *MANUAL* mode.

3.5.4.2 Reference Travel in MANUAL Operating Mode

Holding down the  key starts reference travel.



If reference travels for the robot (ROBOT-REF) and the peripheral equipment (PE-REF) are taught, at first these motions are carried out simultaneously.

If no reference travel for the robot is taught, or if after carrying out the taught reference travel individual axes have not yet reached their 0 position, determined by the first reference travel, these axes are moved into their reference position in the sequence Y-X-Z-C-A.

When the  key is released, motion stops. When it is pressed down again, only those axes that are not yet in reference position are moved.

A reference travel in the mold area is possible and can be taught.

When the reference position is obtained, operation switches to the *REFERENCE* mode.


The ICON  appears at the upper left on the display and the LED in the  key lights.

3.5.4.3 Standard Reference Travel for Robot

If no reference travel was taught (ROBOT-REF) in the current teach program, or if reference travel is started in the *NO REF.* mode, the standard reference travel is carried out.

First a check is made to determine whether the B axis is in its 0 position. If so, and if the robot is not in the mold area, the standard reference travel moves the robot axes in the sequence Y-X-Z-C-A to their respective reference point, which corresponds to the zero position.

The vacuum and gripper circuits have to be brought into the reference state by means of manual functions, otherwise a corresponding error message will be displayed after

the axes are referenced. Use  to acknowledge the error message, obtain the reference position of the vacuum and gripper, and start the reference travel over again.

A standard reference travel is not possible in the mold area; the robot must be moved out of the mold area by means of manual functions before the start of standard reference travel, otherwise an error message appears and the reference travel will not be carried out.

3.5.4.4 Taught Reference Travels for Robot and Peripheral Equipment

In order to be able to carry out a reference travel in the mold area, or to be able to reference the vacuum and gripper automatically, a robot reference travel (ROBOT-REF) can be taught. A taught reference travel also makes it possible to reference in very tight surroundings (e.g., safeguarded area), or to deposit molded parts still on the gripper in controlled fashion.

In addition, it is possible to bring a peripheral system into a defined basic position by a taught reference travel (PE-REF).

3.5.5 Manual Functions

Manual functions may be selected in the *No Reference*, *Manual* and *Reference* modes in order to move the robot, or to switch conveyor belts, gripper, vacuum and peripheral outputs. In addition, manual functions may be used to reset any desired depositing counters.

When an axis function key is activated, a window will show the current position of the axis:



3.5.5.1 Numerical Axes A, C, X, Y and Z



The directions to be traveled are shown in the soft key line.

In direction of reference point: maximum manual speed
 medium manual speed
 lowest manual speed
 (this is traveled in individual steps)

In direction of end position: maximum manual speed
 medium manual speed
 lowest manual speed
 (this is traveled in individual steps)

3.5.5.1.1 Optional digital, motorised B Axis



If configured, this axis, unlike the pneumatic B axis, can be moved in 15° or 30° steps, in a range from 0° to 270°.

In direction of reference point: -90°
 -60°
 -15°

In direction of end position: +90°
 +60°
 +15°

3.5.5.2 Pneumatic Axes A, B and C





















The selectable positions differ according to axis and robot fittings and are shown in the soft key line.


Example: A axis

In direction of reference point:  directly to 0° (reference) position
 -90°

In direction of end position:  directly to 180° (end) position
 +90°

3.5.5.3 Gripper, Vacuum, Belt and Peripheral Equipment Functions

Function	Key	Image	Selection	Soft keys
Gripper			 	 
Vacuum			 	 
Conveyor Peripheral equipment			 	 

Upon actuation of the respective function key, the relevant image is displayed. A  next to an output/circuit indicates that it is turned on. Upon selection with the cursor keys the output/circuit concerned can be switched with the corresponding soft key.



 or  is used to exit the menu.

3.5.5.4 Clearing Placing Counters






This function permits manual clearing of the placing counters for the various placing programs.

NAME	X	Y	Z	ALL
PLCPRG01:	0	0	0	0
PLCPRG02:	0	0	0	0
PLCPRG03:	0	0	0	0
PLCPRG04:	0	0	0	0
PLCPRG05:	0	0	0	0

The cursor keys   are used to select a placing program.

The soft key  clears the counters of the placing program selected.

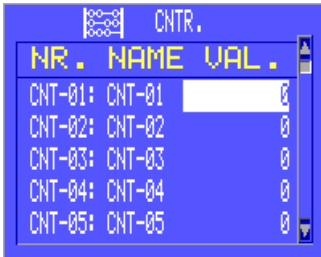
The soft key  clears the counters of all placing programs.



 or  is used to exit the menu.





3.5.6 Counters





This function is used to display and clear counter counts in all operating modes. In the automatic and block stop modes the counters may in addition be set to any desired value.




The cursor keys   are used to select the counter to be modified. The soft keys have the following functions:

-  ... jumps to the beginning of the list.
-  ... jumps to the end of the list.
-  ... clears the counter selected.
-  ... clears all 64 counters.

If you want to set the selected counter to a particular value in automatic mode, enter this value using the number keys and confirm it with .



 Depending upon the application of the counter in the teach program, modifying counters in automatic mode can result in serious changes in execution of the program, as well as in damage due to collisions.

 In automatic operation, therefore, counters should be modified only with caution by persons who are familiar with the effects of such modification on the taught program.

Press  to exit the menu.




3.5.7 Override

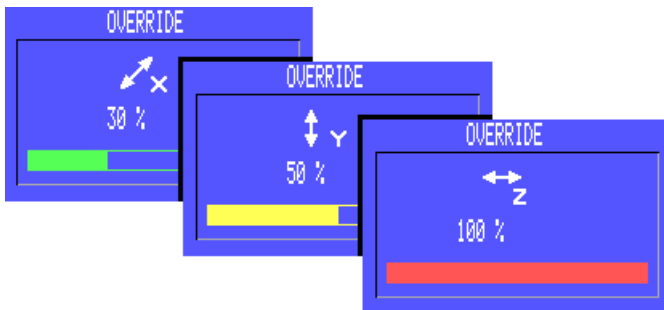
This function is used to set the travel speeds of the motor axes in connection with the maximum speed (Vmax) set in the teach program. If no speed initialization was carried out with the Vmax instruction in the teach program, Vmax is automatically set to 50%.

The soft keys  and  can be used in every operating mode to enter the graphics override.






For robots with servo drives the override is set jointly for all three main axes. To set the Override for additional numeric axes, you have to select those by pressing the axes

keys   .



For robots with asynchronous drives the override is set individually for each axis. To do this, switching between the numerical axes is done by

pressing the axis keys   .

The override is changed by the soft keys       , each change being shown on the display.

Exit the override display by pressing .

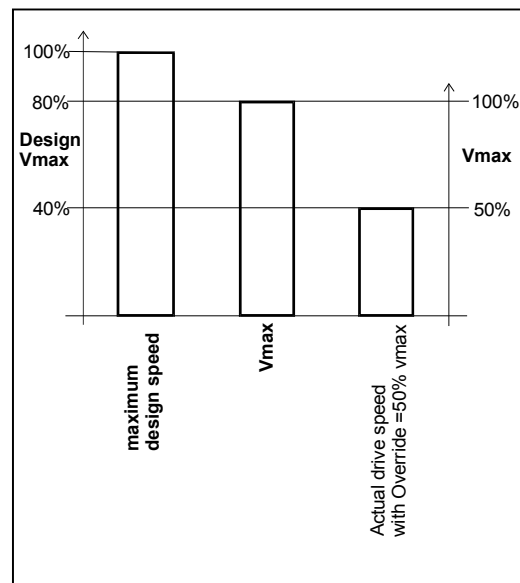
Upon starting a new teach program, the override is automatically set to 30%.

Example:


In the teach program a maximum speed of 80% of the maximum design speed (design Vmax) was programmed for the Z axis (Vmax=80%).



The manual override is set at 50% (of Vmax).


Therefore the drive speed is 40% of the maximum design speed.




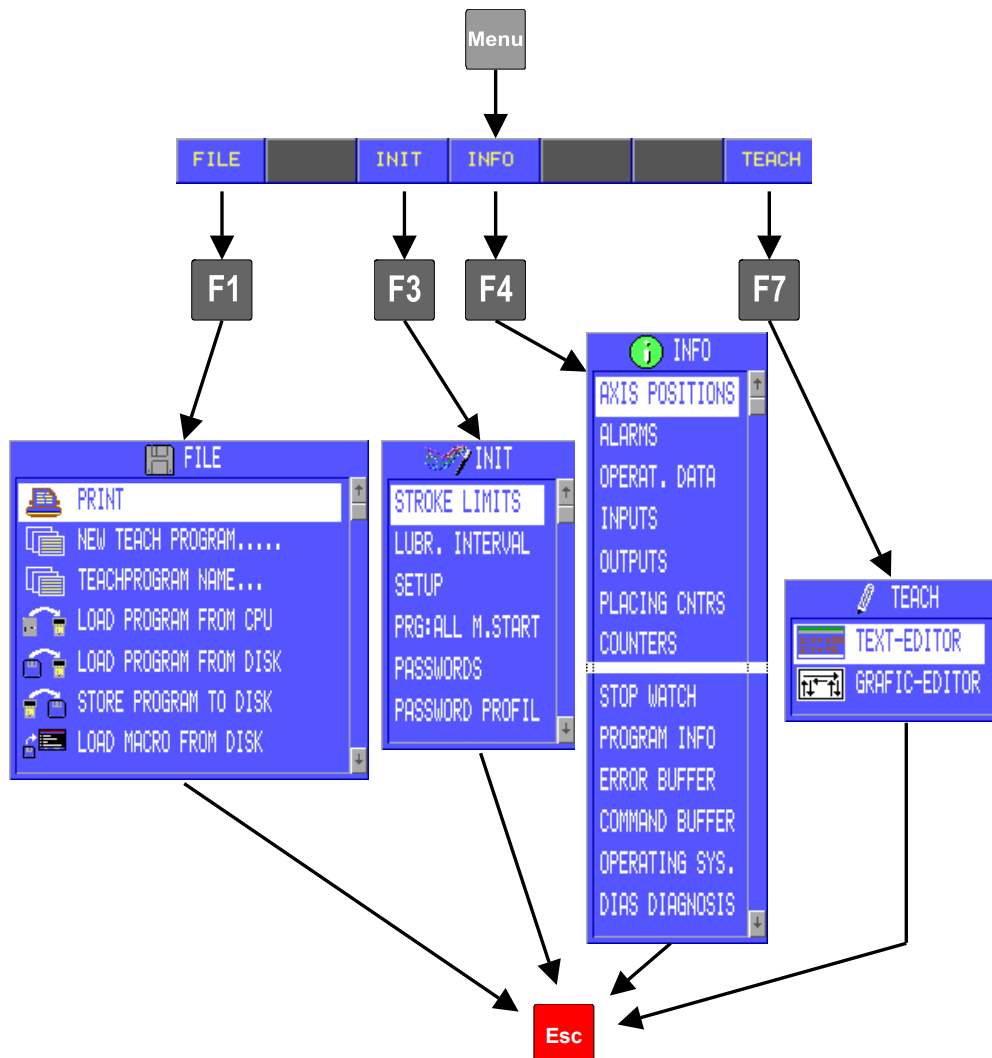
3.5.8 Menu Functions

Menu functions can be called up by pressing the  key, regardless of the operating state of the robot. The soft key line now shows the main menus, which are activated by pressing the corresponding soft keys.

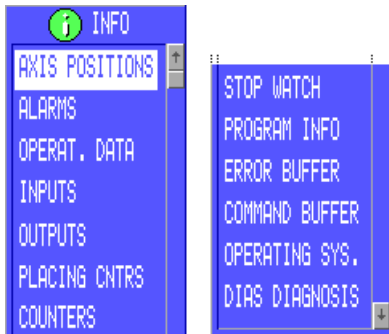
Select the desired function in a menu using the cursor keys  and .

 is used to call up a selected function and to confirm entries.

 is used to exit menus or to discard entries.



3.5.9 INFO Menu



The functions of the Info menu are used, regardless of the operating state of the robot, to display information concerning the operating data of the control.

3.5.9.1 Axis Positions



The current positions of all configured axes are displayed.



Esc or **X** is used to exit the menu.

3.5.9.2 Alarms



Here all errors occurring are shown in plain text.



Red: Error currently exists (is active).

Green: Error occurred, but no longer currently exists (is inactive).

Acknowledge inactive errors with **Enter**. In the case of active errors, first eliminate the the cause of error.

Esc is used to exit the menu without acknowledging errors.

3.5.9.3 Operating Data



Data relevant to operation are displayed here:

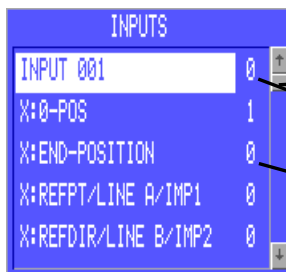


- Time per cycle
- Number of cycles since automatic start
- IMM mold opening time during removal
- Total hours of operation of robot
- Linear axes:
Distance traveled since last lubrication, in kilometers.
INIT/LUBRICATION INTERVAL can be reset in the menu.

3.5.9.4 Inputs



This function is used to display the assignment and current status of all inputs to the control system. For axis inputs, care must be taken to see that the designation of inputs for all 3 types of axes is shown: Numerical / Digital / Pneumatic.



- Bar for display of current position in the list
- Input turned on
- Input turned off

and are used to move up or down in the list line by line.

The soft key line offers additional possibilities for navigation in the list:

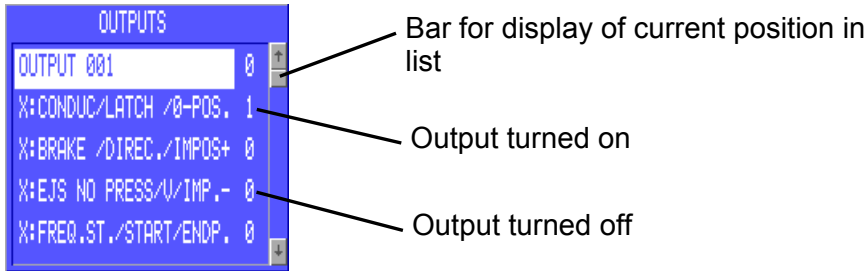
- jumps to beginning of list
- jumps to end of list
- jumps to injection molding machine inputs
- jumps to peripheral equipment inputs
- jumps to gripper monitoring and message acknowledgment inputs
- jumps to vacuum monitoring inputs

or is used to exit the menu.

3.5.9.5 Outputs



This function is used to display the assignment and current status of all outputs of the control system. For axis outputs, care must be taken to see that the designation of outputs for all 3 types of axes is shown: Numerical / Digital / Pneumatic.



and are used to move up or down in the list line by line.

The soft key line offers additional possibilities for navigation in the list:

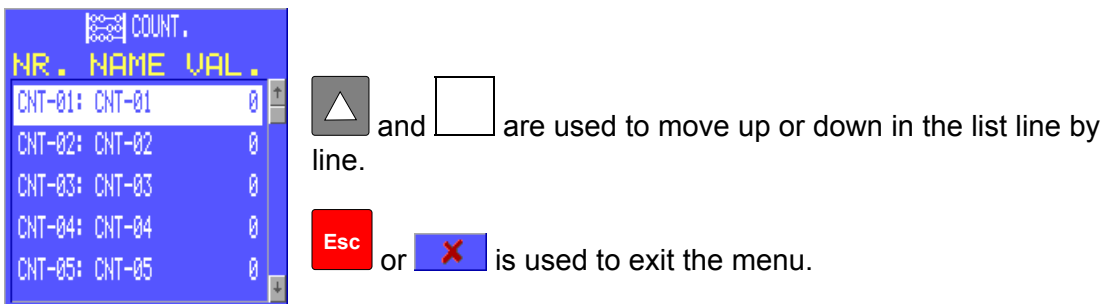
- jumps to the beginning of the list
- jumps to the end of the list
- jumps to injection molding machine outputs
- jumps to peripheral outputs
- jumps to gripper control outputs
- jumps to vacuum control outputs

or is used to exit the menu.

3.5.9.6 Counters



The current readings of the 64 counters are displayed.



3.5.9.7 Placing Counters



The current readings of the depositing and piece counters of all depositing programs are displayed here.

NAME	X	Y	Z	ALL
PLCPRG01:	0	0	0	0
PLCPRG02:	0	0	0	0
PLCPRG03:	0	0	0	0
PLCPRG04:	0	0	0	0
PLCPRG05:	0	0	0	0

is used to exit the menu.

3.5.9.8 Stopwatch



The measured values of the four stopwatches definable in the teach program are displayed here. See also Chapter 3.7.21.

STOPWATCH	
STOPWATCH01	STOPWATCH03
STOPWATCH02	STOPWATCH04
MIN :	0:00,0
MAX :	0:00,0
AVERA.:	0:00,0

Select the timer to be displayed using the cursor keys and .

- smallest measured value since last RESET
- greatest measured value since last RESET
- average value of measurements since last RESET

Use to exit the menu.

3.5.9.9 Program Info



Information about the teach program stored in the teachbox is displayed here.

PROGRAM INFO	
HIGH_SPEED	
PROGRAM SIZE:	2118
LABEL COUNT:	0
TEACHBOX =	CPU

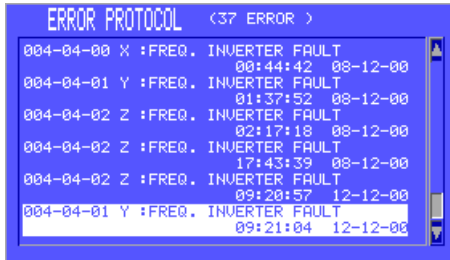
- Name of program stored in teachbox
- Size of program stored in teachbox, in bytes
- Number of labels used
- Comparison with program stored in master CPU

is used to exit the menu.

3.5.9.10 Error Buffer



The 370 errors last experienced are displayed in chronological order.



and are used to move up or down in the list line by line.

jumps to the beginning of the list.

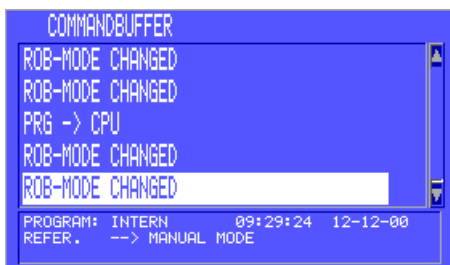
jumps to the end of the list.

or is used to exit the menu.

3.5.9.11 Command Buffer



The manual instructions last activated are displayed in chronological order.



and are used to move up or down in the list line by line.

jumps to beginning of list.

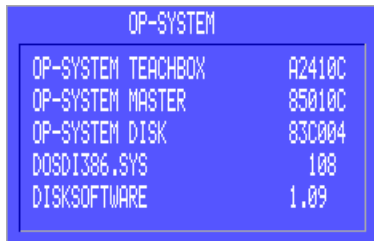
jumps to end of list.

or is used to exit the menu.

3.5.9.12 Operating Systems



The identifications of the operating system versions stored in the CPU are displayed. For diagnostic purposes only.



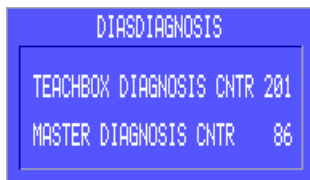
Please make note of this information before you call Customer Service.



3.5.9.13 DIAS Diagnosis



Counter for monitoring function of the DIAS bus. For diagnostic purposes only.



The number of invalid data packets of the bus systems since activation is displayed. However, such invalid packets also occur in normal operation and therefore should not be considered to be errors when they occur sporadically. For example, merely establishing the control connection when the robot is activated often produces invalid packets, which is completely normal.

Only when the counters increase by more than 50 within a short time (15 minutes) is a problem in the wiring of the bus lines present. In this case, please check the lines and plugs, since disturbances of the bus system can cause failure of the robot.



3.5.10 INIT Menu



The functions of the INIT menu are used to carry out various basic settings for the robot.

See also Chapter 3.6.5 Settings in the Teach Mode

3.5.10.1 Stroke Limits



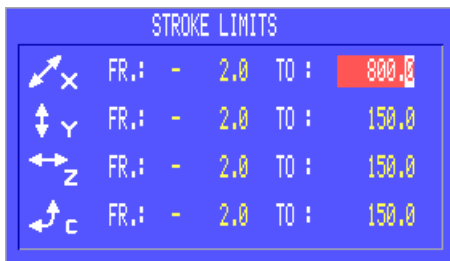
The stroke limit is a software limit switch and acts to limit the maximum permissible travel of a numerical axis. In operating mode “reference missing” the stroke limits are not active, the movement of the axes is only limited by their hardware limit switches.

This limit may be adjusted in two different ways:

•Direct entry through manual operation

The new stroke limit has to be entered as a numerical value.

When traveling toward the stroke limit in the manual mode, the robot will stop at the stroke limit value without indicating an error.



are used to select an axis. and are used to jump back and forth between the entry fields of the respective axes.


The numerical position of the selected stroke limit is entered directly on the numeric keypad.

The entry can be recalled with , while is used to transfer the entry.

is used to exit the menu without storing changes.

is used to store changes and exit the menu.

• **Approaching Limit Switch End Position**

- Enter the maximum value (99999.9) for stroke limit.
- Approach the limit switch end position (+) in the *MANUAL* mode at high speed until the axis stops automatically.
- The error message "Limit Switch End Position" will appear and the stroke limit is adjusted to the current position.
- Acknowledge the error message with  .
- Now move the axis away from the end position again.
- Move the axis back to the end position until an error message no longer appears at the automatic stop.

3.5.10.2 Lubrication Intervals



This function was introduced in order to call the user's attention to regular lubrication of the guides.

LUBRICATION I.		
	CLR INTERVAL CONF:	
	X-AXIS:	NUM 0
	Y-AXIS:	NUM 0
	Z-AXIS:	NUM 0

Configured lubrication interval
 Function for zero setting of travel after lubrication
 Current travelled way of the axes since last lubrication in kilometers

When the travelled way of one axis exceeds the configured lubrication interval, the error symbol will appear in the status field of the display, and an output will be set.

This output can be used for prompting a horn or a light. See also Chapter 3.5.10.3.5, Service Signal.

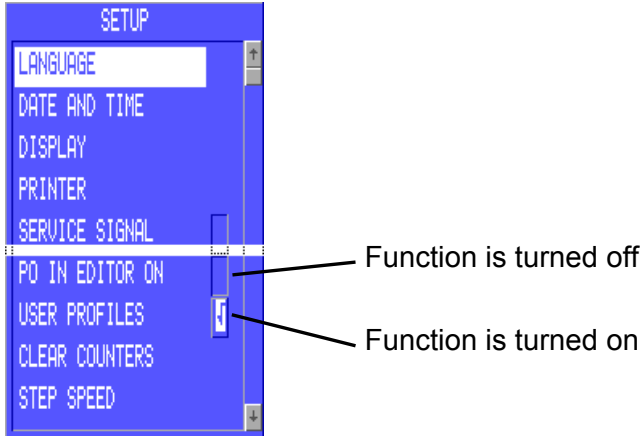
After lubrication has been executed, select the function "lubrication interval" and set the travel path of the axes back to zero with **CLR INTERVAL** .

Press or to exit the menu.

3.5.10.3 Setup



Basic settings may be modified in this menu.



3.5.10.3.1 Language

This function is used to change the language of the teachbox by loading a language file (*LANGUAGE.WSP*) from disk. To do this, first place the corresponding disk in the drive of the control cabinet, then call up the menu:



- Use to select one of the languages stored on the disk.
- Use to switch the teachbox to the language selected.
- Use to exit the menu without changing the language of the teachbox.

3.5.10.3.2 Date and Time

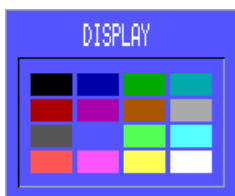
The date and time can be set here:



- are used to set the date and time, and entry is made through the numeric keypad.
- is used to exit the menu without storing changes.
- is used to store changes and exit the menu.

3.5.10.3.3 Display

This function is used to adjust the brightness of the display by means of a test image:



- makes the display lighter.
- makes the display darker.
- calls up the factory setting.
- stores changes and exits the menu.

3.5.10.3.4 Printer

After selection of this function, the printer parameters can be adjusted:



Use to select the parameters.
Enter the number of lines per page through the numeric keypad.

After selecting one of the choices, use to switch between "CR and LF" and "CR only."

Set to "CR and LF", if your printer does not do any linefeed; set to "CR", if your printer executes two linefeeds for each line. Please also refer to the manual of your printer.

Use to exit the menu without storing changes.

Use to store changes and exit the menu.

3.5.10.3.5 Service Signal

This function is used to configure whether or not a signal is to be output cyclically once the lubricating interval has elapsed. Any desired signal transmitter (horn or lamp) may be connected to this output.

3.5.10.3.6 PO in Editor on

This function is used to configure whether or not peripheral outputs and conveyor cycle are turned on or off during teaching when the corresponding function is programmed. I.e., if you have set this function to ON and turned on the peripheral output 2 in the teach editor, the output 2 will in fact be turned on. This will not happen if you set OFF.

3.5.10.3.7 User Profiles

Activates or deactivates User Management, including authorization levels and password system. See Chapter 3.4 .

3.5.10.3.8 Clear Counters

This function determines when the counters of the teach program are to be cleared automatically:



Counters are cleared at each reset, and when the control system is turned on

Counters are cleared upon transfer of a new teach program

are used to select the options; is used to turn the selected option on or off.

is used to exit the menu without storing changes.



is used to store changes and exit the menu.

3.5.10.3.9 Step Speed

Default of speed of axis motions in the stepping mode and upon execution of taught reference travels in percent of configured maximum speed:



Entry is through the numeric keypad.
Values from 1 to 30 may be set.

Use  to exit the menu without storing changes.
Use  to store changes and exit the menu.

3.5.10.3.10 Central Lubrication

Is used to configure an optional central lubrication. Refer to chapter 6.4.1 .



For Service purposes only. Changes in this settings may lead to heavy damage on the mechanical parts of the robot. Do not change this settings.

3.5.10.3.11 Offset



For Service purposes only. DO NOT CANGE ANY SETTINGS!



Changes to the settings of the offset influence the positioning of the numeric axes. Changes may lead to heavy damage on robot, injection molding machine and peripheral equipment!


3.5.10.4 Program „ALL MODES“ Start/Stop

Using this function the mode independant peripheral program „ALL MODES“ can be started or stopped.

3.5.11 Disk Functions

Upon callup of a disk function, the table of contents of the disk that is in the drive at the time is displayed on the screen. If there is no disk in the drive, "NO DISK" is displayed.

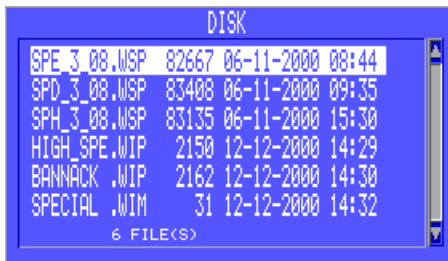
DIR can be used to update the display when necessary.



If the system is busy with a read or write operation, this is indicated by the icon  in the status line.

3.5.11.1 Disk (Contents, Formatting, Deleting a File)



Upon callup of the function a window will appear with the contents of the disk:



Use the cursor keys   to scroll up and down in the list and to select a file.

DEL will delete the file selected after the corresponding checkback message has been acknowledged with **YES**.



Use **FORMAT** to format the disk. Here again, the checkback message must be acknowledged with **YES**. Be careful – all data on the disk will be irretrievably deleted!

X is used to exit the menu.

3.5.11.2 Loading a Teach Program (IN TEACH MODE ONLY)





When this function is called up a window will appear with all teach programs*.WIP stored on the disk :


Use the cursor keys   to scroll up and down in the list and to select a program.

Press **Enter** to load the program selected.

Programs from other robots can be loaded after a checkback message. In order for such a program to be transferred to the master, it must be converted online.

 The program stored in the teachbox will be irretrievably deleted by loading a teach program from disk.

 Every newly loaded teach program must be run through at least once in step mode before automatic operation.

 The file name of a teach program stored on disk need not be the same as the teach program name.



3.5.11.3 Storing a Teach Program (IN TEACH MODE ONLY)






When this function is called up a window will appear with all teach programs*.WIP already stored on the disk:



The first 8 places of the teach program name are given as default for the file name, but the soft keys and the numeric keypad can be used to enter any desired file name.


When necessary, the cursor keys   can also be used to scroll up and down in the list to select the file name of an existing file and overwrite it.

When necessary, the operation can be aborted with ; in this case the soft key  is used to start over again.

Use  to store the program on the disk under the selected name.

Before storing is executed, a check is made to see whether a program of the same name is already on the disk and a checkback message may appear.

If this message is acknowledged with , the file will be overwritten.

If  is pressed, the operation will be aborted and a new file name can be entered.

 is used to exit the menu.

3.5.12 Print



This function allows the teach program loaded in the teachbox to be printed by a printer connected to the control cabinet.

The connector for the printer is located on the right side of the control cabinet, just below the floppy-disc-drive.


Before this function is called up, the printer should be connected, turned on, supplied with paper and switched to ONLINE. To do this, read the operating instructions for your printer.

In addition, the printer setting should be carried out in the INIT menu (see Chapter 3.5.10.3.4).


When the function is called up a window will appear in which the parts of the teach program to be printed may be selected.



A partial program may be selected using the cursor keys.

 is used to activate or deactivate the partial program selected for printing.

Press  to activate all existing partial programs for printing.

Press  to start printing.

An active printing process is indicated by the icon  in the status line.

3.5.12.1 Abort Printing



This function can be used to abort an active printing process at any time.

If data transmission to the printer fails, the print order is automatically deleted after 60 seconds.



3.6 Teach Mode

3.6.1 Partial Programs, ALL MODES Program



A complete teach program consists of the following partial programs:




- Robot teach program
- 1 to 13 peripheral equipment teach programs
- Robot reference program
- Peripheral equipment reference program


In addition, up to 12 additional peripheral programs may be added by the user. One of these may be defined as an "ALWAYS" program, and may be executed independently of the operating mode of the robot (including in "no reference").

Calling up the menu function Partial Programs in the teach mode with  , will bring up a window in which partial programs can be selected:







The cursor keys   are used to select a partial program.

 or  opens the partial program selected for processing.
 clears the partial program selected.


 is used to open the window for inserting a new peripheral partial program:





The name of the new partial program can be entered with the soft keys and the numeric keypad, and has to be confirmed with .

If no "Always" PE program has been defined yet, the soft keys  and  may be used to select the program type, to be confirmed with .

The checkback message "STORE PARTIAL PROGRAM?" is acknowledged with the soft keys:

 aborts the operation.

 jumps back to the entry of the name for the new partial program.





 accepts the entry and opens the new partial program for processing.

Counter designations and vacuum or gripper reference positions that were carried out in the INIT (Settings in Teach Mode) are automatically stored in the corresponding teach program.

3.6.2 Online Teaching


The entire program is created by approaching the various axis positions. It can be tested and optimized immediately.

3.6.3 Offline Teaching during Automatic Operation

The offline editor can be turned on in the teach editor with    **OFFLINE EDITOR** . This puts the teachbox offline, but the keys for robot operation (Reference, Manual, Automatic, Function Stop) remain active.

The teach program is created or edited – while the robot processes another program in the master CPU – without travel with the robot. However, no axis positions can be entered.


The turned-on offline editor is shown by the letter “O” at the upper left on the display. If a numerical axis is selected, instead of the current axis position the characters

"?????." are shown. Upon acknowledgment with , the travel instruction with undefined position is transferred to the teach program. Previously defined positions (see Chapter 3.6.8.6) are correctly transferred.

For a program edited or created offline, all axis instructions created offline must be converted online before the program can be transferred to the master CPU or executed.





3.6.3.1 Online Conversion

Online conversion is started with    **ONLINE EDITOR** . If the teach program contains instructions with undefined positions, the message INSTRUCTION MUST BE ADAPTED appears.

After acknowledgment with , every instruction to be adapted has to be selected using the cursor keys. Then the corresponding axis key has to be pressed and the robot moved to the required position.

Upon acknowledgment with , this instruction is converted online and the position is transferred to the teach program.

Once all axis positions have been converted online, the function Online Editor needs to

be selected once more with    **ONLINE EDITOR**  in order to complete online conversion. When conversion has been made the following message will appear:



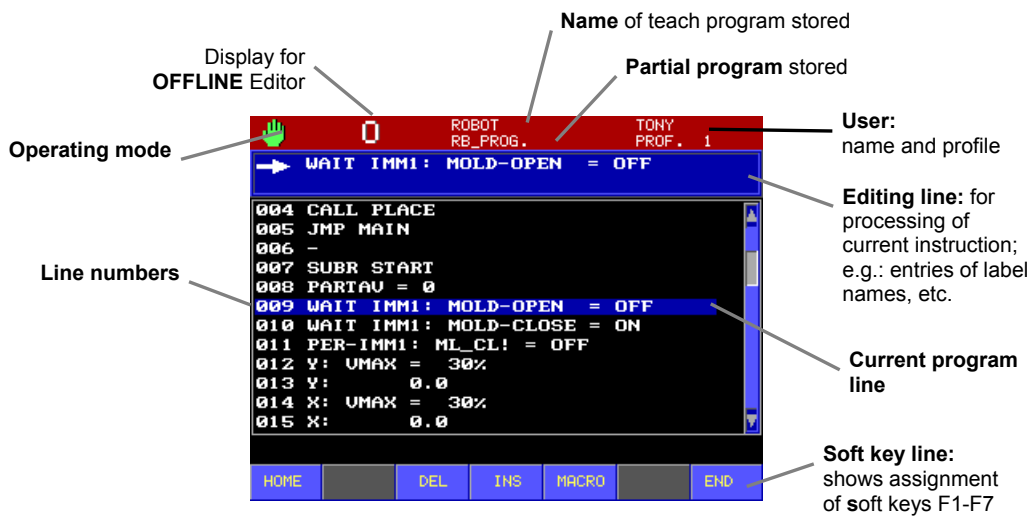
3.6.4 Operation of Editor

3.6.4.1 Calling Up Text Editor



The text editor can be called up with the menu function Teach in all operating modes except "No Reference."

3.6.4.2 Display in the Text Editor



3.6.4.3 Edit Functions

The edit functions can be called up directly through the soft keys:

- HOME** jumps to the first line of the teach program
- END** jumps to the last line of the teach program
- DEL** deletes the current line of the teach program
- INS** inserts a blank line before the current line

3.6.4.4 Macro Functions


MACRO

A macro is a program part (instruction sequence) that may consist of any desired number of connected program lines (instructions).

Within a teach program, such a macro may be shifted or copied, or deleted. In addition, it is possible to store macros on disk – for later use in another teach program - or to load them from disk.

3.6.4.4.1 Highlighting a Macro

In order to be able to work with a macro, it first has to be highlighted.

After calling up the macro functions with the soft key **MACRO**, use the cursor keys  and the soft keys **MAC BEG**, **MAC END** to establish the beginning and the end of the macro. No particular sequence need be maintained here. The line numbers of the lines contained in the macro will be highlighted in red.

Press the soft key **MAC OFF** to turn off the highlighting again.

3.6.4.4.2 Deleting a Macro

You can delete a highlighted macro by pressing the soft key **MAC DEL**.

3.6.4.4.3 Shifting a Macro

A highlighted macro can be shifted to another place in the program by using the cursor keys to select that program line IN FRONT OF which the macro is to be placed.

Pressing the soft keys **MAC MOV** will shift the highlighted program lines from their original location to the new position.

3.6.4.4.4 Copying a Macro

You can copy a highlighted macro to another place in the program by using the cursor keys to select those program lines IN FRONT OF which the copy of the macro is to be placed. Pressing the soft keys **MAC CPY** will copy the macro to the new position. The original will remain in its original place.

If labels or subroutines are copied, a dialog window will appear for input of a new label name.

If an associated JUMP instruction is copied together with a label, the JUMP instruction will also be changed to the new label name. The same applies to CALL instructions that are copied together with their subroutines.

3.6.4.4.5 Storing a Macro on Disk



A highlighted macro may be stored on disk for later use in another teach program (or partial program).

After the function has been called up, the dialog field familiar from disk functions will appear. Macros are stored with the filename extension WIM, and only those files will be shown in the dialog field.



Enter the desired file name using the soft keys and the numeric keypad. Press **Enter** to accept the entry and store the macro.

Press **X** to exit the menu.

3.6.4.4.6 Loading a Macro from Disk

A macro previously stored on disk may be inserted in a teach program by first using the cursor keys to select that program line IN FRONT OF which the macro is to be placed.

Now use **Menu** **FILE** **LOAD MACRO FROM DISK** **Enter** to call up the loading function; a dialog field will appear. Macros are stored with the filename extension WIM, and only those files will be shown in the dialog field:








Select the macro to be loaded using the cursor keys and press **Enter** to load the selected macro.

If labels or subroutines whose names already exist in the teach program are loaded, a dialog window for entry of a new label name will appear.


If an associated JUMP instruction is loaded together with an already existing label, the JUMP instruction will also be changed to the new label name. The same applies to CALL instructions that are loaded together with their subroutines.


If a deposit program, which has the same name as an existing deposit program in the teach program but otherwise differs from the latter in some way, is loaded, a dialog field for the entry of a new name will appear.

If a macro that does not correspond to configured robot hardware (e.g., an axis not present) is loaded, a flag will appear and the offline editor will be activated. The corresponding instructions will now have to be changed or removed manually, after

which the program can be switched back ONLINE again with     **ONLINE**
EDITOR .

If an axis instruction with a reference to a previously defined position, which has the same name as a previously defined position existing in the teach program but otherwise differs in some way from the latter, is loaded, a dialog field for the entry of a new name will appear.

 When a macro is loaded, axis positions of configured axes will be transferred without comment. However, this does not mean that they can be approached without risk. Programs expanded by macros must therefore always be tested in the STEP mode.

 When a macro is loaded, instructions with configured peripheral input/outputs are accepted without comment. However, this does not mean that these instruction sequences are compatible with the attached peripheral, especially when the macro comes from another control system.

3.6.4.4.7 Compatibility of Macros

Only macros from certain other partial programs can be loaded into a partial program (left-hand column):

	PE Always	PE REF	PE Standard	Robot REF	Robot
PE Always	↙				
PE REF	↙	↙			
PE Standard	↙	↙	↙		
Robot REF	↙	↙	↙	↙	
Robot	↙	↙	↙	↙	↙

It is not possible to load an incompatible macro; a corresponding flag will appear.

3.6.4.5 New Teach Program



This function can be used to delete the program in the teachbox and the associated system data in order to create a new teach program.

When the function is called up, a display will appear in which a name can be entered for the new teach program and the system data to be deleted can be selected:



DESIGNATIONS: Names of counters, inputs, outputs,...
see INIT menu in the teach mode - Chapter 3.6.5


CYLINDER: PO/PI function groups, see Chapter 3.6.8.5


POSITIONS: Default axis positions, see Chapter 3.6.8.6

Selection is made with the soft keys **YES** and **NO**.

Then the checkback message "Delete teach program?" will be shown.

Pressing **YES** deletes the teach program, pressing **NO** terminates the function.

 Careful: The program in the teachbox will be irretrievably deleted, and cannot be recovered.

 The name entered here is the teach program name and will be displayed in the status field. The teach program name is not identical with the file name of the program when it is stored on disk. Only the first 8 characters will be stored as the file name.


3.6.4.6 Teach Program Name




This function is used to change the name of the teach program. After the function has been called up, a dialog field will appear for input or correction of the teach program name:



Make the input using the soft keys and the numeric keypad.

Press  to accept the entry.

Press  to abort the action.



The teach program name will be shown in the status field. However, it is not identical with the file name of the program when it is stored on disk. Only the first 8 characters will be stored as the file name.

3.6.4.7 Loading Teach Program from CPU



If different teach programs have been loaded in the teachbox and the CPU, this function can be used to transfer the teach program in the CPU to the teachbox.




When a program is loaded from the CPU the program in the teachbox will be irretrievably deleted.


3.6.4.8 Exiting the Editor

Exit the teach editor by pressing the  key and the soft key  .


If the program in the teachbox is different from the one in the CPU, a corresponding information window will appear.



 ... Replaces the program in the CPU with the program in the editor.

 ... The program in the CPU is maintained.



 ... The editor is exited.

 ... The editor is not exited.



3.6.5 Adapting Positions, Times and Speeds in AUTOMATIC Mode

When the text editor is called up in the AUTOMATIC mode, all numerical axis positions, times and speeds can be modified.

Select the value to be modified using the cursor keys and pressing the appropriate function key.

Example: The position of the X axis is to be modified.

Use the cursor keys to select the line in which the position of the X axis is specified.

Then press the  key. Now enter the new position numerically on the numeric keypad and acknowledge with .


In the case of numerical axes, the position may be corrected by at most ± 10 mm. If too great a value is entered, acknowledgment is not possible. In that case the entry has to be deleted and repeated again with a smaller value.

3.6.6 Adapting Positions, Times and Speeds in BLOCK STOP Mode

When the text editor is called up in BLOCK STOP operating mode, all times and speeds and current numerical axis positions can be modified.

When the function key of a numerical axis is pressed, the cursor will be placed on the current position of this axis.

Using the soft keys, the position can now be modified by ± 10 mm.

If a speed or time is to be modified, the line to be modified must be selected with the cursor keys and the corresponding function key pressed. Enter the new value using the numeric soft keys and acknowledge with .

Editing of numerical axes is not possible when:


- the numerical axis concerned has not yet been moved
- the last function executed was a depositing program

3.6.7 Step Operation

To test a program or a program section, you can run through individual instructions or the complete program.

Step operation may be carried out in various operating modes:

- Step operation in *Block Stop* mode
- Step operation in *Reference* and *Manual* modes

To do this, the control system must be in the teach mode and a program must be in the editor. The highlighted instruction is executed by holding down the  key. Execution of the instruction may be aborted at any time by releasing the key.

3.6.7.1 Step Operation in Block Stop Mode

The program is stepped through chronologically according to the automatic sequence. All travel instructions of the numerical axes are executed at the full speed of the automatic sequence.

3.6.7.2 Step Operation in Reference and Manual Modes

The speeds of travel motions of the numerical axes can be set from 1 to 30% of the maximum speed (see Chapter 3.5.10.3.9).

For safety reasons, a newly created program must be run through in Step operation before the first automatic operation.



The Jump instruction in the alternative sequence will not be executed in step operation.

3.6.8 Settings in the Teach Mode / INIT Menu



3.6.8.1 Online / Offline Editor



Here you can switch between online and offline editor.

The offline editor is used to create teach programs without the robot.

3.6.8.2 Counter Names



This function can be used to assign user-defined names to the counters in order to show the programming of the robot more clearly.



Select a counter using and .

Use and to jump to the beginning and end of the list.

After pressing , you can enter a name.

sets the counter names back to CNT-XX



Press to exit the menu.



3.6.8.3 PI Names



This function is used to assign user-defined names to peripheral inputs in order to show the programming of the robot more clearly.




Select an input with  and .

Use  and  to jump to the beginning and end of the list.

After pressing , enter a name.

 sets the PI name back to PI-XXX.



Press  to exit the menu.



3.6.8.4 PO Names




This function is used to assign user-defined names to peripheral outputs in order to show the programming of the robot more clearly.




Select an output with  and .

Use  and  to jump to the beginning and end of the list.

Press  to enter a name.

 sets the PO name back to PO-XXX.

Press  to exit the menu.

3.6.8.5 Cylinders



This function is useful to ease the teaching of pneumatic cylinders of some peripheral equipment, by combining two peripheral outputs to a cylinder. Additionally you can use two peripheral inputs and a time limit to monitor the correct function of the pneumatic cylinder. Does the cylinder not approach the respective target position within the set time limit, an error message will be displayed on the teachbox.

Up to 8 such cylinders can be defined.

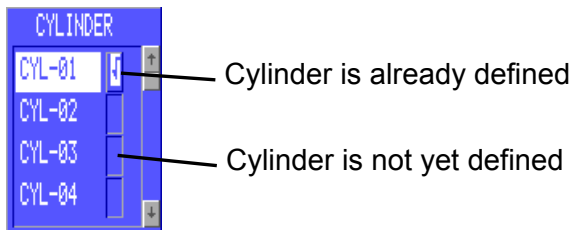
A cylinder consists of:

- 1 to 2 peripheral outputs (O1, O2).
O2 is optional, and negates the status of O1 .
- 0 to 2 peripheral inputs (I1, I2) for acknowledging or monitoring the action controlled by O1/O2 (optional),
where I1 always acknowledges O1 and I2 always acknowledges O2.
- A limit for the time that is allowed to elapse between setting of Ox and acknowledgment of Ix.


The peripheral outputs assigned to outputs O1 are automatically displayed in CYL_xx ; the peripheral outputs assigned to outputs O2 are no longer displayed. See also Chapter 3.6.8.4, PO Names.



The peripheral inputs used are to be maintained, but preferably should be renamed. See Chapter 3.6.8.3, PI Names.

After the function is called up the selection window will appear:



The cursor keys   are used to select the cylinder to be defined or processed.



 is used to delete the selected cylinder.

 is used to define a new cylinder;  to modify an existing cylinder. In both cases, the following window will appear:






is used to switch between the values or to transfer the entries for the individual values.


The cursor keys   are used to modify the input or output selected in each instance.

The time limit is entered with the numeric keypad after selection of the function TIME. If no limit switches are used for acknowledgment, enter 0.0 seconds. If limit switches are defined, select a time appropriate to the application.



will clear the currently selected value.

Use  to store a valid cylinder and exit the menu.

Use  to discard the entries and exit the menu.

3.6.8.5.1 Applying cylinders in a teachprogram

Without using the cylinder function, moving a pneumatic cylinder forward and backward will be programmed something like this:

```
PO-002: OFF          switch off the valve for "backward"  
PO-001: ON          switch on the valve for "forward"  
WAIT PI-001 =ON     wait until the limit switch "cylinder forward" is actuated
```

...

```
PO-001: OFF         switch off the valve for "forward"  
PO-002: ON         switch on the valve for "backward"  
WAIT PI-002 =ON     wait until the limit switch "cylinder backward" is actuated
```

Using the cylinder function simplifies the example like this:

```
CYL-01: ON          switch off the valve for "backward", switch on the valve for "forward"  
WAIT PI-001=ON     wait until the limit switch "cylinder forward" is actuated
```


...

```
CYL-01: OFF        switch off the valve for "forward", switch on the valve for "backward"  
WAIT PI-002=ON     wait until the limit switch "cylinder backward" is actuated
```

If the PIs of the limit switches and the maximum time to move the cylinder are input at the cylinder definition also, one benefits a monitoring function including an error message without additional programming.

3.6.8.6 Positions






Up to 16 different axis positions for the robot can be predefined here. This is especially advisable for positions that are approached fairly often at various locations in the teach program. In addition, offline teaching is made easier. The predefined positions can be called up later with the soft key  after an axis instruction has been called up.


If there are no positions present yet, when the function is called up the editor will jump directly to the window for definition of a position (see Chapter 3.6.8.6.1).


If positions are already defined, after callup of the function, a selection menu with positions is displayed:




The cursor keys   are used to select a position, and the following functions are called up with the soft keys:

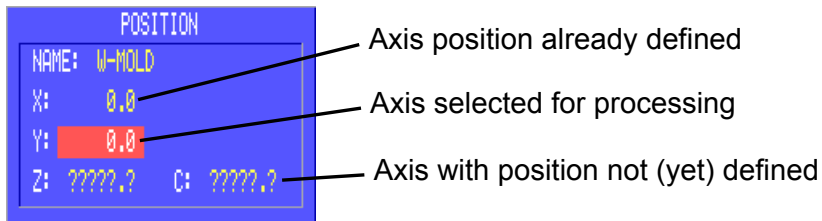
 ... modification of the selected position



 ... definition of a new position


 ... deletion of the selected position


 is used to leave the menu.


3.6.8.6.1 Changing or Redefining a Position



Use the cursor keys   to select the individual axes.

Use  to switch between the axes after approaching the corresponding axis position, and to confirm the value.

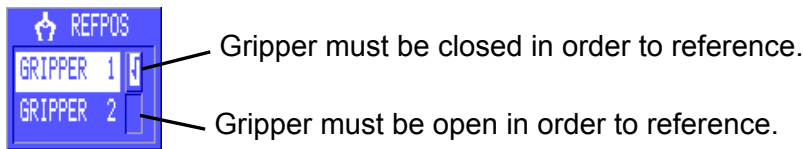
Use  to abort processing of the position.
The entered values will not be transferred.

 is used to end processing of the position and to store the position.

3.6.8.7 Gripper Reference Positions



This function is used to configure the status of the gripper circuits that these must have in the reference mode.



Select the desired gripper with .

Set the reference position of the selected gripper using the soft keys and .

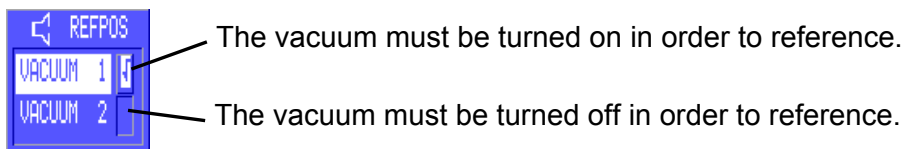
Use to exit the menu and discard changes.

Use to transfer the settings and exit the menu.

3.6.8.8 Vacuum Referencing



This function is used to configure the status of the vacuum circuits, since they must have reference in operating mode.



Select the desired vacuum circuit with .

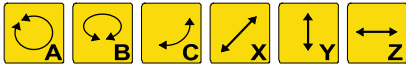
Use the soft keys and to set the reference status of the selected vacuum.

Use to discard the changes and exit the menu.

Use to transfer the settings and exit the menu.

3.7 Direct Instructions and Functions in Teach Mode

3.7.1 Axes



After selection of an axis a window will appear in which the type of travel motion is to be selected:

Numerical - Servo	Numerical - Asynchronous	Pneumatic / Digital

After selecting the type of travel motion, approach the desired position using the soft keys (F1-F7) and acknowledge with .

Alternatively, a predefined position according to Chapter 3.6.8.6 can be approached. To do this, press the soft key and select the desired position with the cursor keys . Now approach the selected position with the soft keys , and use to transfer it to the teach program.

When teaching numerical axis motions a minimum distance of 0.2 mm from the stroke limits of the axes should be maintained for the target positions, in order to ensure smooth automatic operation.

3.7.1.1 Absolute Motion



This instruction is used to approach a particular position with the corresponding axis.

3.7.1.2 Relative Motion



If a position was approached with a numerical axis, this function can be used to move the axis relative to this position. This instruction is identified by the letter "R" after the position entry.

Example:

```
Z: 500.0
X: 100.0
Z: 100.0R
```

With the Z axis, move to position 500.0 mm, and with the X axis, to position 100.0 mm. Starting from this position, move the Z axis to position Z = 600.0 mm. Now if the first Z position is modified, the second Z position will also shift by the same value, but the distance between the two positions will remain constant, namely, exactly 100.0 mm.

3.7.1.3 Parallel Motion

A parallel motion is the simultaneous motion of several axes.

In order to prevent uncontrolled motions, you have to enter the instruction WAIT SYNC after every parallel motion (Chapter 3.8.2). This ensures that all axis motions have been completed before the next instruction is started.

Parallel functions are available only for axes with numerical asynchronous drive, pneumatic axes and digital axes. In the case of robots with servo drive, parallel travel has to be executed with several main axes X, Y, Z by means of 3D motions (see Chapter 3.7.3) or by means of an curve motion (see Chapter 3.7.1.4).



a) Synchronous



When this instruction is started, the following travel instruction (any axis) is also started simultaneously.

Synchronous parallel motion is identified by the symbol "*" after the position to be approached.

Example:

```
C: 0 *
A: 0
WAIT SYNC
```

The A and C axes are started simultaneously and are moved to their 0 position. The instruction WAIT SYNC ensures that both axis motions are completed before the program is continued.


b) **Parallel At**  **PARALLEL AT** 


This function is used to drive the axis concerned alone to an intermediate position (INT.M.P.). When this intermediate position has been crossed, the next travel instruction is started, and the axis travels parallel thereto to its target position (TO POS).

When this function is called up, an entry window will appear:



First the axis has to be moved absolutely to the position from which the parallel motion is to be started (INT.M.P.).

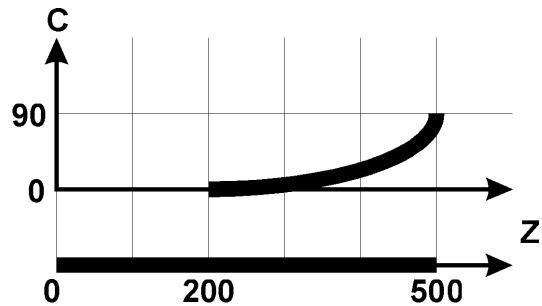
Enter this position with  .

Now move the axis to the final position (TO POS). Acknowledge this position with  to enter the instruction in the teach program.

In automatic operation the next travel instruction is started only from that position that is indicated in second place in the instruction.

Example:

```
Z: 500.0 * 200.0
C: 90
WAIT SYNC
```



The Z axis will travel to the position 1000.0, and from position Z = 500.0 the instruction C: 90 will be processed in parallel. The instruction WAIT SYNC ensures that both axis motions will be carried to the end before processing of the program is continued with the next instruction.

Note: Parallel travel of several main axes (X,Y,Z) is not possible in robots with asynchronous drive, since there is only **one** converter for these **three** axes.

3.7.1.4 Curve

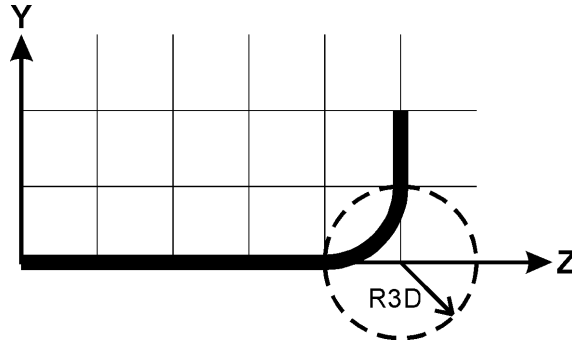


In this function, the relevant position of a numerical axis (servo) is not approached, but is detoured by an adjustable radius (R3D, see Chapter 3.7.3.1).

The function is identified by the symbol "*" before the respective axis.

Example:

```
*Z: 500.0
Y: 200.0
```



The position with the coordinates Z = 500.0 and Y = 200.0 is approached in one motion. The Y axis is started around R3D before reaching the position Z = 500.

The offset function can also be used to start a parallel motion of a pneumatic axis during the motion of a servo axis when the servo axis moves past a given position.

Example:

```
*Z: 500.0
C: 90.0*
Z: 1000.0
```

The Z axis travels in one motion to the position 1000.0. When the Z axis travels past the position 500.0, pivoting of the C axis is started in parallel.

Similarly, peripheral outputs for example can also be switched when a given position is passed, without the motion of the axis concerned being affected.

See also Chapter 3.7.2, WAIT SYNC .

3.7.1.5 Stop Function



Processing of this instruction in automatic mode produces an immediate stop of the selected numerical axis.

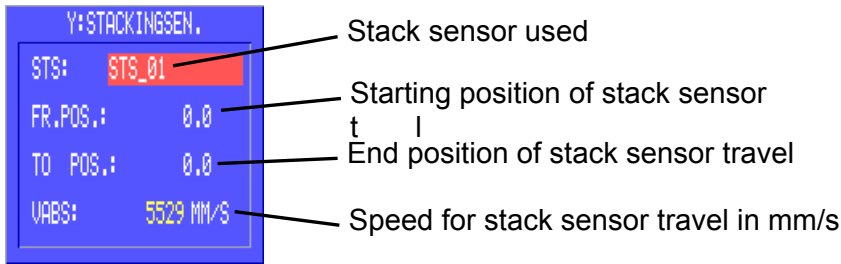
This function is used in alternative operations in piece loss (see Chapter 3.7.6) in order to prevent damage or injury.

3.7.1.6 Stack Sensor





This function makes it possible to react to obstacles in travel of an axis by means of a stack sensor (when present).

When the function is called up the following menu will appear:



Stackingsensor used:


Here  is used to call up a window for selection of the stack sensor to be used.

Make your selection with the cursor keys and .

FROM POS and UNTIL POS

FROM POS is the position that is first approached absolutely at the current speed; this is where travel to the stack sensor starts.

UNTIL POS is the position at which stack sensor travel ends when the stack sensor is not activated during travel.

Approach both positions using the soft keys, and press  to enter them.

Pressing the soft key  makes two additional UNTIL POS possibilities accessible:

 sets the position to the stroke limitation in the minus direction.


 sets the position to the stroke limitation in the plus direction.



In the example at the left, this means that stack sensor travel from position 0.0 is executed in the plus direction until either the stack grid reacts or the stroke limitation is approached.

VABS

Absolute speed in mm/s, by which travel to the stack sensor is carried out between FROM POS and UNTIL POS (is not affected by override).



Entry is made with the numeric keypad; press  to enter the value and exit the menu.

3.7.1.7 Ejector Synchronization (optional)






Using ejector synchronization makes it possible to remove long parts, by travelling synchronous with the ejectors when removing.

The sequence for teaching (shown for the X-axis) is:

1. Select the X-axis
2. Use the Softkeys  travel to the part removal position.
3. Confirm with .
4. Switch on vacuums or/and grippers needed to secure the part.
5. Use +EJ FORWARD to select the function, a window appears:

X: + EJ FOR

EJ. POS.: 126.2

TO POS.: 0.0
6. For EJ.POS travel the X-axis to the end position of the ejector, and confirm this position with .
7. Now use the Softkeys  to travel the X-axis to the final kick stroke position in the mold, from which the vertical arm can be moved up and out of the mold.
8. Confirm with .

The Robot then works as follows:

The End-Of-Arm Tooling is moved to the part in the mold (item 1-3). The part will be gripped with the EOAT (item 4). Then the ejectors in the mold are activated and push against the spring mounted EOAT. After a deflection of approx. 50% of the possible deflection way of the EOAT the robot travels back to the EJ POS in synchronism with the Ejectors (item 5-8); and continues traveling to the final position TO POS using the current speed.



EJ POS should be chosen to be at the end of the travel range of the ejector, where the EOAT is still pushed to approx. 50% of its possible deflection way.

3.7.1.8 Maximum Speed (Vmax)



This function is used to set the maximum speed as a percentage of the configured maximum speed of a numerical axis. The actual axis speed in automatic operation is in addition affected by the OVERRIDE (See Chapter 3.5.7). This instruction remains effective until the next Vmax or Vabs instruction, and affects all subsequently taught motions of the axis concerned.

After calling up the function, enter the desired value with the number keys and press



to enter in the teach program.

3.7.1.9 Absolute Speed (Vabs)



This function permits override-independent speed setting in mm/s of a numerical axis for adaptation to secondary motions (for example, ejector motion in piece transfer). This instruction is effective until the next Vmax or Vabs instruction, and affects all subsequently taught motions of the axis concerned.

Vabs applies only to 1D motions.

After calling up the function, enter the desired value with the number keys and press



to enter in the teach program.

3.7.1.10 Absolute Acceleration (Aabs)



This function permits the maximum acceleration or retardation in mm/s² of a numerical axis with servo drive to be adjusted when the configured acceleration (retardation) is too great for the application.

This instruction is effective until the next Aabs instruction and affects all subsequently taught motions of the axis concerned.

Aabs applies only to 1D motions.

After calling up the function, enter the desired value with the number keys and press



to enter it in the teach program.

3.7.2 WAIT SYNC



This instruction is used to terminate parallel motions.

Program processing is continued until all active axis motions have been completed.

3.7.2.1 WAIT PATH-SYNC



WAIT PATH-SYNC is a version of WAIT SYNC especially designed for axes travelling on a pre-calculated path, and therefore is only available at robots that are equipped with servo driven main axes (X, Y, Z). The pre-calculation of the path-axes (X, Y, Z) is stopped until the last path-movement is active and all other axes are no longer active.

If at the beginning of the braking ramp of the path axes still any other axis is not in its target position, the path axes will stop at their respective last target positions. The pre-calculation only be continued after all other axes have reached their target positions.



Careful: Movements of additional axes (A, B, C), which are taught between the last path axis command (X, Y, Z) and WAIT PATH-SYNC, will not be monitored by this WAIT PATH SYNC!

Example:

*Y : 200.0	at Y = 200 the synchronous movement to C = 90 is started.
C : 90*	
*Y : 0.0	If the C-Axes reaches its position prior to Z = 2000 the robot will continue travelling to Z=0 without stopping.
*Z : 2000.0	If the C-Axes does not reach its position the robot stops at Z= 2000 and
WAIT PATH-SYNC	waits until C reaches its position. Only after that the robot will continue to Z = 0 .
*Z : 0.0	

3.7.3 3D Motions

In 3D travel motions, a position is approached simultaneously with all 3 main axes (X, Y and Z). This function can be selected only with robots having 3 frequency converters (= servo drive).

3D motions may be executed as

- 3D absolute motion
- 3D curve motion
- 3D relative motion

3.7.3.1 3D Parameters V3D, R3D



In addition to


- the position indications contained in the relevant instructions
- Vmax
- the override set


3D motions are carried out based on the following parameters:

- V3D ... maximum absolute speed in mm/s .
- R3D ... radius of offset motion in mm.
This is the distance before the taught end position at which the motion of the next axis instruction is started.

The parameters have to be taught in the program routine BEFORE the 3D motion to be affected.

After calling up the desired parameter, enter the relevant value with the numeric keypad.

Press  to enter the value in the teach program.

Press  to discard the entry.

3.7.3.2 3D Absolute Motion



In automatic operation, in processing of this instruction, the numerical axes X, Y and Z are moved simultaneously to the indicated position, the maximum speed V3D and the acceleration A3D being maintained.

After this function is called up, press the axis keys or to move the respective axis to position individually with the soft keys, and confirm the axis position with . The sequence of the procedure is arbitrary, but the display of axis positions is always in the sequence XYZ.

Only when all axes are in position will the instruction be transferred to the teach program by pressing .

Press to discard the entry.

3.7.3.3 3D Relative Motion



This function is identified in the teach program by the letter "R" after the axis coordinates.

The axis coordinates in this instruction are added to the axis coordinates of the starting position of the axes, i.e., motion is executed relative to this starting position.

The position to which the relative motion is to refer must already have been taught before this function is entered.



If the starting position is changed, the position that is approached with the 3D relative motion is also changed. The distances between the two points remain the same.

After the function is called up, press the axis keys or to move the respective axis to position with the soft keys and confirm the axis position with . The sequence of the procedure is arbitrary, but the display of axis positions is always in the sequence XYZ.

Only when all axes are in position will the instruction be transferred to the teach program by pressing .





Press to discard the entry.

3.7.3.4 3D Curve Motion





This function is identified in the teach program by the symbol "*" in front of the axis coordinates.

In automatic operation, when this instruction is processed, the indicated position is bypassed by the adjustable radius R3D and switched to the next instruction.

After calling up the function, press the axis keys ,  or  to move the respective axis to position individually with the soft keys, and confirm the axis position by pressing . The sequence of the procedure is arbitrary.

However, the axis positions are always displayed in the sequence XYZ.

Only when all axes are in position will the instruction be transferred to the teach program by pressing .

Press  to discard the entry.

3.7.4 Vacuum and Gripper



Both functions are called up directly through function keys.



Vacuum



Gripper

Upon actuation of one of these function keys, a window containing the existing vacuum and/or gripper circuits will appear. Use the cursor keys to select the function to be activated; the current status will be displayed in the status line. Use the soft keys **ON** / **OFF** or  /  to switch the function directly. Vacuum/gripper monitoring may be activated/deactivated as necessary by means of soft keys **M-STOP** / **M-ALT** / **M-OFF** (Chapter 3.7.6).

In the case of the gripper function, it is possible to execute the gripper instruction and the subsequent instruction simultaneously. To do this, set the gripper circuit to the desired state and press the soft key **PAR.** . This parallel function is shown by the symbol "*" after the gripper instruction. Hence it is unnecessary to wait for the OPEN/CLOSED signal of the gripper.

Application:

Additional functions may be started during the closing or opening motion.

In order to prevent uncontrolled motions, the instruction WAIT SYNC has to be entered after every parallel motion (Chapter 3.7.2). This will ensure that all motions have been completed before the next instruction is started.

3.7.5 Peripheral Outputs and Conveyor Belts



When the key  is actuated a window with:

- Conveyor belts
- Peripheral outputs (cylinders)

will appear.

Belt Cycle

Use the cursor keys to select the desired belt. Its current switching status will be displayed in the status line.

After the belt cycle has been switched to the desired state by means of the soft keys **ON** / **OFF** , use the soft key **TIME** to specify how long the belt is to remain activated or deactivated.

The time may be set to a value between 0.1 and 6553.5 seconds. After this time has elapsed, the belt will be activated or deactivated automatically.

Peripheral Outputs

These are handled in the same way as the belt cycle (see above), but in addition they are equipped with a piece-monitoring feature which may be turned on and off at any time (Chapter 3.7.6).

In monitoring, outputs and inputs having the same number will always correspond to one another.

Example:

If monitoring is activated at peripheral output 1, it will be performed through peripheral input 1.



Peripheral outputs will remain set when shifting to manual, block stop or in the event of an error.

3.7.6 Alternative Sequence with "Piece Lost"



The alternative sequence is used for selective interception of the error "piece lost" in order to avoid damage to the mold by parts that have not been removed (e.g., by getting caught in the mold). The alternative sequence will be executed if piece monitoring for the relevant vacuum, gripper or peripheral circuit has been activated.

Piece monitoring is a background function which from its activation (M-STOP) until its deactivation (M-OFF or shutdown of the monitored circuit) will constantly monitor whether there is a piece in the selected gripper/vacuum/peripheral circuit. If a piece is lost, operation will switch to the alternative sequence.

This function can be activated for

- gripper
- vacuum
- peripheral outputs

Alternative Sequence STOP:

Upon actuation of the soft key  in the relevant submenu, M-ON STOP ALT will be displayed in the edit line. Pressing  will transfer this instruction to the teach program.

If a molded part is lost in the automatic mode, the robot will stop, all signals to the molding machine will be reset and the relevant error message will be shown on the display. Since the robot switches to manual operation in the course of this process, it is necessary to approach the reference point prior to the next start of the automatic mode.

Example: VAC1:M-ON STOP

When a piece is lost, automatic operation will be interrupted by the error message "vacuum 1 part lost."

Arbitrarily Defined Alternative Sequence

In order to avoid interruption of automatic operation due to a lost piece, an alternative sequence may be programmed.

To do this, press the soft key **M-ALT** to activate the monitoring in the submenu. Now the teachbox will wait for entry of the label name at which the program is to be continued in the event of a lost piece.

If a molded part was lost in the automatic mode or in the stepping mode (operating mode BLOCK STOP), the numerical axes will be stopped, the pneumatic axes will complete their travel motion, and only then will the alternative sequence be started at the indicated label.

An alternative sequence may be provided with any desired number of instructions, wherein the respective sequence may depend on the current position (removal and depositing range).

It is possible to assign a separate alternative sequence to each of the vacuum, gripper and peripheral circuits; however, it is likewise possible to use a single alternative sequence for all circuits.

Example:

Different sequences have been programmed for several vacuum or gripper circuits.

Now, if an alternative sequence is being processed and if a second monitored circuit also loses a molded part at the same time, the currently active alternative sequence will be completed and the alternative sequence of the second circuit will be executed after that.

If this is not desired, the monitoring system of the respective other circuit or of all circuits may be deactivated during the alternative sequence. In addition, the monitoring system may be switched to "M-OFF." Then if a piece is lost, the robot will stop and shift to MANUAL mode.



An alternative subroutine has to be ended with an **unconditional jump** and the **IMM signals** have to be switched according to the relevant needs in the alternative program. In the alternative subroutine, the monitoring system of the addressed circuit or the circuit itself should be turned off, because otherwise the program will jump back to this subroutine after having completed the alternative sequence.

Example:

```

START
-
Removal process
VAC_01:      ON
VAC_01:M-ON ALT : APROG
-
Depositing
-
JMP START

APROG:
    
```

```
VAC_01: OFF  
-  
WAIT START  
JMP START
```

If a molded part is lost, program execution will continue at the APROG (alternative program) label. Automatic operation will be resumed after the

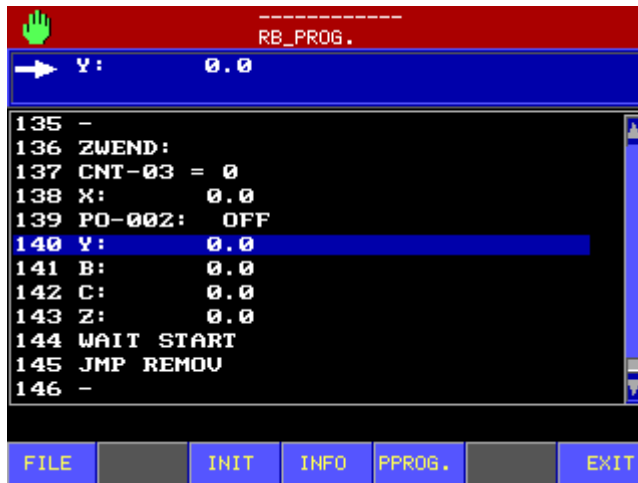


key is pressed.

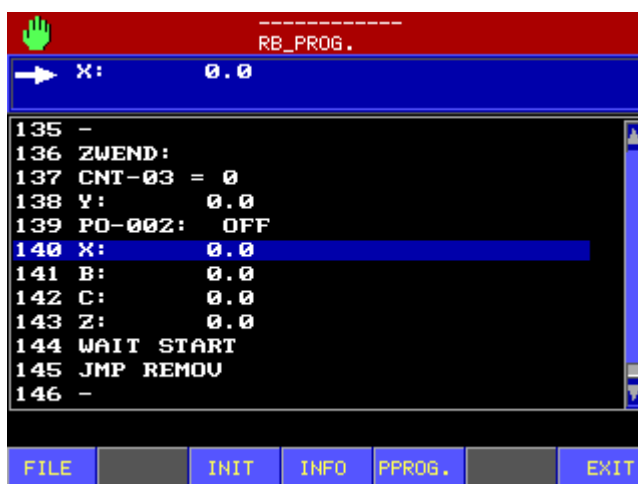
Moving Axes into Starting Position according to an Alternative Program:

In order to avoid collisions, the Y axis, as first axis, should always be moved into its starting position.

This program sequence may lead to collisions:



This modification works:

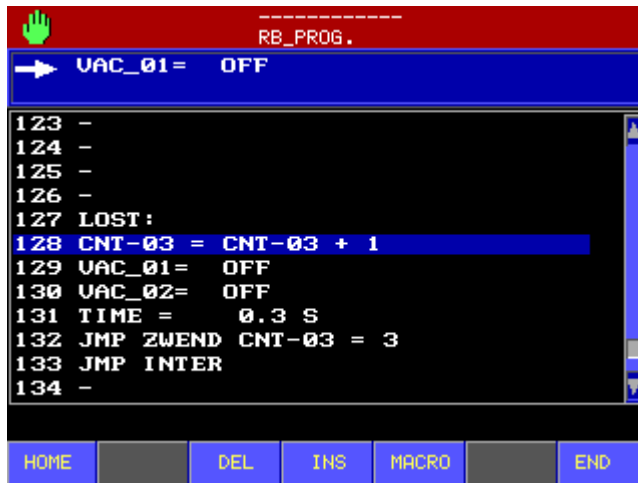


Several Monitorings Using the Same Alternative Program:

If an alternative program is used by several monitorings, all monitorings must be disabled again at the beginning of the alternative program.

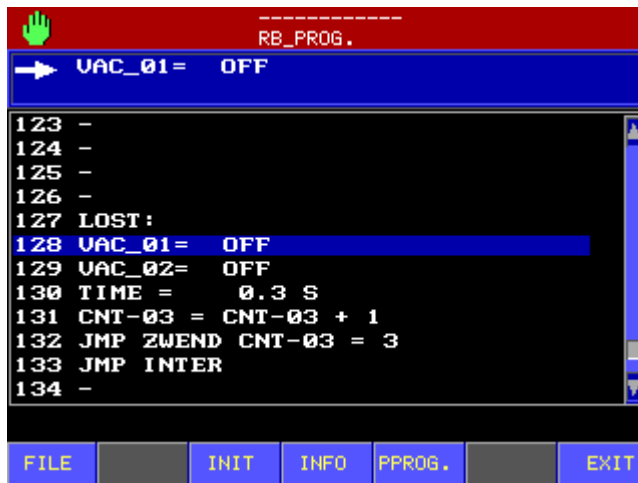
Otherwise there may be multiple callups of the alternative program, and instructions at the beginning of the alternative program will be processed more than once.
(in the example, CNT 03 may in some circumstances be incremented by +1)

Example:





```
-----  
RB_PROG.  
-> VAC_01= OFF  
123 -  
124 -  
125 -  
126 -  
127 LOST:  
128 CNT-03 = CNT-03 + 1  
129 VAC_01= OFF  
130 VAC_02= OFF  
131 TIME = 0.3 S  
132 JMP ZWEND CNT-03 = 3  
133 JMP INTER  
134 -  
HOME DEL INS MACRO END
```

Modification that avoids a multiple increment of CNT 03:




```
-----  
RB_PROG.  
-> VAC_01= OFF  
123 -  
124 -  
125 -  
126 -  
127 LOST:  
128 VAC_01= OFF  
129 VAC_02= OFF  
130 TIME = 0.3 S  
131 CNT-03 = CNT-03 + 1  
132 JMP ZWEND CNT-03 = 3  
133 JMP INTER  
134 -  
FILE INIT INFO PPRG. EXIT
```


3.7.7 Signals to the Injection Molding Machine (IMM)


When the  key is pressed, a window with the teachable function groups of the injection molding machine will appear. If the robot is configured for operation with 2 injection molding machines, repeated pressing of  will permit alternating between the two machines. The editing line will alternately display PER-IMM1 and PER-IMM2.




Use the cursor keys and  to select the desired function group. A menu with the respective switchable signals will be displayed.



Use the cursor keys to select the signal to be switched. The current switching status of the selected signal will be displayed in the edit line. Switch the signal with the appropriate soft keys and press  to transfer it to the teach program.

 If a signal has been enabled in the teach program, it has to be disabled again.

 These signals are only permits (inhibits) to the injection molding machine. The actual control of the movements is done by the IMM.

3.7.7.1 CLOSE MOLD, FULL MOLD OPENING

Use the signals CLOSE MOLD and FULL MOLD OPENING to teach the permits for the movements of the mold of the injection molding machine. The signal FULL MOLD OPENING is only available with the extended E12 interface; here the mold is automatically only opened to an intermediate position.

The robot does not control the standard opening of the mold – the IMM opens the mold when the part is finished.

Furthermore the IMM utilizes E12 signals to send feedback about the position of the mold. This is done using the signals MOLD OPEN and MOLD CLOSED. Only when the mold is fully open, it is possible for the robot to enter the mold.

The extended E12 interface additionally supplies the feedback signal MOLD INTERMEDIATE POSITION. Here the robot can already enter the mold, when it is opened to the intermediate position. The robot then has to permit the mold to fully open.

Example for Standard E12

```
WAIT IMM1: MOLD-OPEN = ON           wait until the mold is completely opened
WAIT IMM1: MOLD-CLOSE= OFF          for safety, wait for the mold not to be closed

enter the mold area,
remove the part,
exit the mold area, then ...

PER IMM1: ML_CLOSE = ON             give permission to close the mold
WAIT IMM1: MOLD-OPEN = OFF          wait until the mold is no longer completely open

while the mold is closing, the robot already could perform something different,
e.g. travel in direction of the placing area ...

WAIT IMM1: MOLD-CLOSE= ON           wait until the mold is closed
PER IMM1: ML_CLOSE = OFF            switch off the permission to close the mold
```

Example for Extended E12

```
WAIT IMM1: MOLD IM.POS = ON         wait until the mold is opened to its intermediate position
WAIT IMM1: MOLD-CLOSE= OFF          for safety, wait for the mold not to be closed

enter the mold area; fix the part on the EOAT

PER IMM1: ENABLE MOLD OPEN = ON      open the mold completely
WAIT IMM1: MOLD-OPEN = ON            wait until the mold is fully open
PER IMM1: ENABLE MOLD OPEN = OFF

exit the mold area, ...

PER IMM1: ML_CLOSE = ON             give permission to close the mold
WAIT IMM1: MOLD-OPEN = OFF          wait until the mold is no longer completely open

while the mold is closing, the robot already could perform something different,
e.g. travel in direction of the placing area ...

WAIT IMM1: MOLD-CLOSE= ON           wait until the mold is closed
PER IMM1: ML_CLOSE = OFF            switch off the permission to close the mold
```

3.7.7.2 EJ FORWARD/BACK, CP PULL/SET

Using the commands EJ FORWARD/BACK, CP PULL/SET the movements of the ejectors, core pullers of the IMM are taught. The most basic way to do so, is to switch on the permit for the desired movement, to wait until the target position is reached (also refer to chapter Chapter 3.7.15 and 3.7.11.2.2), and then to switch off the permit again.

The following example moves the ejector to its forward position:

```
PER-IMM1 : EJ_FORW.! = ON           switch on EJECTOR FORWARD!  
WAIT IMM1 : EJ-FORWARD = ON         wait until the ejector is on its forward position  
PER-IMM1 : EJ_FORW.! = OFF         switch off EJECTOR FORWARD!
```

3.7.7.3 EJ/CP ANTIVALENCE

The Antivalence-commands for ejectors and core pullers simply toggle the respective release signals.

The Antivalence-command for „Move Ejector Back“ for example uses the following syntax:

```
PER-IMM1 : EJ_BACK!      EJECTOR FORWARD! off and EJECTOR BACK! on
```

This substitutes the following sequence of „standard“ commands:

```
PER-IMM1 : EJ_FORW.! = OFF   EJECTOR FORWARD! off  
PER-IMM1 : EJ_BACK! = ON    EJECTOR BACK! on
```

3.7.7.4 EJ/CP WAIT

The Wait-commands for ejectors and core pullers toggle the respective signals and wait until the target positions are reached. This means they are rather „Antivalence+Wait“ commands.

The Wait-command for „Move Ejector Back“ for example uses the following syntax:

```
PER-IMM1 : EJ_BACK! WAIT    EJECTOR FORWARD! off and EJECTOR BACK! on and  
                               wait for the IMM-Signal EJ-BACK = ON
```


This substitutes the following sequence of „standard“ commands:

```
PER-IMM1 : EJ_FORW.! = OFF   EJECTOR FORWARD! off  
PER-IMM1 : EJ_BACK! = ON    EJECTOR BACK! on  
WAIT IMM1 : EJ-BACK = ON    wait until the ejector is back
```

3.7.8 Time Function TIME



If a certain delay in the sequence is required, this may be achieved by means of the time function. The time function may be used to program time delays of from 0.1 to 6553.5 seconds.

After calling up the function, use the numeric keypad to enter the desired delay time and acknowledge your entry with  to transfer it to the teach program.

In the automatic mode, processing of a program will be halted at a time function until the time has elapsed. Only then will the next instruction be started.


3.7.9 Placing Programs

The placing function is used for the automatic calculation of several depositing positions. This makes it possible to fill a crate completely without programming each depositing position separately.

The placing program offers the following possibilities:

- 16 freely definable depositing programs
- up to 6 different depositing sequences
- depositing on stack sensors with adjustable speed
- approach of depositing position with 3D function
- up to 6 different axis sequences
- programmable displacement
- programmable crate height in 3D approach

Because of the automatic robot equipment check, only those functions that the robot is able to execute may be programmed. This means that no 3D motion can be executed if only one frequency converter is available.

The depositing program function is called up with the  key.

If no depositing programs have yet been defined, the editor will jump directly to the function Creation of a New Depositing Program.

If depositing programs have already been created, a selection menu with the available programs will be displayed:



The cursor keys   are used to select a depositing program.

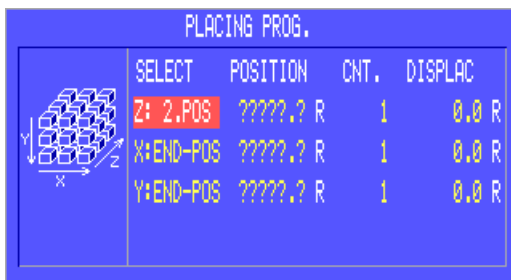
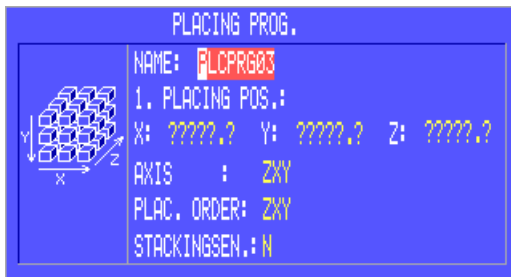
Use the soft keys to call up the following functions:

NEW ... creation of a new placing program

EDIT ... modification of the selected placing program



3.7.9.1 Editing or Creating a Placing Program

The parameters of a depositing program are shown in two displays:



Use the appropriate active soft keys to enter data and move the axes.

Each value entered has to be transferred by pressing **Enter**, after which the cursor will automatically jump to the next input field.

When necessary, the cursor keys   can also be used to switch between input fields, but entries are not transferred this way.

You can use **Esc** to interrupt parametrization at any time, but all changes will be lost.

Press **✓** to end parametrization of the depositing program. If all values have been defined, the depositing program will automatically be transferred to the current line of the teach program (e.g.: 043 PLCPRG03). If one or more values have not been defined, a warning message will appear. Pressing **NO** will allow processing of the placing program to continue, pressing **YES** will abort processing of the placing program without storing it.

3.7.9.2 Adjustable Parameters in the Placing Program

3.7.9.2.1 Name

The soft keys and the numeric keypad are used to give the depositing program a freely selectable name.

3.7.9.2.2 Approach


The soft keys are used to define how approach to the current depositing position is made in each case:

1-D The X,Y and Z axes are positioned individually, one after another. The sequence can be defined with the parameter Axis Sequence.


3-D The axes are positioned simultaneously by means of a 3D motion. The parameters Crate Height and Axis Sequence allow the 3D motion to end, displaced about the crate height in the direction of the last axis in the axis sequence, and this axis then travels into position alone. Otherwise, it would “move through” the wall of the crate.

3.7.9.2.3 First Placing Position

Use the soft keys  to move the X, Y and Z axes into the first depositing position in the crate.


When all axes are in their correct positions, press  to transfer these positions into the depositing program.

3.7.9.2.4 Axis Sequence

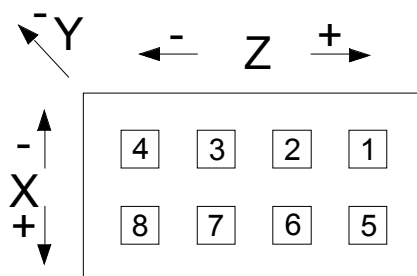
Here the sequence in which the axes are moved to their depositing positions in a 1D motion is specified by means of the soft keys  .

In a 3D motion, the last axis of the axis sequence is used to move into the crate.

3.7.9.2.5 Placing Order

This function is used to determine the sequence of the depositing process. The available options are:  .

Example: Depositing sequence ZXY

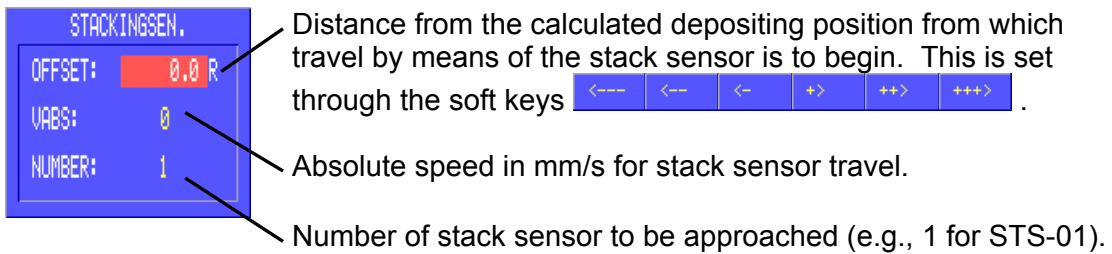


The pieces of each layer are deposited according to the specified sequence. The first four pieces are deposited in the Z direction and have the same X and Y positions. After the fourth piece, the first row will be complete and the following pieces, 5 to 8, will be deposited at the second X position. After the eighth piece, a layer will be complete, i.e., the Y axis travels to its second position and the following pieces will be deposited in the same sequence as in the preceding layer. Thus the entire depositing process will be performed according to a defined sequence.

3.7.9.2.6 Stack Sensor

The soft keys **YES** / **NO** are used to determine whether the last axis in the axis sequence is to travel to the respective depositing position by means of stack sensor, in order to react to pieces already deposited.

If YES has been selected, use **EDIT** to call up a window for defining this stack sensor travel:



Distance from the calculated depositing position from which travel by means of the stack sensor is to begin. This is set through the soft keys **<---** **<--** **<** **>** **>>** **>>>**.

Absolute speed in mm/s for stack sensor travel.

Number of stack sensor to be approached (e.g., 1 for STS-01).

Press **✓** to transfer the values set for the stack sensor and to close the window again.

3.7.9.2.7 Placing Pattern

In order to determine the placing pattern, the number of pieces to be deposited in the axial direction for each axis and the position of either the second or the last piece have to be specified. The second or last position is calculated relative to the first depositing position (this is indicated by the letter "R" after numerical positions).

I.e.: When the first position is changed, the entire depositing program will be shifted and the depositing pattern remains intact.

These parameters are set in the second window of the depositing program.

Using the soft keys **2.POS** / **END-POS**, first set for the respective axis in the Selection field the position you want to approach for parametrization.

Then use the soft keys **<---** **<--** **<** **>** **>>** **>>>** to move the respective axis to the selected position.

After transfer of this position, the number of pieces that are to be deposited in the respective axial direction per layer has to be entered in the NO. field.

Complicated pieces often cannot be stacked with the same X, Z parameters, but may have to be deposited displaced in relation to the layer underneath.

In order to do this, a relative distance for the depositing positions of an axis in different layers can be specified in the Displacement field. Do this by moving the relevant axis by this distance.

3.7.9.2.8 Box Height (for 3D Motions Only)

This value depends upon the dimensions of the crates.

Select the axis to be moved into the crate. This has already been done in the Axis Sequence parameter; select an axis sequence in which this axis is the last to be moved (e.g., ZXY for the Y axis).

- Move the selected axis toward a position outside the crate which may be approached with a 3D motion.

Example:

To save time, the depositing positions are to be approached with a 3D motion. Filling is done from above.

If the robot were to travel with all three axes at the same time, it would most likely hit the wall of the crate.

Since the crate is to be filled from above, select the axis sequence with the Y axis at the end. After all depositing parameters have been taught, the crate height has to be defined, because this is the height at which a piece is moved over the crate.

In the automatic mode, the depositing position is approached in a 3D motion. Positioning in the Y axis is effected above the crate (crate height). Not until then will the Y axis be moved in a linear manner toward the depositing position.

3.7.10 Label



The label constitutes the symbolic entry mark for a jump instruction.

After calling up the function, enter the label name using the soft keys and the numeric keypad and acknowledge it with . This will also transfer the label to the teach program.

In the teach program a label with the name "Test" is displayed as follows:

```
055 TEST:
```

Labels should always be given names which are related to their use, so as to facilitate future editing.

A label name may be used only once. If the same label name is used twice by mistake, an error message will appear on the display and transfer to the teach program will not be possible.

It is possible to jump to every label any number of times.

If the processing sequence in the teach program jumps to a label that is not defined, an error message will be indicated upon exit from the teach editor. This ensures that all labels will have been defined upon exit from the teach mode.

3.7.11 Jump Instruction (JMP)



Normally, a teach program will be processed instruction by instruction, starting at line 0. However, in special cases it may be necessary to change this sequence. In this case, the teach program will be continued at the address (label) specified in the instruction. When the jump instruction is not linked with any condition, it is an absolute jump.


Events requiring a change in the instructional sequence are, for example:

Signal reject piece from IMM	=> Piece is to be deposited on another depositing site.
Peripheral input	=> It is necessary to react to a peripheral input state.
Number of pieces	=> Only a certain number of pieces are to be deposited in a crate. The rest are put into another crate.
Quality control	=> After a certain number of pieces, one piece is to be deposited at a quality control inspection station.


The JUMP instruction will always need a jump address and a jump condition.

3.7.11.1 Jump Address (Label)

After calling up the function, enter the label name where program processing is to be continued when the jump condition has been met.

Provide the label with an alphanumeric name and acknowledge with . Then a window showing the possible jump conditions (events) will appear.

3.7.11.2 Jump Conditions

Select the desired event with the cursor keys and confirm it with . Depending upon the event, the instruction will immediately be transferred to the teach program or a window for additional entries will be opened.



3.7.11.2.1 Absolute


Produces an unconditional jump instruction, i.e., after processing of this instruction the program will always be continued at the specified label.

3.7.11.2.2 IMM - Inputs

The jump is executed based on a selectable ON/OFF signal of the injection molding machine.



When the event is called up, a window with the available signals will be displayed.

Select the desired signal with the cursor keys and use  or  to specify whether the jump is to take place when the signal is turned on or when it is turned off.

Press  to transfer the instruction to the teach program.


3.7.11.2.3 PI – Peripheral Input

The jump is executed based on a selectable ON/OFF signal of the peripheral device.

When the event is called up, a window with the available signals will be shown. Select the desired signal with the cursor keys and use  or  to specify whether the jump is to take place when the signal is turned on or turned off.

The softkey  activates the trigger function. In the teach command, an exclamation mark is added after the peripheral input: `JMP LABEL PIxxx! = ON`

With this function activated, the control also triggers on very short ON-impulses of the input, and memorizes them until the next request occurs.

Press  to return to status monitoring.

Press  to transfer the instruction to the teach program.

3.7.11.2.4 CNT – Counter


A jump based on a counter reading.


Example:

```
JMP LAB01 : CNT 1 = 100
```

When the reading of counter 1 has reached 100, program processing is continued at LAB01.

When the event is called up, a window with the available counters will be displayed. Select the desired counter with the cursor keys and then use the soft keys

 to specify whether the jump is to take place when the counter reading is the same, smaller or greater than the default value.

Then enter the default value with the numeric keypad and press  to transfer the instruction to the teach program.

3.7.11.2.5 Placing Counter

Jump based on the depositing counter reading of an axis of one of the depositing programs. Serves for performing complex depositing patterns, for example in connection with an A axis.

Example:


```
JMP TURN PLCPRG01- AZ X = 3
```


When the depositing counter of the X axis of depositing program 1 has reached 3, program processing is continued at the label TURN.

Upon callup of the event, a window with the available depositing programs will be displayed.

Select the desired program with the cursor keys and then use the soft keys

 to select the depositing counter of the desired axis.

Use the soft keys  to specify whether the jump is to take place when the counter reading is the same, smaller or greater than the default value.

Then enter the default value with the numeric keypad and press  to transfer the instruction to the teach program.

3.7.11.2.6 Piece Counter




Jump based on the piece counter reading of one of the depositing programs. An example would be the jump in a sequence for turning on a conveyor belt for carrying away a full crate.


Example:

```
JMP BELT PLCPRG01- SZ = 12
```

When the piece counter of depositing program 1 has reached the value 12, program processing is continued at the label BELT.

Upon callup of the event, a window with the available depositing programs will be displayed.

Select the piece counter of the desired program with the cursor keys and then use the soft keys    to specify whether the jump is to be made when the counter reading is the same, smaller or greater than the default value.



Then enter the default value with the numeric keypad and press  to enter the instruction in the teach program.

3.7.11.2.7 VACUUM

Jump is carried out based on the ON/OFF switching status of the vacuum monitoring system of the selected vacuum circuit.

This serves to ensure, upon pickup of a piece, that the piece is really held tightly on the cup before further motions are carried out.

When the event is called up, a window with the available vacuum circuits will be displayed.

Select the desired vacuum with the cursor keys, then use the soft keys  /  to select the status of the vacuum at which the jump is to occur.


Press  to enter the instruction in the teach program.


3.7.11.2.8 PROGS – Partial Program

A jump will be carried out based on whether a PE program is running or has completed its routine.

When the event is called up, a window with the available peripheral programs will be displayed.

Select the desired peripheral program with the cursor keys.

Press  to specify that the jump will be carried out when the program is running.

Press  to specify that the jump will be carried out when the program routine has ended.

Press  to enter the instruction in the teach program.

3.7.11.2.9 PLACING AREA




The roller-switch on the Z-beam (S6) is actuated (refer to „mold-monitoring S5/S6“). Used to carry out various alternative routines and reference travels in the mold and depositing area.


3.7.11.2.10 MOLD AREA






The roller-switch on the Z-beam (S6) is not actuated (refer to „mold-monitoring S5/S6“). Used to carry out various alternative routines and reference travels in the mold and depositing area. If the robot is configured for operation with 2 IMMs, mold area 2 will also be available as an event.


3.7.11.2.11 MODE (only available in an ALL MODES program)

The jump will be carried out on the basis of the operating mode of the robot.

After calling up the event, use the soft keys    to specify whether the jump is to take place when the priority of the current operating mode of the robot is the same, smaller or greater than that of the default operating mode. Take the value from the table below.

After switching the soft key level with , use the soft keys to specify the default operating mode on the basis of whose priority the jump will be carried out:

Soft key	Operating Mode	Priority
	No reference	0
	Manual	1
	Reference	2
	Block stop	3
	Automatic	4

Press  to enter the instruction in the teach programm.



3.7.11.2.12 NOT RDY - Not Ready


In this case the jump is executed, as long as a numeric axis or a part program is active. This can be helpful when monitoring axes-movements and part-programs.

3.7.11.2.13 STACK SENSOR


The jump will be carried out on the basis of the ON/OFF switching status of the selected stack sensor.

When the event is called up, a window with the available stack sensors will be displayed.

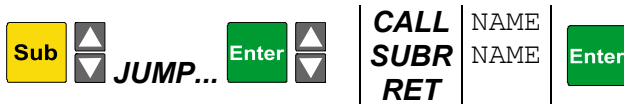
Select the desired stack sensor with the cursor keys, then use the soft keys  /  to select the status of the stack sensor in which the jump is to be made.

Press  to enter the instruction in the teach program.

3.7.11.2.14 START

Jump when the start key  is pressed.

3.7.12 Subroutines



Subroutine callups permit branching into a sequence of instructions. After their execution, the process will jump back to an instruction located directly after the related callup. In this way, program sections that are needed more often have to be taught only once.

When programming subroutines, the following rules have to be kept in mind in order to ensure proper execution:

- Subroutines must always be terminated with the instruction RET.
- A subroutine must not be exited with the instruction JUMP.
- A subroutine routine must never be processed without callup with the instruction CALL.

Instruction CALL

The instruction *CALL Name* is used to call up the subroutine *Name*. Execution of the program will be continued at the subroutine.

Instruction SUBROUTINE

The instruction *SUBR Name* is used to define the start of a subroutine.

Instruction RETURN

RET is used to terminate a subroutine and to return to the main program. Return is made to the line after the CALL instruction by which the subroutine was called up.

Example:

```
Removal
-
CALL UP
-
Depositing
-
END

SUBR UP
-
WAIT PI-01 = ON
PO-02 OFF
-
RET
```

After processing of the instruction CALL UP (subroutine), program processing will be continued in the subroutine (SUBR UP) and will end upon execution of the instruction RET (return). Program processing will then be continued at one line after callup of the subroutine.

3.7.13 Program Branching with IF ... ELSE ... END IF



The three instructions IF ... ELSE ... END IF are used to bring about the execution of two alternative program sequences on the basis of the jump conditions (see Chapter 3.7.11.2) associated with the JUMP instruction. The sequences between IF and ENDIF may not be exited with a JUMP.

There are 2 possible variants.

Variant 1:

The instruction IF defines a condition for the execution of an alternative program sequence. This sequence is taught in the program lines after the instruction IF. The END IF instruction is taught at the end of the alternative sequence.

If the jump condition has not been met, the instructions between IF and END IF will not be carried out. The program routine will be continued with the first instruction after END IF.

If the jump condition has been met, first the instructions between IF and END IF will be carried out. Only then will the program routine be continued after END IF.

Example:

```
START :
CNT-01  +1
-
IF CNT01 =10
-
CNT01 =0           alternative sequence between IF and END IF
-
END IF
-
JMP START
```

The counter will be increased until it reaches 10. Then the jump condition will have been met and the counter will be set to zero.

Variant 2:

The instruction IF is used to specify a condition for the execution of two alternative program sequences.

- Sequence 1 is to be executed only when the condition has been met.
- Sequence 2 is to be executed only when the condition has not been met.

Sequence 1 is taught in the program lines after the instruction IF. Then the instruction ELSE and, following that, sequence 2 is taught. At the end of sequence 2, the instruction END IF is taught.

If the jump condition has not been met, the instructions between IF and ELSE will not be carried out, and the program routine will be continued with the first instruction after ELSE (= sequence 2).

If the jump condition has been met, first the instructions between IF and ELSE will be carried out (= sequence 1), and then the program routine after END IF will be continued.

Example:

```

START :
CNT-01  +1
IF CNT01 =10
CNT01 =0           alternative sequence 1 between IF and ELSE
-
ELSE
PO_001: ON  0.5 S  alternative sequence 2 between ELSE and END IF
-
END IF
JMP START
    
```

The counter will be increased until it reaches 10. Then the jump condition will have been met and the counter will be set to zero. In addition, if the counter is not at 10 the peripheral output 1 will be turned on at each run for 0.5 second. If the counter has the value 10, the output will not be turned on.

3.7.14 **AND / OR**



IF and JMP instructions can be carried out with the AND/OR function on the basis of several jump conditions.

To do this, begin by programming the instruction with the first jump condition. Then, using the AND/OR function, program the other jump conditions (see Chapter 3.7.11.2) in the following program lines.

Example of AND:

```

IF CNT01=1
AND CNT02=1
    
```

The sequence will be executed only if counter 1 AND counter 2 have the value 1.

Example of OR:

```

IF CNT01=1
OR CNT02=1
    
```

The jump will be executed if counter 1 OR counter 2 has the value 1.



AND and OR instructions must be taught in the line(s) directly after the instruction to which they refer. Otherwise logical operation will not take place.

3.7.15 WAIT Function (WAIT)



This function stops program processing until a given event occurs. The events which may be awaited are identified by the jump conditions associated with the jump instruction (see Chapter 3.7.11.2).



3.7.16 Peripherals Teach Program

Like the robot, peripheral equipment is fully teachable with up to 13 PE programs. In peripheral programs it is not possible to move robot axes.

Peripheral programs are processed in parallel with the robot program. However, peripheral programs must be started by the robot program. After complete execution of the peripheral program its routine is automatically stopped. Only at the next PE-PROG. START in the robot program will the routine be started over again at line 0.

Call up the instruction for starting/stopping the PE program as follows:



Select the program to be started/stopped with the cursor keys and use the soft keys  /  to select the relevant function.

Press  to enter the instruction in the robot teach program.


In automatic operation, the peripheral equipment will only be started by the instruction START PE program. The instruction PE PROG STOP will stop the peripheral program.

3.7.16.1 Peripheral program ALL MODES

One of the 13 peripheral programs can be defined as „ALL MODES“ program. Also refer to chapter 3.6.1. This „ALL MODES“ program is executed by the CNC-6 control in the background, regardless of the current mode of operation the robot is in. Meaning not only in „Automatic, but practically always, even when the robot is in „Reference missing“, „Manual“, „Reference“ or „Block stop“ .

With the ALL MODES program it is not possible to operate vacuums, grippers or axes. Only peripheral outputs can be switched. All „logical“ functions are fully available.


The all modes program is not started automatically. It has to be started or stopped using the respective teach commands in the robot program, like every other peripheral program. One can also activate or deactivate it using the function „PRG: ALL MOD START/STOP“ of the INIT-Menu.

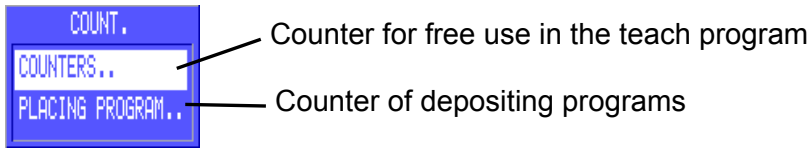
Once the ALL MODES program is activated, it is executed cyclicly unlike the „standard“ peripheral programs. The icon  is shown on the Teachbox as an indicator right to the mode of operation. Changes of the mode of operation will not interrupt the ALL MODES program. Only the PE-STOP command or an emergency off or complete shutdown of the robot will end the execution of the ALL MODES program. Even more flexibility can be added to ALL MODES programs using the event MODE. This gives the possibility to react on the actual robot mode. Also refer to Chapter 3.7.11.2.11.




The following example of an ALL MODES program shows a simple monitoring-routine, that flashes a peripheral output, if the robot is not in automatic. With additional wiring added, the result could be a flashing warning lamp „robot not working“:

```
001 IF MODE < AUTOMATIC
002 PO-008: ON           PO on for 0,5 seconds, if robot mode is not automatic.
003 TIME = 0.5 S
004 ENDIF
005 PO-008: OFF        PO off for 0,5 seconds
006 TIME = 0.5 S
007 -
```

3.7.17 Counter Function

When the  key is actuated, a window will appear with the counter types:





Select the desired counter type with the cursor keys  . Enter the associated counter menu by pressing .




3.7.17.1 Counters (CNT)

Counters are used to program certain repeat functions or to carry out an event count.

64 freely usable counters are available.

After entering the counter menu, first select the counter to be modified using the cursor keys  . In the following this counter will also be designated as CNT-xx.




Now use the soft keys to select the type of value by which the selected counter CNT-xx is to be modified:

-  A number from -2147483648 to 2147483647
-  The value of a (second) counter CNT-yy
-  The result of timing with a timer in 1/10 seconds

The other input possibilities depend upon the type of value, and are described in detail below for each type of value.

3.7.17.1.1 Value

The soft keys are used to select the type of calculation:

-  $CNT-xx = CNT-xx + VALUE$ (standard default for VALUE here is 1)
-  $CNT-xx = CNT-xx - VALUE$ (standard default for VALUE here is 1)
-  $CNT-xx = VALUE$ (standard default for VALUE here is 0)

Use the numeric keypad to enter the desired number for VALUE.

Press  to transfer the instruction into the teach program.

3.7.17.1.2 Counter

The soft keys are used to select the type of calculation:

+ CNT CNT-xx = CNT-xx + CNT-yy

- CNT CNT-xx = CNT-xx - CNT-yy

= CNT CNT-xx = CNT-yy

Use the cursor keys to select the (second) counter CNT-yy.

Press **Enter** to transfer the instruction into the teach program.

3.7.17.1.3 Stopwatch

The soft keys **WATCH +** and **WATCH -** are used to select the desired STOPWATCH-z.
(z = 1 - 4)

The other soft keys are used to select the type of timing of the stopwatch:

ACT CNT-xx = STOPWATCH-z ACT current (last) measured value

MIN CNT-xx = STOPWATCH-z MIN minimum measured value
since last RESET

AVERAGE CNT-xx = STOPWATCH-z AVERAGE average value of measured values
since last RESET

MAX CNT-xx = STOPWATCH-z MAX maximum measured value since last
RESET

Press **Enter** to transfer the instruction to the teach program.

3.7.17.1.4 Example

```
START
Removal process
-
CNT 01 = CNT 01 + 1
JMP QUALI CNT 01 = 11
-
Depositing
-
JMP START

Quality control
QUALI
-
-
CNT 01 = 0
JMP START
```




Every 11th piece removed is to be sent to a quality control station. Since this piece has to travel along a path different from that of the 10 pieces before it, a special sequence is created, which is dependent upon the current counter reading and will be executed for every 11th piece only.

3.7.17.2 Placing Counters (Placing and Piece Counters)

The placing counters are required in the depositing program in order to remember how many pieces have been placed for each axis and to approach the next placing position. Once the placing program is finished (the last piece has been placed), the associated placing counters for the axes X, Y and Z and the piece counter are set to zero prior to a new start of the placing program.

The reading of the number of pieces previously deposited by the respective depositing program is in the piece counters. If the depositing program has been completed (last piece has been deposited), the associated depositing counters for the axes X, Y and Z, as well as for the piece counters, are set to zero before the depositing program starts anew.

Use the teach program function PLCPRG XX RESET to clear the depositing and piece counters of the depositing program XX at any time.

Following entry into the Depositing Counter menu, select the desired depositing program using the cursor keys   and press  to enter the instruction in the teach program.

When the depositing and piece counter is cleared, the depositing program will be discontinued and the next time this depositing program is run it will start depositing again at the first position.



During operation, the depositing and piece counters will be cleared only upon completion of the depositing program, after a RESET or after a change in the teach program. In the event of an error, they will remain intact.

Clearing Placing and Piece Counters in Manual and Reference Modes

See Chapter 3.5.5.4

3.7.18 Remarks





REMARK

In order to facilitate future editing, every program should be provided with a sufficient number of remarks. Remarks are shown in the teach program preceded by "REM:"

```
045 REM THIS IS A REMARK
```

After calling up the function, use the soft keys and the numeric keypad to enter the desired text.


Enter blank spaces with the key .

Press  to enter the remark in the teach program.

For clearer structuring, logically associated program blocks may be separated from other program blocks by blank lines (remark without text).

3.7.19 Locking/Unlocking Block Stop



  **BLOCK ST.**


Normally, if you press the block stop key  in automatic operation the currently processed instruction (axis motion) will be completed and the robot will be halted and shifted into the manual mode.


The LED of the key will flash during this process.

The instruction LOCK BLOCK STOP allows a block stop to be carried out only after the UNLOCK BLOCK STOP instruction has been reached and all instructions found before it in the routine have been processed.

Thus an entire motion sequence (e.g., travel out of the mold area) can be completed with a block stop.

After calling up the function, use the soft keys  (lock) and  (unlock) to select the desired instruction.


Enter the instruction in the teach program by pressing  .

Press  to discard the entry.

3.7.20 Cycle End

  **CYCLE END** 

This instruction is used for selective stopping of automatic operation.

Activate this function in automatic operation by actuating the  (REFERENCE) key. The control lamp of the key will begin to flash in confirmation of this function.

The robot will now execute one more removal. Close Tool will no longer be enabled with activated Cycle End function. Thus the mold will no longer close. Up to this time, the Cycle End function can be deactivated by renewed actuation of the reference key. Otherwise the robot will continue its cycle until the Cycle End instruction is reached. Here automatic operation will be stopped and a switch made to the MANUAL mode.

3.7.21 Stopwatch



The stopwatch function allows times that are required for processing any desired parts of a teach program to be measured. Four such software timers, accurate to 1/10 second, are available.

When this function is called up, a selection window will appear:



Use the cursor keys to select the desired stopwatch.

Use the soft keys **START**, **STOP** and **RESET** to select the corresponding instruction for this timer.

Press **Enter** to transfer the instruction, **Esc** to discard the entry.

Measurement with a stopwatch is simply started in the teach program with the instruction `STOPWATCH-x START`, and halted again with the instruction `STOPWATCH-x STOP`. The time between the two instructions gives the current measured value. After each measurement a minimum value, average value and maximum value are calculated from all measured values present. In order to reset these calculations (or to start them over again), use the instruction `STOPWATCH-x RESET`.

The results of time measurement may also be viewed in the Info menu (see Chap. 3.5.9.8), as well as entered as counter value (see Chap. 3.7.17.1.3) for further logic processing.

Example:

The time required for a sequence of Z-X-Y axis travels is to be measured. Calculation of the average value and of the min/max values is to start over again every 10 cycles.

```

-
-
IF CTR 01 > 9
TIMER 01 RESET           calculation started over again at every 10th cycle
CTR 09 = 1
ELSE
CTR 01 = CTR 01 + 1
ENDIF
-
TIMER 1 START           measurement started
Z: 2500.0
X: 350.0
Y: 938.0
TIMER 1 STOP           measurement stopped
-
-

```

3.7.22 End Instruction



Every program should be terminated with the instruction END, in order to avoid unintended processing of additional subroutines.

Robot programs and All Modes programs will continue their automatic processing at program line 001 after processing the END command.

Reference programs and standard peripheral programs stop at the END command.

3.8 Graphics Editor

Using the graphics editor, you can create a runnable program without detailed knowledge of the robot instructions. After creation of the program in the graphics editor, the program will be available in the text editor for checking.

The graphics editor composes “simple“ robot programs. This should make it easier for the inexperienced user to understand and modify a program produced in this way.

Should the possibilities offered by the graphics editor be insufficient, the robot program can be adapted using the text editor as desired by the user. The graphics editor is likewise suitable for writing a basic framework of a program that can be developed further in the text editor.



The graphics editor can be used with 3-axis servo or asynchronous robots of the CNC-6 series. These may be equipped with additional standard axes and pneumatic and/or vacuum grippers. The latter must be configured before using the graphics editor, otherwise these elements cannot be accessed.



Although a graphics program modified with the text editor can be reloaded and stored with the graphics editor, in doing so user-specific modifications will be lost.

3.8.1 Callup of Graphics Editor

The graphics editor can be called up in all operating modes except *Reference missing*.

In the main menu, select the option TEACH / GRAPHICS EDITOR.



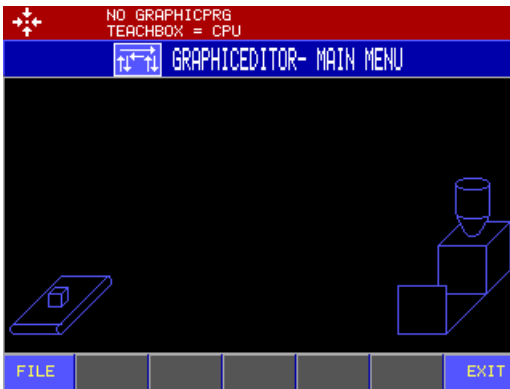
In operating modes Automatic and Block Stop only positions and times can be altered. In manual mode all options are available.

If no graphics program is loaded yet, the robot must be in reference position, to enable the creation of a new graphics program. If not, an error message will be displayed:



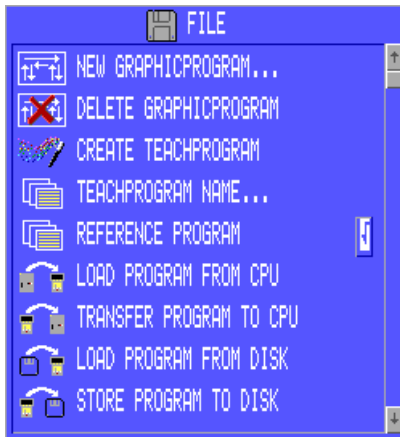
3.8.2 Main Menu

The main menu of the graphics editor can always be called by .



Here one can use  to exit the editor, or  file to open the menu file.

3.8.2.1 Menu File



3.8.2.1.1 New Graficprogram



This function is used to clear the existing graphics program in the teachbox, and to create a new, empty graphics program. The display switches to the menu for selecting program sequences. This is only possible when the robot is in reference mode.

3.8.2.1.2 Delete Graficprogram



Deletes the graphics program in the Teachbox. This function is only available, when a graphics program is loaded.

3.8.2.1.3 Create Teachprogram



Creates a teachprogram based on the graphics program loaded, and also loads it to the Master CPU. If the graphics program is not fully defined yet, a warning will be displayed.

3.8.2.1.4 Teachprogram name



This function is used to change the name of the Teachprogram. After callup of the function a window for enter the new name appears:



Input is done using the softkeys and the numeric keys.

Enter confirms the new name,

Esc exits without any changes.

3.8.2.1.5 Reference Program

This enables or disables the function that creates a robot reference program automatically. When the function is activated, the control automatically writes a teach robot reference program RO-REF for Mold area and placing area. If the function is disabled, the reference program RO-REF will remain unchanged. Also refer to chapters 3.5.4, 3.7.11.2.9 and 3.7.11.2.10.

3.8.2.1.6 Load program from CPU

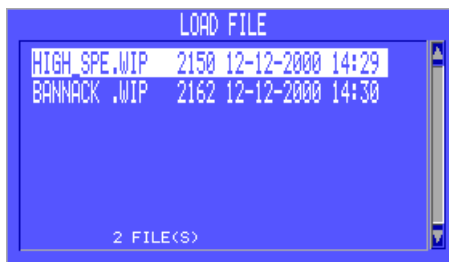
Loads the program from the Master CPU to the Teachbox. The Program in the Teachbox will be overwritten.

3.8.2.1.7 Transfer program to CPU


Transfers the teachprogram loaded in the Teachbox to the Master CPU. The Program in the Master CPU will be overwritten.

3.8.2.1.8 Load program from disk

When this function is called up a window will appear with all teach programs*.WIP stored on the disk:



Use the cursor keys   to scroll up and down in the list and to select a program.

Press  to load the program selected.



If the selected program is no graphics program, it will not be loaded to the graphics editor, but to the text editor of the teachbox.



3.8.2.1.9 Store program to disk


When this function is called up a window will appear with all teach programs*.WIP already stored on the disk :






The first 8 places of the teach program name are given as default for the file name, but the soft keys and the numeric keypad can be used to enter any desired file name.

When necessary, the cursor keys   can also be used to scroll up and down in the list to select the file name of an existing file and overwrite it.

When necessary, the operation can be aborted with ; in this case the softkey  is used to start over again.

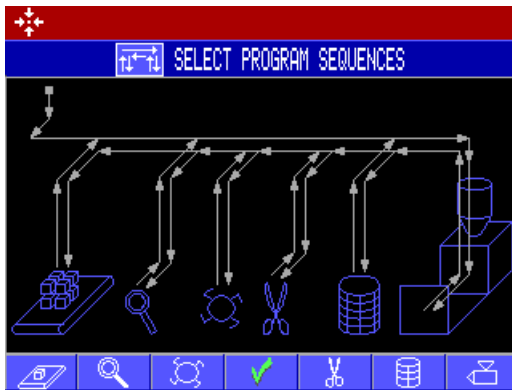
Use  to store the program on the disk under the selected name.

Before storing is executed, a check is made to see whether a program of the same name is already on the disk and a checkback message may appear. If this message is acknowledged with , the file will be overwritten. If  is pressed, the operation will be aborted and a new file name can be entered.

 is used to exit the menu.

3.8.3 Select Program Sequences

When programming of a new graphics program is started by using the function „New Grahicprogram“, the screen for selecting the sequences needed will be shown:



Use the Softkeys to activate or setup the desired options as described below. The graphical display of the program changes accordingly.

3.8.3.1 Injection molding machine





By repeatedly pressing the Softkey it can be selected how to travel during removal:

STANDARD	ACCELERATED	NOZZLE SIDED	L-TYPE ROBOT

3.8.3.2 Placement



The Softkeys toggle between simple placement () and placement using a placing program () .

3.8.3.3 Reject Part



This softkey activates a routine for Rejected parts. A certain number of parts at every start of the program and parts signalled as „reject parts“ by the IMM can be placed to an alternative placing position.

3.8.3.4 Sprue Cutter



Activates the routine for a sprue cutter. Every part is delivered to a sprue cutter after removal.

3.8.3.5 Placement of Sprue



Activates a routine to place the Sprue to an alternative position. Requires additional grippers. If pressed twice the routine will be put after the placement of the part itself. If pressed for a third time, the routine will get deactivated again.

3.8.3.6 Quality Control



Activates a routine to deposit parts for a quality control on an alternative position. During teaching it has to be decided whether this should happen after a fixed number of molded parts, or according to the state of a peripheral input.

3.8.4 Teaching a robot program



Teaching a robot program is done by selecting commands (functions) at the „action points“ and of travel commands for the main axes. Every program starts with an action point (the small square will flash). In general programming is done step by step starting at action point 1 and is finished at action point 38. Nevertheless it is possible at every


step of the way to use the cursorkeys   to navigate through the program and to apply changes.

3.8.4.1 Travelling axes

Basically the axis to be travelled is given by the graphics editor, and it is displayed in the editing line. The line symbolizing the movement to be taught is flashing. There is no need to select anything, simply travel the axis using the softkeys

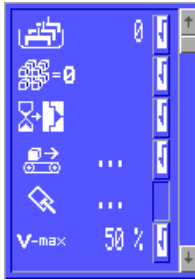


If the softkeys   are offered by the editor, the target position was already taught with another movement, or is fixed in the program structure. This given position can be travelled to automatically, by pressing and holding either the softkey for fast or slow speed.

At certain axes movements (e.g. positioning in the mold with X) it is possible to adapt the already taught positions of the other main axes. In this case all the axes which may be displaced, are shown in the editing line. They can be selected by pressing the respective axis keys,  is used to activate the selected axis movement for editing.

Press  or  to confirm.

3.8.4.2 Action Points


















At the action points the other necessary functions of the program are taught between the movements of the main axes. The graphics editor offers default settings for the most important functions, but the sequence has to be adapted to the actual needs.

To enable changes to a action point, first the editing function has to be activated by pressing the softkey . Now the cursor keys can be used to navigate through the menu. is used to activate a function, deactivates it. Press to confirm and close the action point.











The function symbols are listed in the table below:











	Function to move the A-axis
	Function to move the A-axis
	Function to move the A-axis
	Curve the last main axis movement (X,Y,Z) with the next one.
	speed setting using VMAX
	Conveyors
	Peripheral outputs
	Wait for peripheral inputs
	Wait a certain time
	Wait for a vacuum
	Grippers
	Vakuums
	Activate vacuum monitoring
	Activate gripper monitoring
	close the mold and wait until it is closed
	Wait until the mold is fully opened
	Move ejectors forward, and wait for them
	Move ejectors back, and wait for them
	Reset the placing program
	If the placing program is finished, start the conveyor
	Number of parts displaced with every program start („reject part“ routine)
	Look for IMM signal „Reject part“ and memorize
	Piece for quality control after number of pieces
	Piece for quality control, if peripheral input

Some functions open sub-menus with special softkeys. They are listed below:

 			
	Conveyor on		PO on
	Conveyor on for a time		PO on for a time
	Deactivate the conveyor command		Deactivate the PO- command
	Confirm entry and close		Confirm entry and close
	Conveyor off for a time		PO off for a time
	Conveyor off		PO off

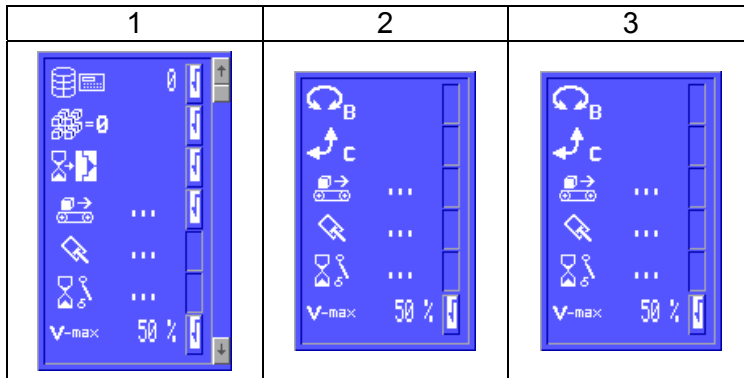
			
	Vacuum on		Gripper close
	Deactivate the vacuum command		Deactivate the gripper command
	Confirm entry and close		Confirm entry and close
	Vacuum off		Gripper open

 			
	Vacuum Monitor on		Wait for the vacuum
	Gripper Monitor on		Deactivate the command
	Deactivate the command		Confirm entry and close
	Confirm entry and close		

			
	Wait until the input is 1		quality control if input is 1
	Deactivate the command		Deactivate the command
	Confirm entry and close beenden		Confirm entry and close
	Wait until the input is 0		quality control if input is 0

3.8.4.3 Sequence

3.8.4.3.1 Start-Routine



At action point 1 at first the number of parts to reject with every start of the program is set, if the routine for rejected parts is activated. Prepared settings are to reset the placing program, wait for the mold to close for the first time, and to switch on the conveyor for 5 seconds. Peripheral outputs may be switched as needed.

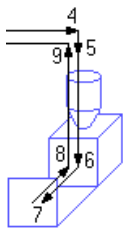
The Y- and X-axes can be moved to a position suitable to travel over the IMM.

At the action points 2 and 3 rotary axes can be moved as needed, also conveyors and peripheral outputs can be operated.

Speed settings with v_{max} are always for the next movement.

Peripheral inputs can be waited for in all action points.

3.8.4.3.2 Removal



(„STANDARD“-sequence is shown and described, the other sequences work similar)

4	5	6	7	8	9

First, the Z-axis is moved over the mold. At action point 4 rotary axes could be moved and peripheral outputs could be switched.

Now the Y-arm can be moved to a waiting position closely over the mold. S5 must still be actuated by its cam. At action point 5 the robot automatically waits for the mold to fully open, the speed for the Y-arm ist set to 100%.

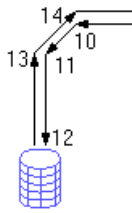
After entering the mold with Y at action point 6 already a vacuum could be activated. The option curves the Y-movement with the next X-movement.

After positioning with X also, at action point 7 the part is taken. The following sequence is prepared: move ejectors forward, close all grippers and turn on all vacuums, wait 0,5 seconds and then move the ejectors back again. The gripper- and vacuum-commands should be adapted. If the routine is activated, the signal „reject part“ could now be memorized using .

After the part has been taken, the X-axis is moved back again, at action point 8 it would again be possible to memorize the signal „reject part“. It is also possible to activate the gripper and vacuum monitoring on STOP if needed. If an alternative routine for piece lost is needed, it must be programmed later using the text editor. The option curves the X-movement with the following Y movement out of the mold. After the mold has been left by the Y-arm, in action point 9 it would again be possible to request the signal „reject part“. Prepared is sending the signal CLOSE MOLD to the IMM, wait until the mold is actually closed and to switch off the signal again. Other selectable options are now: rotary axes, conveyor, and peripheral outputs. Vmax in point 9 is for the following Z movement.

Peripheral inputs can be waited for in all action points.

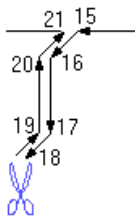
3.8.4.3.3 Reject Part



10	11	12	13	14

In case of a rejected part (Signal from the IMM, counter) the axes Z, X, Y are moved to an alternative position. There at action point 12 it is prepared, that all grippers are opened and all vacuums are turned off, to release the part. After 0,5 seconds of waiting-time, the X- and Y-axes are to be moved to their position taught at the start-routine, just like the rotary axes A,B,C. Peripheral inputs can be waited for in all action points.

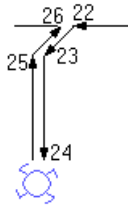
3.8.4.3.4 Sprue Cutter



15,16,17	18	19, 20, 21

The axis Z,X,Y are moved to the intermediate position for the sprue cutter. At all action points a peripheral input can be used to wait for some release signal from the cutter. At action point 18 the robot waits 0,5 seconds (for the cutter to cut). Grippers, Vacuums or peripheral outputs can be operated if needed.

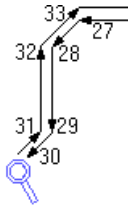
3.8.4.3.5 Placement of Sprue



22	23	24	25	26

The axes Z,X,Y are moved to the intermediate position to place the sprue. In action point 24 the grippers are opened, and the robot waits for 0,5 seconds. Grippers, Vacuums and peripheral outputs can also be operated differently if needed. Peripheral inputs can be waited for in all action points.

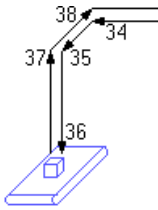
3.8.4.3.6 Quality control



27	28, 29	30	31, 32, 33

A piece is placed to an alternative position for quality control. At action point 27 has to be decided, how the parts for testing should be selected. Prepared setting is to check a part after a chooseable number of molded parts. The other method is to decide depending on the state of a peripheral input, if a part is to be tested. At action point 30 all grippers are opened and all vacuums are turned of by default, to release the part. The robot waits 0,5 seconds, afterwards the X- and the Y-axes have to be moved to their position taught in the Start-routine, just like the rotary axes A,B,C. Peripheral inputs can be waited for in all action points.

3.8.4.3.7 Placement



34	35	36	37	38

The part is placed on the respective placing position.

At action point 35 the C-axis has to be turned down to 90° by default. If not already on position the axis must be turned now.

At action point 36 the part is placed. Therefore all grippers are opened and all vacuums are turned off by default. Afterwards the robot waits for 0,5 seconds to release the part. This sequence should be adapted as needed.

If placement with a placing programm is selected, the placing program can be set after closing action point 36. Also refer to Chapter 3.7.9.



When using a placing program, thought should be given to the movements of Z,X,Y teached before action points 34,35,36. Special care should be taken about the Y-movement between the action points 35 and 36. If in case of a multi-layered placement the Y-arm is travelled to the first (lowest) position with this movement, a crash in automatic mode is inevitable!

After the Y-arm is moved back up to the position teached in the start-routine, at action point 37 the default setting in case of a placing program is, that the conveyor is operated every time the placing sequence is finished.

After also moving the X-axis back to the position out of the start-routine, the C-axis must be turned up again in action point 38.

Peripheral inputs can be waited for in all action points.

3.8.4.4 Finish programming, transfer the program, exit the editor

After the last action point was confirmed with , the editor will suggest to create the teachprogram:





Afterwards the program has to be transfered to the Master CPU:



If set that way in the INIT menu, the request about clearing counters and placing programs appears:



After confirming with yes, exit the editor by pressing  .

3.9 Safety System

3.9.1 Startup with Safety System

3.9.1.1 Manual Setup Mode

In order to be able to travel in the manual mode after the control unit has been activated, the selector switch must be in the MANUAL SETUP position, and one of the

permit keys  on the teachbox must have been actuated.

3.9.1.2 Automatic Mode, Stepping Mode, Reference Travel

After the control unit has been activated, safety must be ensured, since otherwise the AUTOMATIC, STEPPING and REFERENCE TRAVEL modes cannot be used with the robot.

To ensure safety:


- 1.) Open safety door
- 2.) Close safety door
- 3.) Press outside acknowledgment key
- 4.) Set selector switch to position Auto-Stepping-Reference

The period between opening and acknowledgment outside may be as long as desired (no time monitoring features are in place).

3.9.2 Selection of Operating Modes

3.9.2.1 Manual Setup Mode

If the selection switch is in the position MANUAL SET UP, each axis may be moved by


pressing the permit key  located on the manual control unit. If you release the key the selected function will be stopped immediately (software axis stop function; power supply 24 V for outputs will be disconnected through hardware).



During each change of function (e.g., X axis to Y axis) the permit key must be released and then pressed again.

In order to enter the teach mode, you must first perform referencing (ensure safety – set selector switch to position Auto – Stepping – Reference). Then call up the teach mode and set the selector switch to position MANUAL SET UP. Now the safety door can be opened and it will be possible to teach the positions inside the protective grating using the permit key.

3.9.2.2 Automatic Mode, Stepping Mode, Reference

In order to travel to the reference position, all doors must be checked for safety. The selector switch must be set to AUTOMATIC – STEPPING - REFERENCE position. This applies to the automatic and stepping modes as well. Should it be necessary to

access the machine during the automatic cycle, press the  key first in order to unlock the door.
The door will be unlocked when all axes have completed their motions.

If the door is not opened, automatic operation can be continued with the  key. However, if the door is opened, safety must be ensured (Chapter 3.9.1.2) after the intervention and the removal cycle will be continued with the  key. If *Safety ensured* is shown on the input, the reference position may be approached and automatic operation started. Safety must also be ensured for the STEPPING mode.

3.9.3 Monitoring of Safety Gate

The safety gate monitoring system is active only when the selector switch is in the AUTOMATIC – STEPPING – REFERENCE position.

Safety Gate:

The safety gates are electrically monitored by a safety module which ensures that the robot can be used only in manual operation when someone is within the safeguarded area, and that no one can accidentally enter the hazardous area of the plant while the robot is used in the automatic mode. In addition, it is verified that no switches have been bridged or “illegal” interventions made in the safety circuits.

3.9.4 Error Effect Analysis

- Safety gate is forced open during automatic operation -> The safety contactor circuit disconnects all outputs from the power supply by means of hardware. At the same time, the automatic cycle is interrupted by the software and shift to manual operation is made.
- The safety gate is opened during the block stop mode -> The safety contactor circuit disconnects all outputs from the power supply by means of hardware. At the same time, the software does not permit start of a new function. Hence a defective output or a faulty program will not lead to an undesirable motion.
- In the MANUAL SETUP MODE (safety gate not monitored) an axis motion can be executed only with the permit key (mid position). If this key is pressed for a longer period (30 sec.) without a motion being performed, no new travel instruction may be executed (by the software). The entire system will go into a failure state (time monitoring permit key).
- In addition, in an unsafe state all motor axes will be disconnected by means of hardware from the frequency converter/servo module feeder line through contactor disconnects.

4 How to Teach a Program



Before teaching the robot a program for the first time, please read the safety instructions in Chapter 1.

Familiarity with the operating functions of the CNC control in Chapter 3 is essential for creating a teach program.

4.1 Programming the Robot

The robot is programmed simply by manually moving the robot through the motions and functions that you want it to make in automatic mode. The instruction sequence created in this way is stored in a teach program and is then processed step by step in automatic operation. When the last instruction is reached, the program sequence is begun again at the first instruction.

A program may be created completely new (as described below) or may be a revision of an existing program. Once you are familiar with programming, revising an existing program and saving it with a new name is a much quicker way to create programs.

4.1.1 Creating a New Program in the Teach Editor

1) Enter the Teach Editor by pressing **TEXTEDITOR** .

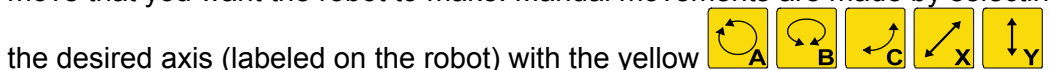
2) To start with a blank program, the program stored in the editor must first be deleted:



Use the soft keys / to select which system data in the teach program should be deleted.

Answer the query DELETE TEACH PROGRAM? with the soft key .

3) Starting from the reference position, move the robot manually to trace the first move that you want the robot to make. Manual movements are made by selecting



the desired axis (labeled on the robot) with the yellow



keys. After selecting the motion, the direction of motion and the speed may be selected by using the soft keys .

(**Plus motions** are away from reference position and **minus motions** are toward reference position.)

When you reach the desired position, press and the instruction will be stored



as a line in the program. (Only the instruction active when you press the key will become a line in the teach program – all other motions made will be ignored.)


- 4) Repeat the process for the remainder of the motions and functions that you want the robot to reproduce. Remember to enter a travel speed (**Vmax**) for each axis to program speeds other than 50% (the default value).
- 5) The program is complete once you have programmed all of the motions and functions desired and the robot is in a suitable position to restart from the beginning of the program.



Caution!

Don't forget to program the arm back up after releasing parts next to the molding machine since the first motion in the program is typically a Z-axis (traverse) motion.

4.1.2 Verifying Your Program Using STEP Mode

- 1) Bring the cursor back up to the beginning of the program using the soft key  .
- 2) Move the robot to reference position with the  key.
- 3) Test the program one line at a time in the STEP mode.




Each time the  key is held down, the next instruction will be executed.


- 4) Releasing the  key will cause the robot to be halted immediately, in order to avoid collisions or other program errors. A flag will appear. Correct the program line and then continue to step through the program.
- 5) When the end of the program is reached, press the  key and the cursor will jump back up to the beginning of the program.

It is important to continue stepping through the program a second time around to verify that there is no problem with the robot's position at the end of the program.

4.1.3 Storing Your Program on Disk


- 1) Insert a formatted disk in the drive on the control cabinet.

- 2) Call up the function for storing the program on disk with    **STORE**

PROGRAM ON DISK  . The teach programs *.WIP already stored on the disk will be displayed.

- 3) Enter the desired name for the program with the soft keys

       and confirm with  .

- 4) Exit menu with  .

- 5) Exit editor with   . Press  to transfer your new program

Into the SPS, and also answer the query „Exit Editor?“ with  .

- 6) You are now ready to run the program in full AUTOMATIC mode.

4.2 Program Example

The following example will help you to further understand and practice the teach programming of the system.



Please note that this is only an example. At a minimum, axis positions, IMM interface signals and program functions must be adjusted to your specific application!

The program example is based on a standard robot with a vacuum circuit.

4.2.1 Function of Program

Plastic housings are to be injection molded.

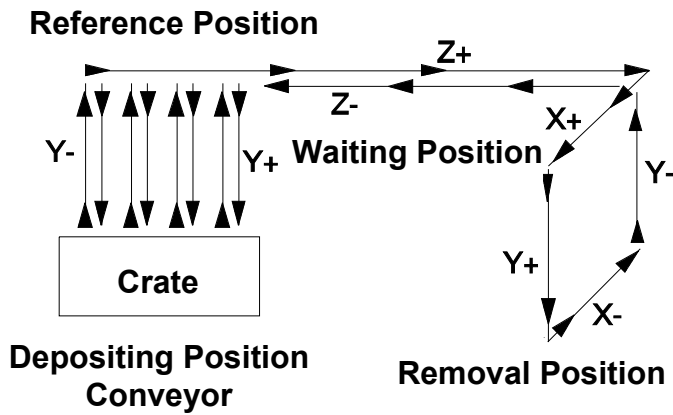
The robot's job is first to move into waiting position above the injection molding machine. When the mold opens, the robot removes the molded part. The molded part is stacked in a crate by means of a depositing program. When the crate is full, it is carried away on a conveyor belt, and at the same time a new crate is put into position.

4.2.2 Sequence

- The first part is placed in the mold by hand and the mold is closed. Then the robot is started in automatic operation.
- The robot travels to the waiting position above the mold, and waits for the „Mold Open“ signal from the machine.
- The molded part is removed from the mold using vacuum circuit 1.
- The robot travels back and up out of the mold and turns on the „Mold Closed“ signal.
- The removed part is placed in a crate using a depositing program.
- If the crate is full, the conveyor is indexed for 3 seconds.
- The presence of the removed part is sensed during the entire cycle by the vacuum switch. If the part is lost, a STOP of the robot is released.
- The robot moves to reference position through a taught sequence.

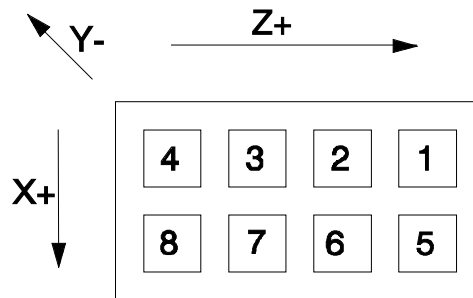
4.3.3 Sketch of Sequence

The ejector presses the parts on the vacuum cup.



4.2.3 Sketch of Depositing Program

The numbers below indicate the sequence of part depositing. Three layers are stacked in the vertical (Y) direction.



4.2.4 Robot Arm

Equipped with a Gripper plate with vacuum for removal of molded parts.

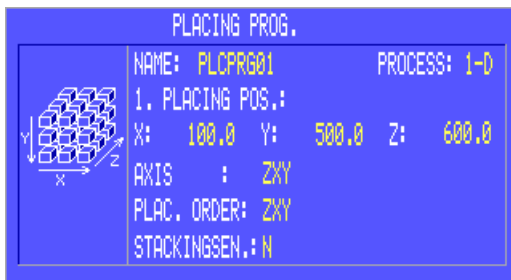
4.2.5 Reference Positioning of Robot

The robot reference program must include axis motions in the mold, in order to allow reference positioning in the mold area. In reference position, the vacuum is switched off.

4.2.6 Robot Teach Program

000	X: VMAX = 60%	
001	Y: VMAX = 60%	Speed settings
002	Z: VMAX = 60%	
003	PER-IMM1: ML_CLOSE! = ON	Initial closing of the mold
004	WAIT IMM1: MOLD-OPEN = OFF	Wait for "mold closed" and
005	WAIT IMM1: MOLD-CLOSE = ON	automatic turnoff of
006	PER-IMM1: ML_CLOSE! = OFF	close mold signal
007	START:	Start cycle (Label "START")
008	Z: 2000.0	Waiting position above mold
009	X: 300.0	
010	Y: VMAX = 100%	Speed setting for
011	X: VMAX = 80%	removal operation
012	WAIT IMM1: MOLD-CLOSE = OFF	
013	WAIT IMM1: MOLD-OPEN = ON	Wait for "mold open"
014	VAC_01 = ON	Removal operation, vacuum on,
015	Y: 600.0	travel into mold
016	PER-IMM1: EJ FORW.! = ON	Eject part
017	WAIT IMM1: EJ-FORWARD = ON	Wait until ejector is in front, and
018	PER-IMM1: EJ FORW.! = OFF	turn off "ejector forward"
019	WAIT VAC-01 = ON	Pick up part
020	X: 0.0	
021	VAC_01=M-ON STOP	Activate part monitoring
022	PER-IMM1: EJ-BACK! = ON	Move ejector in again
023	WAIT IMM1: EJ-BACK = ON	Wait until ejector travels in,
024	PER-IMM1: EJ-BACK! = OFF	turn off "ejector back"
025	Y: 0.0	Travel out of mold
026	PER-IMM1: ML_CLOSE! = ON	Close mold
027	WAIT IMM1: MOLD OPEN = OFF	
028	WAIT IMM1: MOLD CLOSE = ON	
029	PER-IMM1: ML_CLOSE! = OFF	
030	C: 90.0	
031	Y: VMAX = 50%	Speed settings
032	X: VMAX = 50%	for depositing operation
033	PLCPRG: PLCPRG01	Depositing program (see Chapter 4.2.6.1)
034	VAC_01 = OFF	Deposit part
035	TIME = 0.5 S	
036	Y: 0.0	Travel out of crate
037	C: 0.0	
038	JMP CONV PLCPRG01-PC = 24	Jump to "Conveyor" label when 24 parts have been deposited in crate
039	JMP START	Jump to program start
040	CONV:	"Conveyor" label
041	CONV01: ON 3.0 S	Index conveyor for 3 seconds
042	PLCPRG01 RESET	Clear depositing counter and piece counter (new crate)
043	JMP START	Jump to cycle start
044	-	

4.2.6.1 Placing Program PLCPRG01



4.2.7 Reference Program for Robot (Robot REF Program)

000	JMP MOLD	MOLD AREA 1	Callup of reference travel
001	JMP OFF		in mold area.
002	MOLD:		Reference travel in mold area
003	X:	250.0	
004	Y:	0.0	
005	Z:	0.0	
006	C:	0.0	
007	OFF:		Automatic turn-off
008	VAC_01 =	OFF	of vacuum circuit
009	END		
010	-		

5 Troubleshooting

There are three types of errors that may occur:

- System errors
- Teachbox errors
- Operating errors

5.1 System Errors

System errors may occur due to interferences from external sources or due to a fault in the control system hardware. This type of error is indicated by flashing of the characters „Er“ in the LED display of the master CPU module. The related system error code is shown in plain text.

System error codes:

Code	Message	Meaning	Cause/Remedy
02	RUNTIME	The program was aborted because time was exceeded.	Possible causes: - - Processor fault Remedy: - Eliminate program error - Replace central unit
03	POINTER	Faulty program pointers were found before execution of user program.	Possible causes: - Program storage module is missing, not programmed or defective - Program in user program memory (RAM) cannot be run - Battery buffer failure - Software error that overwrites user program Remedy: - Reprogram program memory module, in case of repetition replace - Replace buffer battery - Eliminate program error
04	CHKSUM	An incorrect checksum was found before execution of user program.	Cause/Remedy: see POINTER

05	WATCHDOG	The program was aborted by the Watchdog logic.	Possible causes: <ul style="list-style-type: none">- Interrupts of user program locked for lengthy period (STI instruction forgotten)- Faulty programming of a hardware interrupt- INB, OUTB, INW, OUTW instructions used incorrectly- Processor defective Remedy: <ul style="list-style-type: none">- Eliminate program error- Replace central unit
----	----------	--	--

Code	Message	Meaning	Cause/Remedy
07	PROM DEFECT	An error occurred in programming of the program storage module.	Causes: - Program storage module is defective - User programs is too big - Program storage module is missing Remedy: - Replace program storage module
08	RESET	The CPU has received the RESET instruction and is waiting for further instructions. The user program is not being processed.	
09	WD DEFECT	The hardware-monitoring circuit (watchdog logic) is defective. After being turned on the CPU checks the functions of the watchdog logic. If an error occurs in this check the CPU runs in an endless loop in which it no longer accepts any instructions.	Remedy: Replace CPU
13	PROG END	Programming of a program storage/memory module has been successfully ended.	
14	PROG MEMO	The CPU is programming the program storage module.	
15	STOP BRKPT	The CPU was stopped by a breakpoint in the program.	
16	CPU STOP	The CPU was stopped by the PG software (F6 STOP in status test).	
17	INT ERROR	The CPU executed an incorrect interrupt and aborted the user program, or ran into an unknown instruction during execution of the program.	Causes: - A nonexistent operating system instruction was used - Stack error (unlike number of PUSH and POP instructions) - The user program was aborted by a software error Remedy: - Eliminate program error
18	SINGLE STEP	The CPU is in SINGLE STEP mode and is waiting for further instructions.	
19	READY	A module or project was sent to the CPU, and it is now ready to execute the program.	
20	LOAD	Program processing has stopped and the CPU is receiving a module or project.	
21	ILLEGAL MODULE	The CPU has received a module that does not belong to the project.	
22	MEMORY FULL	In recording a module/project in the CPU it was found that the user program memory was too small.	
23	NOT LINKED	When the CPU was started it was found that a module in the project was missing or did not belong to the project.	
24	DIV BY 0	An error occurred in a division.	Possible causes: - Division by 0 - Result of division does not fit in the result register Remedy: Eliminate program error

Code	Message	Meaning	Cause/Remedy
25	DIAS ERROR	An error occurred upon access to a DIAS module.	Possible causes: - Access to a DIAS module not present - DIAS bus error Remedy: - Check DIAS bus - Check terminal resistors
26	WAIT	CPU is busy.	
27	OP PROG	Operating system reprogrammed.	
28	OP INSTALLED	Operating system reinstalled.	
32	NO MEMORY	No external program storage module present.	Possible causes: - An attempt was made to program an external program storage module even though none was installed in the CPU
34	MEM ERROR	The operating system recorded does not correspond to the hardware configuration.	
35	MAX. IO's	The maximum number of addressable DIAS modules was exceeded.	
37	CHK USERPA	Process image checksum faulty.	Possible causes: - Program error
38	ERROR RAM DISK	RAM disk error.	Reformat RAM disk
39	PR PRO&LIST OK	Program images successfully stored in PROM.	
40	MEMORY TOO SMALL	Not enough memory for images.	

The following displays are also possible and do not indicate error:


Code	Message	Meaning	
00	RUN RAM	The user program is being executed in the RAM. The display is not affected.	
01	RUN ROM	The user program that is in the program storage module was loaded into the RAM and is being executed. The display is not affected.	

5.2 Teachbox Messages



Teachbox messages appear when operating the robot and point out an operating error or a program error but may also appear only to convey information.

The numbers of teachbox messages are distinctive, and identify individual errors.

To acknowledge such a message, either press  or answer the question asked in the message with the appropriate soft keys.

No.	Message	Cause	Remedy
2	TRANSFER FAILURE PRESS ESC TO CONTINUE	No connection to master CPU	Go online again
3	TRANSFER SUCCESSFULLY COMPLETED PRESS ESC TO CONTINUE	Confirmation, OK	
4	THIS AXIS IS NOT CONFIGURED PRESS ESC TO CONTINUE		
5	THE CPU IN THE CONTROL CABINET IS OFFLINE CONNECTION FAILED PRESS ESC TO CONTINUE	Going online, connection to master CPU failed	Go online again
6	THIS FUNCTION CANNOT BE EXECUTED IN AUTOMATIC MODE PRESS ESC TO CONTINUE		
7	THIS FUNCTION CANNOT BE EXECUTED IN BLOCK STOP PRESS ESC TO CONTINUE		
8	INVALID PASSWORD PRESS ESC TO CONTINUE	Incorrect password entered	
9	TEACH PROGRAM<->SPS PROGRAM OFFLINE EDITOR IS ON PRESS ESC TO CONTINUE		
10	TRANSFER FAILURE OFFFLINE EDITOR IS ON PRESS ESC TO CONTINUE	No connection to CPU in teaching, teach offline	
11	PROGRAM OF OTHER CONTROL OFFLINE EDITOR IS ON PRESS ESC TO CONTINUE	Loaded program is from another system	
12	OFFLINE EDITOR IS ON PRESS ESC TO CONTINUE	When no reference teach editor started	
13	A FILE WITH THIS NAME ALREADY EXISTS OVERWRITE?		
14	USER NOT REGISTERED PRESS ESC TO CONTINUE		

No.	Error Message	Cause	Remedy
15	PASSWORD INVALID PRESS ESC TO CONTINUE		
16	MAXIMUM NUMBER OF LINES REACHED PRESS ESC TO CONTINUE	Too many lines entered in Teach editor	
17	NAME ALREADY ASSIGNED PRESS ESC TO CONTINUE		Assign new name
18	OFFLINE PROGRAM NOT TRANSFERABLE EXIT EDITOR ?		
19	TEACHBOX DIFFERENT FROM SPS TRANSFER PROGRAM?	Teach program transferred to CPU	
20	EXIT EDITOR ?		
21	MAXIMUM NUMBER OF LABELS REACHED PRESS ESC TO CONTINUE	Too many labels defined	
22	DEMAG CLOSING PROGRAM ACCESS PRESS ESC TO CONTINUE		
23	CLEAR ALL DEPOSITING PROGRAMS AND COUNTERS?	Upon exit from Editor query whether these values should be reset	
24	CURRENT USER CANNOT BE DELETED PRESS ESC TO CONTINUE		
25	SUPERVISOR CANNOT BE DELETED PRESS ESC TO CONTINUE		
26	NOT AUTHORIZED PRESS ESC TO CONTINUE		
27	MAXIMUM TEACH PROGRAM SIZE REACHED PRESS ESC TO CONTINUE		
28	NO ADDITIONAL USERS CAN BE ADDED! PRESS ESC TO CONTINUE		
29	TURN ON OFFLINE EDITOR?		
30	ONLINE NOT POSSIBLE PRESS ESC TO CONTINUE	When no reference in teach editor online not possible	
31	PROGRAM CHANGED TO ONLINE PRESS ESC TO CONTINUE		
32	NO INIT MARKER FROM MASTER ONLINE NOT POSSIBLE PRESS ESC TO CONTINUE	Master CPU not initialized	
33	THIS NAME IS ALREADY IN USE PLEASE ASSIGN ANOTHER NAME PRESS ESC TO CONTINUE		
34	YOU HAVE USED A DEFAULT NAME PLEASE ENTER ANOTHER NAME PRESS ESC TO CONTINUE		

No.	Error Message	Cause	Remedy
35	FUNCTION NOT SELECTABLE PRESS ESC TO CONTINUE		
36	THIS FUNCTION CAN ONLY BE EXECUTED IN A ROBOT PROGRAM. PRESS ESC TO CONTINUE		
37	ALL POSITIONS DEFINED. SAVE PROGRAM?		
38	NOT ALL POSITIONS WERE DEFINED SAVE PROGRAM ANYWAY?		
39	NOT CONFIGURED PRESS ESC TO CONTINUE		
40	FUNCTION NOT SELECTABLE ONLINE NOT POSSIBLE PRESS ESC TO CONTINUE		
41	INCOMPATIBLE MASTER VERSION ONLINE NOT POSSIBLE PRESS ESC TO CONTINUE	Teachbox and master incompatible	Boot correct versions of program
42	INCOMPATIBLE CONFIGURATION ONLINE NOT POSSIBLE PRESS ESC TO CONTINUE	Configuration incompatible	Load correct configuration
43	CONFIGURATION SECTION MISSING ONLINE NOT POSSIBLE PRESS ESC TO CONTINUE		Load correct configuration
44	CONFIGURATION POINTER ONLINE NOT POSSIBLE PRESS ESC TO CONTINUE		Load correct configuration
45	CONFIGURATION CHECKSUM ERROR ONLINE NOT POSSIBLE PRESS ESC TO CONTINUE		Load correct configuration
46	CONFIGURATION TOO BIG ONLINE NOT POSSIBLE PRESS ESC TO CONTINUE		Load correct configuration
47	NO CONFIGURATION ON DISK ONLINE NOT POSSIBLE PRESS ESC TO CONTINUE		Load correct configuration
48	DISK ERROR LOADING CONFIGURATION ONLINE NOT POSSIBLE PRESS ESC TO CONTINUE		Load correct configuration, check disk drive
49	BRAKES INCORRECTLY CONFIGURED ONLINE NOT POSSIBLE PRESS ESC TO CONTINUE		Load correct configuration
50	REFERENCE POSSIBLE IN OPERATING MODE ONLY PRESS ESC TO CONTINUE	Graphics editor can only be started in reference	
51	DEPOSITING NUMBER IS TOO BIG PRESS ESC TO CONTINUE		
52	PRINTER ERROR OUT OF PAPER PRESS ESC TO CONTINUE		Add paper
53	PRINTER ERROR PRINTER OFFLINE PRESS ESC TO CONTINUE		Turn on printer, check cable
54	PRINTER ERROR GENERAL ERROR PRESS ESC TO CONTINUE		Turn on printer, check cable

No.	Error Message	Cause	Remedy
55	PROGRAM CANNOT BE EXECUTED, THEREFORE IT WAS NOT LOADED. PRESS ESC TO CONTINUE		
56	PROGRAM IS FROM ANOTHER CONTROL SYSTEM. LOAD ANYWAY?	Program in the CPU is from another control system	
57	WRONG VERSION PROGRAM NOT LOADED PRESS ESC TO CONTINUE	Wrong version of teach program	Load program with correct version
58	EXISTING PROGRAM WILL BE DELETED CONTINUE?	Existing program in teachbox will be deleted	
59	VACUUM WAS NOT TURNED ON INVALID INSTRUCTION PRESS ESC TO CONTINUE		
60	FUNCTION WAS ABORTED PRESS ESC TO CONTINUE	Function not ended	
61	INSTRUCTION MUST BE ADJUSTED PRESS ESC TO CONTINUE	Online change Re-enter instruction	
62	STEPPING NOT POSSIBLE PROGRAM DIFFERENT FROM SPS PRESS ESC TO CONTINUE	Manual stepping operation not possible	
63	INSTRUCTION NOT STEPPABLE PRESS ESC TO CONTINUE	Instruction cannot be stepped	
64	ILLEGAL MASTER STATUS PRESS ESC TO CONTINUE	Handshake between teachbox and master failed	Try function again, turn control off/on
65	TOO MANY CALL INSTRUCTIONS PRESS ESC TO CONTINUE	Too many nested call instructions stored	
66	RET WITHOUT CALL INSTRUCTION PRESS ESC TO CONTINUE		
67	TOO MANY IF INSTRUCTIONS PRESS ESC TO CONTINUE	Too many nested if instructions stored	
68	ELSE WITHOUT IF INSTRUCTION PRESS ESC TO CONTINUE		
69	ENDIF WITHOUT IF INSTRUCTION PRESS ESC TO CONTINUE		
70	ENDIF MISSING PRESS ESC TO CONTINUE		
71	IF YOU FORMAT THE DISK, ALL DATA ON IT WILL BE LOST. DO YOU WANT TO FORMAT THE DISK?		
72	DEPOSITING PROGRAM IS NOT COMPLETELY DEFINED DO YOU WANT TO ABORT INPUT ANYWAY?		
73	ROTARY AXES DO NOT RETURN TO STARTING POSITION PRESS ESC TO CONTINUE		
74	TEACH PROGRAM<->SPS PROGRAM GRAPHICS OPERATION NOT POSSIBLE PRESS ESC TO CONTINUE		

No.	Error Message	Cause	Remedy
75	TEACH PROGRAM<>GRAPHICS PROGRAM GRAPHICS OPERATION NOT POSSIBLE PRESS ESC TO CONTINUE		
76	START TEXT EDITOR?		
77	ACTIVATE USER PROFILE? ARE YOU SURE?	Activating password system	
78	DEACTIVATE USER PROFILE ? ARE YOU SURE?	Deactivating password system	
79	NO AUTHORIZATION FOR ONLINE EDITOR OFFLINE EDITOR IS ON PRESS ESC TO CONTINUE	Online changes not possible	
80	BLOCK STOP ACTIVE FUNCTION NOT AVAILABLE ESC TO CONTINUE	Robot is not in manual mode	switch to manual mode
81	ALL MODE PROGRAM RUNNING TRANSFER NOT POSSIBLE LEAVE EDITOR?	transfer not possible because the all modes program is active	stop the all modes programm
82	MAX. NUMBER OF PLC-PROGRAMS REACHED ESC TO CONTINUE	All available placing programs are used	re-think your teachprogram
83	MAX. NUMBER OF POSITIONS REACHED ESC TO CONTINUE		teach the movements in the „conventional“ way
84	MACRO COPY NOT POSSIBLE MACRO IS NO ALL MODE PROGRAM ESC TO CONTINUE		teach
85	MACRO COPY NOT POSSIBLE MACRO IS NO PE-PROGRAM ESC TO CONTINUE		teach
86	MACRO COPY NOT POSSIBLE MACRO IS FROM ROB-PROGRAM ESC TO CONTINUE		teach
87	POSITION HAS BEEN CALCULATED AND CAN NOT BE ALTERED ESC TO CONTINUE	Position is given by the graphics editor	
89	POSITION IS NOT COMPLETELY DEFINED ESC TO CONTINUE	one or more axes values are not confirmed yet	confirm the missing axes values with ENTER
90	ROTATE THIS AXIS TO THE PROGRAMMED POSITION ESC TO CONTINUE		
91	NOT POSSIBLE IN ROBOT MODE REFERENCE MISSING ESC TO CONTINUE		Perform a reference travel
92	NEW GRAPHICPROGRAM CAN ONLY BE CREATED IN ROBOT MODE REFERENCE ESC TO CONTINUE		Perform a reference travel
93	THIS PROGRAM CAN NOT BE LOADED IN THE GRAPHIC-EDITOR ESC TO CONTINUE	Teachprogram is no Grafics program	edit the program in the Texteditor

No.	Error Message	Cause	Remedy
999	UNDEFINED LABEL: xxxxx EXIT EDITOR ?		
998	xxxxx LABEL FROM OTHER PROGRAM PRESS ESC TO CONTINUE		
997	xxxxx LABEL ALREADY DEFINED PRESS ESC TO CONTINUE		
996	nn:MODULE ERROR mmm ONLINE NOT POSSIBLE PRESS ESC TO CONTINUE		
995	DO YOU REALLY WANT TO DELETE filename FILE?		
994	POSITION NAME AXIS NOT CONFIG. position name PRESS ESC TO CONTINUE	Changing online	
993	POSITION NAME AXIS VALUE UNDEFINED position name PRESS ESC TO CONTINUE	Changing online	
992	ADJUST CYLINDER cylinder name PRESS ESC TO CONTINUE	Changing online	

The placeholder mmm in error message No. 996 stands for module names:

ROBOT MAIN BOARD
DDI 161
DTO 161
DEZ 161
DNC 031,
DNC 305
DNC 115
DISK CONTROLLER
ROBOT NC EXPANSION
DDM 161
DSS 105

The placeholder nn stands for the module address in hexadecimal numbers.

5.3 Operating Errors

These errors are the result of operational causes. If such an error occurs, the relevant text error message will be displayed on the teachbox. Multiple errors are listed according to their priority:




Every error message is preceded by an error code with the following meaning:


Error group – Error number – Supplementary number



In addition, the error icon  is displayed on the right in the status line.

The majority of these errors cause an immediate stop of the robot and a switch to *MANUAL* mode. In order to continue automatic operation, first clear the errors by

pressing the  key, after their causes have been eliminated. The robot must be moved to reference position before restarting automatic operation.

Errors whose cause is still present are displayed in red. If the cause of error is eliminated or is no longer active, the display color changes to green.

 Errors whose cause is still present cannot be acknowledged.

 Pressing  closes the window, but cannot acknowledge or delete errors.

5.3.1 Operating Errors in Plain Text Messages

5.3.1.1 Axis Errors

Group	No.	Supplement	Message	Cause/Remedy
4	0	0-11	xx:CONTOURING ERROR	Actual speed of axis lags behind internal calculations; can be caused by mechanical friction in guides/bearings or by too high a payload. May also indicate a defective converter or servo module.
4	1	0-11	xx :END SWITCH: 0 POSITION	When the axis was moved the end switch was moved in – direction.
4	2	0-11	xx :END SWITCH: END POSITION	When the axis was moved the end switch was moved in + direction.
4	3	0-11	xx :MOTOR OVER TEMPERATURE	
4	4	0-11	xx :FREQ. CONVERTER FAULT	There may be many causes of converter fault; the display on the converter should be read and the relevant cause looked up in the converter manual. The error messages of the controller can be confirmed by sending a drive command (selecting the axis emits the release signal). If for example 3 errors are active at the controller, the axis has to be selected 3 times. However, this error may also indicate a mechanical defect or sluggishness of guides/bearings.
4	5	0-11	xx :END SWITCH MONITORING	
4	6	0-11	xx :INCREMENTAL ENCODER FAULT	This error indicates that the incremental encoders do not count as provided. The reason for this could be a cable failure in the incremental transmitter line or a defect in the scoring logic. Another cause might be increased mechanical friction between guide shaft and bearing. In this case this error occurs mainly at very low speeds, especially in the first acceleration or last braking phase.
4	10	0-11	xx :ILLEGAL AXIS POSITION	
4	12	0-11	xx :ILLEGAL SET POSITION	There is an invalid set position in the teach program for the robot or the stroke limit was set too low. With activated safety areas this message appears when the robot would leave the safety areas.

Group	No.	Supplement	Message	Cause/Remedy
4	15	0-11	xx :ROLLER SWITCH FAULT	Roller switches are important for mold monitoring and hence for perfect operation of the robot; therefore they are continuously checked for their proper switching instant. If the number of error messages increases this means that there are delayed switch impulses – a sign of wear. Roller switches should be replaced.
4	16	0-11	xx :SAFETY AREA VIOLATED	
4	17	0-11	xx :AXIS NOT IN 0 POSITION	Before start of reference travel the B axis is checked to see whether it is in 0 position. If not, reference travel is aborted by this error message.
4	19	0-11	xx :POSITION MONITORING	Position monitoring compares internally the listed end position with the actual position. If they do not coincide this error message appears.
4	20	0-11	xx :LATCH NOT OPEN	
4	22	0-11	xx :TIME MONITORING	A pneumatic axis has not reached its set position within ten seconds.

The supplementary number indicates the axis, xx stands for the axis designation.

0:X
1:Y
2:Z
3:A
4:B
5:C
6:X2
7:Y2, etc.

5.3.1.2 Vacuum Errors

Group	No.	Supplement	Message	Cause/Remedy
6	0	0..n	VACUUM xx PART LOST	This error message appears when the vacuum monitoring for circuit xx is activated without an alternate sequence having been defined and this circuit receives no parts return message. Activation takes place by the teach program instruction M-ON STOP.
6	1	0..n	VACUUM xx NOT TURNED OFF	In the vacuum reference position OFF was chosen, and in the reference position of this vacuum circuit it is switched on.
6	2	0..n	VACUUM xx NOT TURNED ON	In the vacuum reference position ON was chosen, and in the reference position of this vacuum circuit it is switched off.
6	3	0..n	THERMAL MONITORING OF PUMP	Thermal contact of vacuum pump responded to increased temperature of motor.

xx indicates the vacuum number, e.g., 01

Supplementary numbers: 0 = VACUUM 01
1 = VACUUM 02, etc.

5.3.1.3 Gripper Errors

Group	No.	Supplement	Message	Cause/Remedy
7	0	0..n	GRIPPER xx PART LOST	This error message appears when the gripper monitoring for circuit xx has been activated without an alternate sequence having been defined and this circuit receives no parts return message. Activation takes place by the teach program instruction M-ON STOP.
7	1	0..n	GRIPPERxx NOT OPEN	The position OPEN (= standard) was chosen in the gripper reference position and here this gripper is closed.
7	2	0..n	GRIPPER xx NOT CLOSED	The position CLOSED was chosen in the gripper reference position and here this gripper is opened.
7	3	0..n	GRIPPER xx TIME MONITORING	

xx indicates the gripper number, e.g., 01

Supplementary numbers: 0 = GRIPPER 01
1 = GRIPPER 02, etc.

5.3.1.4 Peripheral Equipment Output Messages

Group	No.	Supplement	Message	Cause/Remedy
9	0	0..n	xx MONITORING	This error message is displayed when parts monitoring for peripheral input/output NN was activated without an alternate sequence having been defined and this input receives no parts return message. Activation takes place by the teach program instruction M-ON STOP.

xx shows the PO names: e.g., PO-001

Supplementary numbers: 0 = PO-001
1 = PO-002, etc.

5.3.1.5 If Messages

Group	No.	Supplement	Message	Cause/Remedy
16	0	0	TOO MANY IF INSTRUCTIONS	This error appears when the nesting depth of IF branches becomes too big. The cause of this could be a teach program error or too frequent calling of IF instructions without previous encounter of ENDIF instructions.
16	1	0	ELSE WITHOUT IF INSTRUCTION	This is a teach program error. The cause is that the program routine has found the ELSE instruction without previous execution of an IF instruction.
16	2	0	ENDIF WITHOUT IF INSTRUCTIONS	This is a teach program error. The cause is that the program routine has found the ENDIF instruction without previous execution of an IF...ELSE instruction.
16	3	0	NO ENDIF INSTRUCTION	This is a teach program error. The program routine has reached an END instruction or the end of the program even though an IF...ELSE condition was not closed with the ENDIF instruction.

5.3.1.6 Conveyor Belt Messages

Group	No.	Supplement	Message	Cause/Remedy
19	0	0..n	CONVEYOR xxTHERMAL MONITORING	The thermal contact of the conveyor belt responded to increased temperature of motor.

xx shows the belt number: e.g., 01

Supplementary numbers: 0 = CONVEYOR BELT 01
1 = CONVEYOR BELT 02, etc.

5.3.1.7 Call Messages

Group	No.	Supplement	Message	Cause/Remedy
26	0	0	TOO MANY CALL INSTRUCTIONS	This error appears when the nesting depth of subprogram calls becomes too big. The cause could be a teach program error or too frequent calling of CALL instructions without previous encounter of RET instructions.
26	1	0	SUBROUTINE WITHOUT END	Execution of the teach program encounters an END instruction or the end of the program, even though a subroutine was called and therefore the program is not on the main level. Remedy by inserting a RET instruction to end subroutine.

5.3.1.8 Ret Messages

Group	No.	Supplement	Message	Cause/Remedy
27	0	0	RET WITHOUT CALL INSTRUCTION	This is a teach program error. Cause is that the program execution encountered instruction RET without previously executing a CALL instruction.

5.3.1.8 General Error Messages from Master

Group	No.	Supplement	Message	Cause/Remedy
124	0	0	EMERGENCY STOP	Emergency stop button was actuated either at the IMM or at the robot. After resetting the emergency stop switch, The key at the control cabinet must be pressed to switch on the control-voltage again.
124	1	0	NO OPERATING PRESSURE	Operating pressure dropped below 3.5 to 4 bar.
124	2	0	PHASE MONITORING	Phase monitoring F12 in the control cabinet reports voltage fluctuations and asymmetries in supply exceeding a given adjustable range.
124	3	0	CHECKSUM ERROR IN TEACH PROGRAM	The automatic program is no longer valid or was destroyed. Load valid program from disk into control.
124	4	0	ILLEGAL PARALLEL MOVE	This error message appears with robots with 1 or 2 converters if it is attempted to move more axes simultaneously than there are converters. Remedy by entering the instruction WAIT SYNC after start of a parallel function and before start of next numeric axis.
124	5	0	OPERATION WITHOUT ROBOT	In order to change to automatic operation, press the operation-with-robot key. A switch to operation without robot was made during operation.
124	6	0	IMM IN MANUAL MODE	The injection molding machine was in manual operation when the AUTOMATIC key was pressed.
124	7	0	MOLD MONITORING	Mold safety ensures that the robot does not travel into a closed mold or that the mold does not close while the robot is in the mold area. Mold safety is realized with the roller switches S5 (Y axis) and S6 (Z axis).

Group	No.	Supplement	Message	Cause/Remedy
124	8	0	SAFETY DOOR OPEN	The safety door of the injection molding machine was opened during automatic operation.
124	9	0	ROBOT DOOR NOT LATCHED	The door of the safety package could not be locked mechanically. The door contact may have become bent, not allowing the bolt to lock.
124	10	0	MONITORING DOOR NOT ACKNOWLEDGED	The internal safety package of the robot reports that the safety requirements for operation have not been met. (See also Chapter 3).
124	11	0	TIME MONITORING PERMIT KEY	The permit key on the teachbox must be pressed and released at regular intervals.
124	12	0	REFERENCE TRAVEL IN MOLD NOT ALLOWED	For safety reasons, standard reference travel may not be carried out in the mold area. Error message appears when the robot is in the mold area and the operator did not teach reference travel. Note that in the <i>NO REF.</i> mode reference travel cannot be carried out in the mold area.
124	13	0	GENERAL ERROR	
124	14	0	TEACH PROGRAM ERROR	The teach program is corrupt/ed.
124	15	0	RELEASE PERMIT KEY	The permit key on the teachbox must be pressed and released at regular intervals.
124	18	0	SAFETY NOT MET	The internal safety package of the robot reports that the safety requirements for operation have not been met (see also Chapter 3). Also check EMERGENCY OFF of robot and IMM.
124	19	0	BM IN MANUAL OPERATION	
124	20	0	SR: x VIOLATED	Es wurde versucht in den Sicherheitsbereich Nr. x einzufahren. betroffene Achse wieder zurückfahren.
124	21	0	SR: x INITIALIZATION	
124	22	0	SR: x INIT ABORTED	An already initialized axis was moved on the cam again. Initialize safety area x again
124	23	0	SR: x IS INITIALIZED	Initialization of safety area x is finished
124	24	0	SR: n AXIS INITIALIZATION	
124	25	0	SR: x AXIS IS INITIALIZED	
124	26	0	y SR NOT INITIALIZED	After a URINIT, battery change, BOOT-procedure a reference travel on a robot equipped with safety areas was executed without initializing the safety areas again. y is the number of not initialized safety areas. Refer to Chapter 2
124	27	0	SR: x ALREADY DEFINED	
124	28	0	CHECK CENTRAL LUBRICATION	Stop the robot as soon as possible and check the central lubrication system. (Run out of grease ?)
124	29	0	CENTRAL LUBRICATION FAILED	Check and repair the central lubrication system (Run out of grease?)
124	30	0	AUTOMATIC-MODE NOT POSSIBLE	Check and repair the central lubrication system (Run out of grease?)
124	31	0	PRESSURE SENSOR CENT. LUB. FAULT	

5.3.1.9 Protocol Error Messages

Group	No.	Supplement	Message	Cause/Remedy
125	0	0	DISK PROTOCOL	
125	1	0	PRINTER PROTOCOL	

5.3.1.10 System Error Messages

Group	No.	Supplement	Message	Cause/Remedy
127	0	0..n	SYSTEM ERROR xx	Internal error
127	2	0	ERROR BUFFER WAS DELETED	
127	3	0	EXTERNAL TEACH PROGRAM CHANGE	Upon integration. A teach program from the tool catalog of the IMM was rerecorded in the master SPS of the robot. In order to see this in the editor of the teachbox as well, it must first be loaded from the SPS.

xx System error number, e.g., SYSTEM ERROR 01

Supplementary numbers: 0 = SYSTEM ERROR 01
 1 = SYSTEM ERROR 02 , etc.

5.4 Using the Boot Disk

If it is suspected that the system software of the master CPU or of the teachbox is damaged for any reason (e.g., dead buffer battery of master CPU), this software may be reloaded and reinitialized by means of the boot disk (system disk) included with delivery of the robot.

Procedure:

- If possible, store the teach program on disk.
- Turn off control panel.
- Insert boot disk in disk drive of control panel.
- Turn on control panel.
- The software will now be automatically loaded into the control system. This process takes about 10 minutes. During this time the error messages 20 LOADING and 23 LINKING will appear alternately, first on the LED display of the master CPU, then on the teachbox display. During the last 1-2 minutes the teachbox will display the messages LOADING TEXT and LOADING LANGUAGE.
- After completion of the booting process the main screen will appear on the teachbox.
- Remove the disk from the drive.



The stroke limitations and any safety areas present must be reset and reinitialized after execution of the original reference travel.



The user management password system is deactivated, and must be recreated.



The teach programs stored in the master and in the teachbox are deleted.



All INIT settings have to be checked.



Lubrication intervals are reset.

6 Maintenance

Following the recommended maintenance schedule is required to ensure trouble-free operation of the robot. The robot warranty does not cover neglected or poorly maintained equipment.

Maintenance must be performed by qualified personnel only.

6.1 General



The user of the robot is responsible for maintenance and monitoring of the safety devices and systems.

In particular, the safety systems marked  must be checked according to the instructions to ensure a safe and fully functioning robot system.




Before entering the work envelope of the robot to perform maintenance work, lock out the main power disconnect switch and turn off the compressed air supply to the robot.

IMPORTANT! Robots with pneumatic linear axes often use 5-way or 3-way valves, which can leave trapped high-pressure air in a cylinder even with air pressure removed. This can result in uncontrolled axis motions if one side of the cylinder is exhausted during a maintenance procedure. For this reason, it is recommended that all pneumatic axes be blocked to prevent unintended hazardous motions.

6.2 Lubrication Instructions for Linear Guides and Gear Racks

6.2.1 Lubrication Intervals for Standard Robots

The lubrication intervals are calculated automatically by the control system and are displayed with a message "lube interval reached" and the lubrication flag  on the upper right-hand corner of your screen. Generally, it is necessary to lubricate the tracks and the bearings after a distance of 500 km; the axis that completes this distance first is the one that determines the beginning of the lubrication interval.

6.2.2 Lubrication Procedures


<u>LINEAR SHAFTS:</u>	Remove old grease from the shaft and the bearing wiper rings with a rag. Apply fresh grease to the shaft with a brush.
<u>LINEAR RAILS:</u>	Remove old grease from the bearing wipers with a rag. Use a grease gun to fill the bearing until grease begins to come out of the bearing wipers.
<u>GEAR RACKS:</u>	Remove old grease with a rag and apply fresh grease to the entire length of the gear rack using a spatula or a brush.

6.2.3 Grease Specification

<u>GREASE:</u>	MANUFAC- TURER:	TYPE:
	SHELL	ALVANIA G2
	MOBIL	DARINA GREASE 2 MOLYKOTE LONG TERM 2PLUS MOBILGREASE 28 MOBILUX 3
	ESSO	UNIREX N3
	KLÜBER	ISOFLEX NBU 15 ISOFLEX NCA 15

**As well as all BEARING GREASE TYPES KP2K PER DIN 51825
CONSISTENCY CLASS NGLI 2 PER DIN 51818**

6.3 Maintenance Schedule

Description of Service	INTERVAL IN OPERATING HOURS PER CYCLE TIME		
	<10 s	10-30 s	>30 s
<p>1) Safety Systems and Devices </p> <p><u>Emergency Stop Buttons:</u> With the robot stopped, press the Emergency Stop button and check to see that the 2 LEDs on the Disconnect Unit (PNOZ) are turned off.</p> <p><u>Function of Permit Keys on the Teachbox:</u> Switch robot to manual operation, set selector switch at the safety door to <i>Set-up Mode</i>. When the permit key is pressed, the “robot enabled” light must go on. This function must be tested with both permit keys.</p> <p><u>Safety Roller Switches S5+S6:</u> Switch to operation without robot (robot LED key does not light). Close mold slightly (Mold Open signal must be out). Now try to ride into the mold area with the Y axis. The Y axis should ride only until leaving S5. The error message “mold monitoring” must be displayed on the robot. Acknowledge message with ESC. Now try to close and open the mold. This should not be possible, and an error message should appear on the IMM. Now raise the Y axis.</p>	150	150	150
<p>2) Guides and Gear Racks</p>	See 6.2	See 6.2	See 6.2
<p>3) Other Components</p> <p><u>Function of Vacuum Switches:</u> The vacuum switch inputs should be checked using the Input Display screen on the teachbox. The input must only be on when a complete set of parts is on the vacuum cups. Be sure that the input switches back off when just one part is removed.</p> <p><u>Air Filter:</u> Drain the filter bowl and check and fill the oiler as required. IMPORTANT: Use only oil in accordance with ISO VG 32 KL1.</p> <p><u>Control Cabinet Cooling Fan:</u> Clean the cooling fan filters and check that the fan is operating whenever the control cabinet is powered up. (In high dust environments clean the filter more often than specified.)</p> <p><u>Drive Belts:</u> Visually check belt alignment and tension while the axis is moved through first full stroke. Inspect the belt for damage and “necked-down” areas which indicate approaching belt failure.</p> <p><u>Rack and Pinion Clearance:</u> Check for minimum rack to pinion clearance of 0.1 mm (0.004”).</p> <p><u>Cleaning motor contactors:</u> (for robots with 1-2 freq. converter only) With the robot turned off, press each motor contactor manually about five times to clean contacts.</p> <p><u>Gearbox Gaskets and Drain Plugs:</u> Check for leaks.</p> <p><u>Cable Chains:</u> Inspect for proper alignment of cables in cable chain (IMPORTANT: Loose cable clamps can cause cable binding and chafing)</p> <p><u>Motor Brakes:</u> Check for 0.2 mm (0.008”) air gap with a feeler gauge</p> <p><u>Screws:</u> Check robot screws and bolts for tightness.</p>	150	150	150
	150	300	500
	150	150	150
	150	300	500
	150	150	150
	300	600	800
	300	600	800
	300	600	800
	500	800	1000
	500	800	1000
	800	1200	2000
	800	1200	2000


6.4 Automatic Lubrication

6.4.1 Automatic Lubrication Standard-version 2001


6.4.1.1 Description:

The optional, automatic system lubricates all linear bearings and the respective sprockets and racks of the robot. The system measures the X, Y, and Z-axis travel distances to determine when grease should be applied. When the lubrication interval (50 km) is reached, a fixed quantity of grease is injected into each bearing through the grease distributors.


The grease-pump is equipped with a pressure sensor. If the given pressure is not reached within 15 seconds after switching on the pump, or if the pressure doesn't drop below the given value within 15 seconds after switching off the pump, the error message „CHECK CENTRAL LUBRICATION“ will be displayed on the Teachbox. This will not interrupt the automatic execution of the robot teachprogram, but can be

confirmed with . The lubrication system should be checked as soon as possible, and the cause of the error should be fixed. Possible causes for the error are:

- Lack of grease in the container
- Leaking, unplugged or burst hoses
- Functional breakdown of the pump

If the cause of the error is not fixed before the next lubrication interval, the error message “CHECK CENTRAL LUBRICATION” will be displayed again, and can be confirmed with  again.

Should the cause of the error again not be fixed until the 3rd lubrication interval, the error message “CENTRAL LUBRICATION FAILED” will be displayed, and the robot will switch to block stop. Now the cause of the error must be fixed.. After the cause of the

error was fixed, the grease pump can be started by pressing  inside the menu INIT/LUBRICATION INTERVAL a number of times until lubrication was executed correctly without error message. This enables the satr of atuomatic mode again.

During filling of the grease pump container, extra precaution must be taken to avoid air bubbles in the grease and to use only the specified greases.

6.4.1.2 System Maintenance:

It is important to remember that the automatic lubrication system does not eliminate maintenance requirements for the robot! It just reduces the frequency of the maintenance intervals. Lubrication system maintenance is crucial in detecting system faults, such as:

- Burst Hoses
- Plugged Tubes
- Air Pockets
- Faulty Lubrication Pump or Solenoid Valve
- Faulty Injectors

6.4.1.2.1 Lubrication System Maintenance Procedure:

1. Inspect the system for burst, leaking, or disconnected tubes and hoses.
2. Check that some grease build-up is present on all linear bearings wipers to verify that grease is reaching all bearings. Clean the grease off of the wipers to "reset" this test for next time.

Refill the grease pump as needed, being careful not to leave any air pockets. Use only the specified greases!

6.4.1.2.2 Suitable greases

Manufacturer	Type	Specification
ARAL	Aralub MFL 00	GP 00 K-30
BP	Energrease PR – EP 00	GLP 00 G-30
ESSO	Grease TCL 435	GP 00/000 G-40
Fuchs – DEA	Renolit G-FHT 00	KP 00 P-30
Mobil	Mobilux EP 004	GP 00 G-20

6.4.2 Automatic Lubrication Standard

Description:

The optional automatic system applies grease to all of the linear bearings on the robot. The system measures the X, Y and Z-axis travel distances to determine when grease should be applied. When the lubrication interval is reached, a pre-measured quantity of grease is injected into each bearing through the grease distributors. The grease pump is equipped with a level sensor to measure the quantity of grease. If there is a minimum amount of grease in the pump a message is displayed on the screen of the teachbox and dry bearings are prevented. There is also a sensor on the grease distributor most distant from the pump to detect if grease reaches all the bearings. Only when this sensor detects the grease is the pump switched off.

During filling of the grease pump container, extra care must be taken to avoid air bubbles in the grease and to use only the specified grease.

6.4.3 Automatic Lubrication USA

Description:

The optional automatic lubrication system applies grease to all of the linear bearings on the robot. The system measures the X, Y and Z-axis travel distances to determine when grease should be applied. When the lubrication interval is reached, a pre-measured quantity of grease is injected into each bearing.

The injectors used are adjustable. They are preset at the factory at the midpoint (one turn open). The amount of grease applied to each bearing can be fine-tuned by opening or closing the injector for that bearing. Closing the injector one-half turn will cut the quantity of grease in half, while opening the injector one turn (to two full turns from hand tight) will double the grease applied to the bearing.

System Maintenance:

It is important to remember that the automatic lubrication system does not eliminate maintenance requirements for the robot! It just reduces the frequency of the maintenance intervals. In particular, the gear racks must still be cleaned and hand-greased at the intervals outlined in the maintenance schedule. Additionally, the following lubrication system maintenance procedure must be performed at the same intervals as the gear rack service intervals. Lubrication system maintenance is crucial for detecting system faults, such as:

- burst hoses
- plugged tubes
- air pockets (which will disable the entire system!)
- faulty lubrication pump or valves
- faulty or misadjusted injectors (especially when injectors are adjusted to less than one-half turn open).

Lubrication System Maintenance Procedure:

1. Inspect the system for burst, leaking, or disconnected tubes and hoses.
2. Check that some grease buildup is present on all linear bearing wipers to verify that grease is reaching all bearings. Clean the grease off the wipers to „reset“ this test for next time.
3. Test the system functionally:
 - a) Manually energize the lubrication pump valve using the manual override of the valve.
 - b) Verify that all of the injector pins extend within ten seconds. If some or all pins do not extend, then grease is not being applied to all bearings. Possible causes are air pockets, burst or leaking supply hoses, or a defective pump.
 - c) Deenergize the valve and verify that all injector pins retract within twenty seconds. A non-retracting pin indicates a plugged tube between the injector and the bearings.

Refill the grease pump as needed, **being careful not to leave any air pockets**. Use only grease conforming to the Wittmann grease sheet.

6.5 Buffer Batteries of Master CPU and of Teachbox CPU

The memories of the master and teachbox control systems for the system software and the teach programs are buffered with batteries in case of loss of supply voltage (e.g., robot turned off at main switch). Without these batteries the robot would have to be rebooted after every time it is turned off and on again, the teach program would have to be reloaded from disk, the stroke limitations and safety areas would have to be reinitialized, etc.



As a precaution, the batteries of both control systems should therefore be replaced every 3 years (before they are actually dead).

6.5.1 Battery Replacement in Teachbox

- Unscrew 4 screws on back of keyboard.
- In Emergency Off condition carefully lift up the keyboard and tilt it on its side.
- Unplug the old battery and remove it from its mounting.
- Plug in the new battery and snap into the mounting.
- Reinstall the keyboard and fasten with the 4 screws.

6.5.2 Battery Replacement in Master CPU

The master CPU “DCP643” is located at the upper left of the control cabinet.

- Pull the gray insert strips (with the label “Battery”) toward the left from the module (may stick a little).
- Remove the old battery on the transparent plastic strip from its mounting.
- Insert the fresh battery.
If possible, touch the battery only on the plastic strip.
- Push the insert strip onto the module from the left.

7 Key Terms

For better understanding of these operating instructions, some key terms are explained below:

Term	Explanation
EJ	Ejector
BM	Blow machine
DIAS BUS	DIAS – Decentralized Intelligent Automation System
CNC	CNC - Computer Numerically Controlled – microprocessor control system
CPU	Central Processor Unit
Euromap 12	Interface standard between IMM and robot
Flag	Various letters/symbols indicating particular operating conditions
CP	Core puller
Position control	In the case of servo devices, in automatic operation the motor will be triggered continuously after a numerical axis has been positioned, so as to hold the position.
LCD Display	Liquid Crystal Display
Master	Control system in control cabinet
MS-DOS	Microsoft Disk Operating System – standard operating system for IBM-PCs and compatibles
Emergency Stop keypad	Additional keypad for full operator control of the robot without manual control unit
Offline	No communication between partial subgroup control units
Online	Communication between all partial subgroup control units is functioning
Override	Adjustment - speed adjustment
PO	Peripheral outputs
PI	Peripheral inputs
Robot	Control on the robot
IMM	Injection molding machine
Soft key	Key of uppermost row of keys on the teachbox, whose assignment varies depending on the current function.
Soft key line	Shows current assignment of soft keys.
Teach mode	Operating mode for programming of sequence programs
Teachbox	Manual control unit
Teaching	Programming of robot
Teaching	Programming of sequence programs
Teach program	Sequence program
T/M	Tool / Mold

8 Index

—3—		
3D-Motions	101	
Absolute	102	
Curve	103	
Parameters V3D, R3D	101	
Relative	102	
—A—		
Aabs	99	
Abort Printing	74	
Absolute Acceleration	99	
Absolute Motion	93	
access	45	
Administrator	43	
Password	44	
Alarms	61	
Alternative Sequence		
Example	106	
Alternative Sequence with "Piece Lost"	105	
AND	124	
Automatic	52	
AW	182	
Axes	51, 93	
Axis functions	51	
Axis selection	51	
Axispositions	61	
—B—		
Basic settings	40	
BAUDRATE	41	
B-Axis, numerical		
Manual functions	55	
Belt	104	
Manual Functions	56	
Block Stop lock / unlock	130	
BM	182	
—C—		
CALL	122	
CAN-STATION	41	
Central Lubrication	71	
Clear		
Lubrication Interval	68	
Placing counters	57	
CNC	182	
Command		
CALL	122	
End	132	
RET	122	
SUBR	122	
Command Buffer	65	
Commands	51	
Control Cabinet	38	
Conveyor	51	
Counter Function	127	
Counter Names	86	
Counters	51, 58, 63	
clear	70	
clear	58	
modify	58	
CPU	182	
Cursorkeys	50	
Curve	96	
Cycle End	130	
Cylinders	88	
Definition	88	
—D—		
Date	69	
Del	77	
delete	77	
Depositing Counters	64	
Depositing Programs	51	
DIAS Diagnosis	66	
DIAS-BUS	182	
Disk		
Contents	72	
Deleting a File	72	
format	72	
Loading a Teachprogram	72	
Storing a Teachprogram	73	
Disk Functions	72	
Display	49	
Brightness	69	
Teachmode	77	
—E—		
E12-Outputs	109	
Edit functions	77	
Editor		
exit	83	
Online / Offline	86	
Operation	77	
Ejector		
Synchronisation	98	
EJS	98	
ELSE	123	
Emergency Stop keypad	182	
Emergency-stop	50	
End	132	
END IF	123	
Enter	50	
Error buffer	65	
Error Effect Analysis	149	
Errors	61	
Esc	50	
establishing connection	41	
Euomap 12	182	
Exit		
Teachmode	83	

—F—

Features37
 Flag182
 Function keys51
 Function Stop52
 Functionkeys50

—G—

Graphics Editor
 Action points140
 Axes139
 Change Teachprogram name135
 Create teachprogram135
 Delete program135
 exit147
 Injection molding machine.....138
 Load program from CPU136
 Load program from disk136
 New program135
 Placement138, 146
 Placement of sprue139
 Placement of Sprue.....145
 Placing program138
 Program sequences138
 Quality control139, 145
 Reference Program136
 Reject part138
 Reject Part144
 Removal143
 Sequence142
 Sprue cutter139, 144
 Start-routine142
 Store program to disk136
 Teaching a program139
 Transfer program to CPU136
 Graphics Editor133
 Callup134
 File135
 Main menu134
 Gripper
 monitoring104
 Gripper Reference Positions92
 Gripper, monitoring105
 Grippers51, 104
 Manual Functions56

—H—

Help50

—I—

IF123
 IMM51
 Info61
 Init67
 INIT40
 Injection Molding Machine51
 Inputs62
 Ins77
 insert77

—J—

Jump adress118
 Jump Command117

Jump Conditions118
 Label117, 118
 Jump Conditions
 Absolute118
 Counter119
 Mode121
 Operating Modes121
 Partial Program120
 Piece Counter119
 Placing Counter119
 Vacuum120
 Jump Conditions118
 Jump Conditions
 Stack Sensor121
 Start121
 Jump Instruction117

—K—

Keypad50
 Keys50
 KZ182

—L—

Label117, 118
 Language69
 LCD-Display182
 Login45
 Logoff45
 logon45
 Logout45
 Lubrication Interval
 clear68
 Lubrication Intervals68

—M—

Macros78
 copy78
 delete78
 highlight78
 load from disk79
 shift78
 store on disk79
 Manual52
 Manual Functions
 Belt56
 Grippers56
 Peripherals56
 Pneumatic Axes56
 Vacuums56
 Manual Functions55
 Numerical Axes55
 numerical B-Axis55
 Master38, 182
 Menu50, 60
 Alarms61
 Axispositions61
 Command Buffer65
 Counters63
 Depositing Counters64
 DIAS Diagnosis66
 Error Buffer65
 Errors61
 File81
 Info61
 Init67

INIT in Teachmode.....86
 Inputs62
 Lubrication Intervals.....68
 Operating Data.....62
 Operating Systems.....66
 Outputs63
 Print.....74
 Program info64
 Setup.....69
 Stopwatch64
 Stroke Limits67
 Menu Functions.....60
 Monitoring
 Safety Gate149
 More51
 MS-DOS182

—N—

No reference.....52
 Numeric keypad50
 Numerical Axes
 Manual Functions.....55

—O—

Offline.....41, 86, 182
 Offline-Teaching76
 Online.....41, 86, 182
 Online Conversion.....76
 Online with CPU41
 Online-Teaching76
 Operating Data.....62
 Operating mode
 Reference53
 Operating Modes.....52
 Operating Systems.....66
 OR.....124
 Outputs.....63
 Override.....59, 182

—P—

PA182
 Parallel from95
 Parallel Motion.....94
 Parallel-Motion
 additional axes A, B, C.....94
 Asynchronous95
 Partial programs75
 Passwords.....43
 activate.....44
 deactivate.....44
 PE182
 Peripheral programs75
 Peripherals
 Manual Functions.....56
 Peripherals, monitoring.....105
 Peripherie-Outputs105
 Permit keys.....50
 PI Names.....87
 Piece counters.....129
 Placing counters129
 Placing Counters
 clear57
 Placing Program
 3-D114, 116
 Approach.....114

Axis Sequence.....114
 Box Height116
 clear counters129
 Clear in Manual and Reference Modes
 create.....113
 discard113
 edit.....113
 finish definition.....113
 First Placing Position114
 Name114
 Parameters114
 Placing Order.....114
 Placing Pattern115
 rename113
 reset.....129
 Settings.....114
 store.....113
 Placing Programs.....112
 Pneumatic Axes
 Manual Functions56
 PO in Editor on/off.....70
 PO Names87
 Position control182
 Positions90
 define.....91
 edit.....91
 rename91
 Print74
 Printer70
 Program ALL MODES
 Start/Stop.....71
 Program ALL MODES.....126
 Program Branching123
 Program info64

—R—

R3D.....101
 Reference52, 53
 Reference programs75
 Reference travel.....53
 Axes sequence53
 Reference travel in operating mode "Manual"
 53
 Reference travel in operating mode "No
 Reference".....53
 Relative Motion93
 REM.....129
 Remarks.....129
 RET122
 Robot39, 182
 Robot Axes36

—S—

Safety Gate Monitoring149
 Safety System
 Automatic, Step, Reference Travel148
 Description.....148
 Start Up148
 Screen.....49
 Selection of Operating Modes
 Automatic, Step, Reference148
 Manual Setup Mode.....148
 Selection of Operating Modes.....148
 Service Signal70
 Settings in Teachmode86
 Setup69

Brightness 69
 Clear counters 70
 Date 69
 Display 69
 Language 69
 PO in Editor on 70
 Printer 70
 Service Signal 70
 Step Speed 71
 Time 69
 SGM 182
 Shift 50
 Signals to the Injection Molding Machine
 (IMM) 109
 Softkey 182
 Softkeyline 182
 Softkeys 50, 77
 speed 59, 99
 Standard reference travel 54
 Startup 40
 Step Operation in Block Stop Mode 85
 Step Operation in Reference and Manual
 Modes 85
 Step Speed 71
 Stop-Function 96
 Stopwatch 64, 131
 Stroke Limits 67
 Sub 51
 SUBR 122
 Subroutines 122
 Synchron 94

—T—

T/M 182
 Taught Reference travel 54
 Teach Mode 182
 Teachbox 39, 49, 182
 Display 49
 Teaching 182
 Teachmode 75
 Axes 93
 call 77
 Counter Names 86
 Cylinders 88
 Display 77
 enter 77
 exit the editor 83
 Gripper Reference Positions 92
 INIT-Menu 86
 Online / Offline 86
 PI Names 87
 PO Names 87
 Positions 90

Settings 86
 Vacuum Referencing 92
 Teachprogram
 load from CPU 82
 Load from Disk 72
 Name 82
 new 81
 print 74
 Storing to Disk 73
 transfer to CPU 83
 Teachprogramm
 clear 81
 Teachprogramm 182
 Texteditor 77
 Time 51, 69
 TIME 112
 Time Function 112
 Trigger 118

—U—

User
 change 46
 create 46
 delete 46
 logoff 45
 logon 45
 new 46
 User Management
 deactivate 44
 User Management 43
 activate 44
 User profiles 47

—V—

V3D 101
 Vabs 99
 Vacuum 51
 monitoring 104
 Vacuum Referencing 92
 Vacuum, monitoring 105
 Vacuums 104
 Manual Functions 56
 vmax 59
 Vmax 99

—W—

WAIT 125
 WAIT BAHNSYNC 100
 WAIT Function 125
 WAIT SYNC 100