Wadkin LEICESTER

CC2000

COMPACT / COMPACT-XL

COMPUTER-CONTROLLED ROUTERS

INSTRUCTION MANUAL No. 5005

MANUFACTURERS E.C. DECLARATION OF CONFORMITY

The following machine has undergone "Conformity Assessment" and is "self" certificated in accordance with:-

Supply of Machinery (Safety) Regulations 1992
and Amendment No. 2063

COMPANY

WADKIN PLC
Green Lane Road
Leicester LE5 4PF

RESPONSIBLE PERSON

Mr R T Perks (Managing Director)

MACHINE DESCRIPTION

TYPE   COMPUTER   CONTROLLED   ROUTER

MODEL   CC 2000

DIRECTIVES COMPLIED WITH

Supply of Machinery (Safety) Regulations 1992
Amendment No. 2063 1994
Draught Proposal CEN/TC 142
ISO 9001 Part 1

SIGNED ON BEHALF OF WADKIN PLC

....

MAINTENANCE & OPERATING INSTRUCTIONS

FOR WADKIN CC 2000 'COMPACT'

COMPUTERISED NUMERICALLY CONTROLLED ROUTER

WITH BOSCH CC 120 CONTROL

Whilst every effort has been made to ensure that the information contained in this publication is accurate and up-to-date, Wadkin PLC cannot accept any responsibility for any damage that may be caused as a result of omissions or errors contained herein.

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SECTION 1

HEALTH & SAFETY INFORMATION

07/91

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+----------------------------------------+
|                                        |
|             BE CAREFUL                 |
|                                        |
|     THIS MACHINE CAN BE DANGEROUS      |
|         IF IMPROPERLY USED             |
|                                        |
|          Always Use Guards             |
|   Keep Clear Until Rotation Has Ceased |
|                                        |
|    Always Operate As Instructed And    |
|    In Accordance With Good Practice    |
|                                        |
|        Read Instruction Manual         |
|                                        |
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_____ : PLEASE INSERT MACHINE TYPE AND SERIAL NO.

_____ : BOOK NUMBER AND DATE OF ISSUE.

For Replacement Parts, Tools & Accessories
Contact:

WADKIN COLNE
DIVISION OF WADKIN PLC.
LODGEHOLME, TRAWDEN
NR. COLNE, LANCASHIRE
BB8 8RB, ENGLAND
A MEMBER OF THE THOS. ROBINSON GROUP PLC.

Telephone: Colne (0282) 866717

Telex: 635032 (BURCOL G)

Fax: 0282 862541

1.1 **WARNING**

Ensure that you fully understand the manufacturer's instruction manual and have received sufficient training in the use of this machine and the particular safety precautions to be observed.

Persons under the age of 18 years should not operate this machine except under supervision during a course of training.

BEFORE OPERATING THIS MACHINE ENSURE THAT;

All guards and fences are securely fitted and correctly set in accordance with the current Regulations.

Tooling is of correct type, securely fastened, sharp and direction of rotation is appropriate.

Please do not run cutters above manufacturers recommended spindle speeds. If you are unsure check with the manufacturer.

Correct spindle speed and feed is selected for the cutter equipment.

Loose clothing is either removed or fastened and jewellery removed.

Suitable jigs and push sticks are available for use where appropriate.

The working area is well lit, clean and unobstructed.

Extraction equipment is switched on, properly adjusted and working efficiently.

Suitable protective equipment is available, eg. goggles, ear defenders and dust mask.

WHEN SETTING, CLEANING AND MAINTAINING THIS MACHINE;

Ensure all moving parts of the machine are stationary before setting, cleaning or making adjustments.

Report immediately to a person in authority any machine malfunction or operator hazard. Do not attempt to repair the machine unless competent to do so.

Ensure all power sources are isolated before any maintenance work commences.

1.2 HEALTH AND SAFETY ADVICE

This machine is designed and constructed to the principles of safeguarding and practical guidance contained in the British Standard Codes of Practice BS 5304:1988 'Safeguarding of Machinery', BS 6854:1987 'Safeguarding Woodworking Machines' and current guidance issued by the Health and Safety Executive.

The Health and Safety at Work etc. Act 1974 places duties on designers, manufacturers and suppliers to ensure that among other things: 1. articles supplied for use at work are, so far as is reasonably practicable, safe and without risks to health during setting, use, cleaning and maintenance and 2. persons supplied with the articles are provided with adequate information about the use for which they are designed and about conditions necessary to ensure that they will be safe and without risks to health.

These duties will apply to you if you re-supply the machine by way of sale, lease, hire or hire purchase.

Persons who install this machine for use at work have a duty under the Health and Safety at Work etc. Act 1974 to ensure, so far as is reasonably practicable, that nothing about the way in which it is installed makes it unsafe or a risk to health at all times during setting, use, cleaning and maintenance, this includes such aspects as correct assembly, electrical installation, construction of enclosures, fitting of guards and exhaust ventilating equipment. When installing this machine, consideration must be given to the provision of adequate lighting and working space.

This machine is supplied complete with all necessary safeguards to enable the user to comply with Woodworking Machine Regulations 1974. Details of correct installation and use, together with guidance on fitting and proper adjustment of guards are described in the Maintenance Manual.

The Woodworking Machine Regulations place absolute legal duty on employers and employees to ensure that guards and any other safety devices are securely fitted, correctly adjusted and properly maintained.

Repairs and maintenance must only be undertaken by competent technicians. Ensure that all power supplies are isolated before maintenance work commences. Instructions for routine maintenance are included in the Maintenance Manual.

Machine operators must have received sufficient training and instructions as to the dangers arising in connection with the machine, the precautions to be observed and the requirements of the Woodworking Machines Regulations which apply, except where they work under the adequate supervision of a person who has a thorough knowledge and experience of the machine and the required safeguards.

Persons under the age of eighteen years must have successfully completed an approved course of training before operating this machine at work, unless participating in a course of training under adequate supervision. (NB:-This paragraph is only relevant to: circular sawing machines, any sawing machine fitted with a circular blade, any planing machines for surfacing which is not mechanically fed or any vertical spindle moulding machine, including routers.

Before commencing work, ensure that the tooling is set to cut in the correct direction, securely fastened, sharp and is compatible with the machine and spindle speed.

1.2.1 DUST

Wood dust can be harmful to health by inhalation and skin contact and concentrations of small dust particles in the air can form an explosive mixture. These concentrations usually occur in dust extraction equipment which may be destroyed unless explosion precautions have been taken in the design and installation of the equipment.

Employers have duties under the Factories Act 1961, The Health and Safety at Work etc. Act 1974 and the Control of Substances Hazardous to Health Regulations 1988 to control wood dust in the workplace.

Employers should carry out an adequate assessment of the possible risks to health associated with wood dust to enable a valid decision to be made about the measures necessary to control the dust. It may be necessary to provide effective exhaust appliances.

Prevention or control of wood dust exposure should, so far as is reasonably practicable, be achieved by measures OTHER than the provision of personal protective equipment.

Further information and references to practical guidance are contained in free leaflets available from the Health and Safety Executive.

1.2.2 NOISE

Noise levels can vary widely from machine to machine depending on conditions of use. Persons exposed to high noise levels, even for a short time, may experience temporary partial hearing loss and continuous exposure to a high level can result in permanent hearing damage.

The Woodworking Machine Regulations require employers to take reasonable practicable measures to reduce noise levels where any person is likely to be exposed to a continuous equivalent noise level of 90 dB(A), or more, over an 8 hour working day. Additionally, suitable ear protectors must be provided, maintained and worn.

Machines identified as generating unhealthy noise levels should be appropriately marked with a warning of the need to wear hearing protection and it may be necessary to designate particular areas of the workplace as 'Ear protection zones'. Suitable warning signs are specified in the Safety Signs Regulations 1980. It may be necessary to construct a suitable noise enclosure, in which case professional advice should be sought.

Further information and references to practical guidance are contained in free leaflets available from the Health and Safety Executive.

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1.3 DEALING WITH CHIPS AND DUST

This machine has been designed, taking into account the latest state of the art, and to the greatest extent which is reasonably practicable, to provide for the removal of chips and dust produced during its use.

The employer's attention is drawn to:

THE CONTROL OF SUBSTANCES HAZARDOUS TO HEALTH REGULATIONS 1988

The levels of dust emitted by a woodworking machine depends upon many factors including:

Type of operation   eg. sawing, planing, sanding
Feed speed
Material removal
Workpiece   eg. solid wood, MDF, chipboard
Moisture content

The control limit of 5 mg/cubic metre has been adopted as the exposure level for hardwood dust, the recommended exposure limit for softwood dust is also 5 mg/cubic metre.

Trade associations should be able to give advice on who can carry out the necessary tests. (Wadkin may also be able to furnish this information.)

The recommended air velocity at the extraction connection point is:

18.6 M/sec — at each head

Under certain circumstances Wadkin will be able to provide information on expected emission levels, or may, given the exact specifications, determine the expected emission levels for a given machine performing on a given component.

Dust test performed on CNC Routers at Wadkin Colne show personal exposures (which are the most meaningful) of 1.4, 1.5 and 1.2 mg/m^3 for 3 woods —
Pine, MDF and Oak. These values are significantly below their relevant occupational or maximum exposure limits. (Full details of these tests can be provided by Wadkin Colne, if required.)

REFERENCES
1988 No. 1657 — The control of substances Hazardous
                Health Regulations 1988
                ISBN 0 11 087657 1   £3.00 HMSO
             — Wood Dust: Hazards and Precautions   HSE
             — Occupational Exposure limited
                ISBN 0 11 885411 9   HMSO

ASK, IF YOU REQUIRE ANY FURTHER INFORMATION.

1.4 NOISE AT WOODWORKING MACHINES

This machine has been designed, taking into account the latest state of the art, and to the greatest extent which is reasonably practicable, to reduce the noise emission to the lowest level.

A model of this machine has been tested in accordance with the draft European standard:

ISO/DIS 7960   AIRBORNE NOISE EMITTED BY MACHINE TOOLS
                OPERATING CONDITIONS FOR WOODWORKING MACHINES

Machine: UX/FLC/C3/2612 - CNC ROUTER

Tooling Details: ('LC'Head)
Spindle number: 1   2   3   4   5   6

Speed RPM   18,000 ....

Tool dia. (mm):..90.. ....

Cut depth (mm):..17.. ....

Workpiece: width   height   length

              350   *   20   *   500
              ....

Species/type: ....OAK.............

Moisture: ..../...............

Feed M/min: ..../.3000............

Note any other
special conditions: .... Vacuum clamping; not tandom
loading ....

Noise level at operator(s) position: ...... 86 dB (A)Leq ....

Noise level at noisiest position (state where)
if other than operator position: .... 90.5 dB (A) Leq ....

The employer's attention is drawn to:

THE NOISE AT WORK REGULATIONS 1989

Under these regulations, in certain circumstances, further action will need to be taken, eg the provision of ear protectors.

Wadkin will be pleased to help with further advice.

NOISE AT WOODWORKING MACHINES

This machine has been designed, taking into account the latest state of the art, and to the greatest extent which is reasonably practicable, to reduce the noise emission to the lowest level.

A model of this machine has been tested in accordance with the draft European standard:

ISO/DIS 7960   AIRBORNE NOISE EMITTED BY MACHINE TOOLS
                OPERATING CONDITIONS FOR WOODWORKING MACHINES

Machine: UX/FLC/C3/2612 - CNC ROUTER

Tooling Details: ('LC'Head)('F'Head)

Spindle number:	1	2	3	4	5	6
Speed RPM	18,000	24,000	......	......	......	......
Tool dia. (mm):	..30..	..30..	......	......	......	......
Cut depth (mm):	..25..	..25..	......	......	......	......

Workpiece:	width		height		length
	80	*	25	*	180
	....		....		....

Species/type: ....PINE..........

Moisture: ..../............

Feed M/min: ....3.5............

Note any other special conditions: .... Vacuum clamping; not tandom loading ...

Noise level at operator(s) position: ...... 87 dB (A) Leq ....

Noise level at noisiest position (state where) if other than operator position: .... 91.7 dB (A) Leq ....

The employer's attention is drawn to:

THE NOISE AT WORK REGULATIONS 1989

Under these regulations, in certain circumstances, further action will need to be taken, eg the provision of ear protectors.

Wadkin will be pleased to help with further advice.

NOISE AT WOODWORKING MACHINES

This machine has been designed, taking into account the latest state of the art, and to the greatest extent which is reasonably practicable, to reduce the noise emission to the lowest level.

A model of this machine has been tested in accordance with the draft European standard:

ISO/DIS 7960 · AIRBORNE NOISE EMITTED BY MACHINE TOOLS OPERATING CONDITIONS FOR WOODWORKING MACHINES

Machine: UX/FLC/C3/2612 – CNC ROUTER

Tooling Details: ('LC'Head) (Drill)
Spindle number: 1   2   3   4   5   6

Speed RP   18,000 3,000 ....

Tool dia. (mm): ..12. ..3.. ....

Cut depth (mm): ..18. ..15.. ....

Workpiece: width   height   length

                  200   *   18   *   400
                  ....

Species/type: .... MDF ....

Moisture: ..../.................

Feed M/min: ....4.5.............

Note any other special conditions: .... Vacuum clamping; not tandom loading .....

Noise level at operator(s) position: .... 85 dB (A) Leq ....

Noise level at noisiest position (state where) if other than operator position: .... 86.3 dB (A) Leq ....

The employer's attention is drawn to:

THE NOISE AT WORK REGULATIONS 1989

Under these regulations, in certain circumstances, further action will need to be taken, eg the provision of ear protectors.

Wadkin will be pleased to help with further advice.

MACHINE SPECIFICATION

BASIC MACHINE - CC 2000 COMPACT-XL

LONGITUDINAL TRAVERSE	(X AXIS)	1275 MM	(50 IN)
LATERAL TRAVERSE	(Y AXIS)	620 MM	(24.5 IN)
VERTICAL TRAVERSE	(Z AXIS)	275 MM	(7 IN)
TABLE AREA		1350 X 700 MM	(53 X 27.5 IN)
TABLE HEIGHT		920 MM	(36 IN)
SPINDLE NOSE TO TABLE	MAXIMUM	300 MM	(8 IN)
	MINIMUM	25 MM	(1 IN)
TABLE FEEDRATE	(X AND Y)	0 - 10 M/MIN	(400 IN/MIN)
TABLE RAPID FEEDRATE	(X AND Y)	12 M/MIN	(475 IN/MIN)
HEAD FEEDRATE	(Z AXIS)	0 - 5 M/MIN	(200 IN/MIN)
HEAD RAPED TRAVERSE	(Z AXIS)	6 M/MIN	(236 IN/MIN)
REPEATABILITY		0.5 MM	(0.002 IN)
FLOOR SPACE		2080 X 2315 MM	(82 X 92 IN)

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SECTION 2

SPECIFICATION

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MACHINE SPECIFICATION

BASIC MACHINE – CC2000 'COMPACT'

LONGITUDINAL TRAVEL	(X AXIS)	920 MM	(36	IN)
LATERAL TRAVERSE	(Y AXIS)	620 MM	(24.5	IN)
VERTICAL TRAVERSE	(Z AIXS)	175 MM	(7	IN)
TABLE AREA		1000x700 MM	(39x27.5	IN)
TABLE HEIGHT		920 MM	(36	IN)
SPINDLE TO NOSE TO TABLE	MAXIMUM	200 MM	(8	IN)
	MINIMUM	25 MM	(1	IN)
TABLE FEEDRATE	(X and Y)	0-10 M/MIN	(400	IN/MIN)
TABLE RAPID FEEDRATE	(X and Y)	12 M/MIN	(475	IN/MIN)
HEAD FEEDRATE	(Z AXIS)	0-5 M/MIN	(200	IN/MIN)
HEAD RAPID TRAVERSE	(Z AXIS)	6 M/MIN	(236	IN/MIN)
REPEATABILITY		0.5 MM	(0.002	IN)
FLOOR SPACE		2080mm x 2315 MM	(82 x 92	IN)

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HEAD DETAILS

COLUMBO HEAD

TYPE   12 HP

SPINDLE SPEE DS   INFINITELY VARIABLE   1500 - 18000 RPM

SPINDLE POWER   9 KW (12 HP)

SPINDLE TAPER   ISO 30

LUBRICATION   GREASED FOR LIFE
                                            BOTH SPINDLE AND MOTOR

SECTION 3

DESCRIPTION

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INTRODUCTION

The Wadkin CC 2000 routing machine is designed for accurate, high speed continuous contouring operations on wood, plastics, metals and numerous other materials. The machine operates under Computerised Numerical Control (CNC) giving optimum performance with a high level of reliability.

The machine comprises of a robust base unit, which supports the headslide and high speed router head. The machine table/saddle assembly is mounted on a separate base unit rigidly attached to the main base. the table has two axes of movement; front to rear -Y axis, and left to right -X axis.

The head is moved up and down by the Z axis.

The main components of the machine are more fully described overleaf.

MACHINE BASE

The main base is a heavy rigid fabrication which supports the table, carries the head, carries the electrics and pneumatic equipment and bolts to the machine foundation.

'X' AXIS ASSEMBLY

This consists of the axis slideway and ballscrew and servo drive assemblies bolted to the machine base.

'Y' AXIS SADDLE

This assembly consists of the axis slideway, ballscrew and servo drive assemblies and is carried by the X axis bearings.

'Z' AXIS ASSEMBLY

The headslide is mounted onto the front face of the main base upper extension. The assembly consists of the axis slideway, ballscrew and servo drive which provides the power for the head vertical movement. This slide also carries auxilliary slides for drill heads.

COLUMBO HEAD

The head is driven by a static inverter which provides infinitely variable speeds of 1500 - 18000 rpm at the spindle.

The spindle bore is Machine Tool Standard ISO 30. Tools are released by a hydraulic cylinder, either from manual rapid tool-change or with the automtic tool-change within the program.

The motor is cooled by

SLIDEWAYS

All three axes are supported on linear bars which are hardened and precision ground. The moving part rides on these bars via two pairs of anti-friction re-circulating ball bushings.

TABLE SUPPORT CASTING

The table comprises of an aluminium casting which is ground to accept the main table option. There is a trough around the perimeter of the table to collect lubricant when used for machining non-ferrous metals.

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VACUUM TABLE

The vacuum pump provides suction for component clamping. The vacuum table is constructed of high molecular weight polyethylene and the machined in a matrix pattern with a pitch of 30 mm.
The vacuum system is controlled by means of push buttons on the pendant control panel. When clamping is selected, a vacuum sensing switch inhibits axis movement until sufficient vacuum is generated to hold the component securely in place. Control panel lamps indicate the current state of the system. Feedhold is forced when vacuum pressure is insufficient.

The upper surface of the table has pattern of grooves in to which a rubber sealing strip may be fitted to provide an efficient seal between the table and component. Removable stops or fences can be used. Also vacuum cups are available.

VACUUM CUPS

These are used to minimise the number of fixtures required for parts with a reasonable surface area, for clamping by vacuum to the vacuum table. They fit into the matrix on the vacuum table and come in various sizes and heights.

Because the part is raised from the table when these are used, undercut tools and drills or any tool which has to go lower than the underside of the component, can be used without damage to the vacuum table.

AXIS DRIVES

The X, Y and Z axes are driven in a similar manner, by a pre-loaded precision ground re-circulating ballscrew. Each ballscrew is driven by a D.C. Servo motor under full control of the CNC system. A ballnut connected to the axis, moves the axis linearly along its slideways as the ballscrew rotates.

PNEUMATIC SYSTEM

The mains air connection is located at the left hand side of the machine and connects to the mains air valve. A regulator is provided and pressure should be adjusted to 80 P.S.I. (factory set).

Incorporated in the regulator is a water trap with automatic draining when the air is turned off. Air then passes through a lubricator unit to provide oil lubrication for the valves and cylinders used throughout the system.

Pneumatics are used to control the vacuum on/off valve, for the drill heads and for raising and lowering the heads in the case of twin head machines.

Pneumatic clamps can also be connected into the system by the customer, and when used with the 'M' code extension options an automatic system can be realised.

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ELECTRICAL

The machine's electrical equipment comprises of the CNC system, axis servo drive units, router motors and inverter and associated power supplies, relays and contactors. Control of such relays and contactors is interfaced between the built in PLC via a printed circuit board with plug in connections and has LED indicators to show the current state of each output. This is an important aid to trouble shooting.

The power supply units, axis servo drive unit, fuses and control relays are mounted in the electrical cabinet attached to the rear of the main base.

The electrical cabinet has acrylic windows so that the output LED's and contactors can be seen without opening the doors.

WARNING   **ALWAYS ISOLATE THE MACHINE BEFORE GOING INSIDE THE ELECTRICAL CABINET.**

The electrical circuit diagrams for the machine are included in this manual in Section ___

'M' CODE EXTENSION PACKAGE

Six sockets are provided to enable the customre to interface other equipment to the machine.

These are programmable 'on' or 'off' by 'M' codes.

110 AC 0.5 amp for controlling an external relay.

Typical uses: pneumatic clamps, retractable stops, on/off
                intialise, conveyor or handling equipment etc.

SINGLE DRILL HEAD

A single drill head is fitted enabling components to be drilled as well as profiled within the same cycle. See chuck for maximum shank diameter.

Drill rotation is pre-set 3000 rpm.

The drill unit is a self feed type but is controlled by the CNC system allowing precise control of the depth of hole. Drilling cycles are contained with the CNC system, also cylces are available for drilling patterns ie. P.C.D. drilling and hole row and matrix patterns with variable parameters.

The drill are lowered to position by an 'M' code, but are fed into the workpiece by the 'Z' axis. The drill head is retractable by an 'M' code after all the desired holes have been drilled.

EDIT ALLOW KEY SWITCH

With the key switch in the vertical position ie. 'off' and the key removed, the programs and cycles are protected from being modified by an unauthorised person. With the key inserted, and turned to the horizontal position ie. 'on', programs and cycles can be modified.

AXIS ALLOW KEY SWITCH

With the key switch in the vertical position ie. 'off' and the key removed, the X and Y axes will not be allowed to move if one or both heads are down and there is no spindle rotation, this is to protect the cutter from being broken. With the key inserted and turned to the horizontal position ie. 'on', the X and Y axes are allowed to move with the heads down and no spindle rotation.

WARNING this key switch is for setting up pruposes only, ie. 'Teach-In' and the machine is not to be run in Auto cycle with the key in the horizontal position, as damage to machine and/or personnel can occur.

SECTION 4

INSTALLATION

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INTRODUCTION

It is normal practice for the customer to prepare the machine site, position the machine and provide the required electrical and air supplies. A foundation plan for the machine is provided well in advance of the machine delivery.

Normally, the machine will be delivered in an almost fully assembled and pre-aligned state. However, certain items forming part of the machine will have been disconnected and stored separately to simplify transit. Tyically, the general state of the machine when delivered, will be as follows:-

(i)   The table will be centralled positioned.

(ii)   A tooling pack will normally be brought by the demonstrator.

The customer should contact Wadkin Colne on 0282 866 717 or in the case of machines outside Great Britain, the local distributor or Wadkin office, when the machine is in position with all services connected, to arrange for a commissioning to take place. This involves a demonstrator to final level the machine and check opertion and alignments. This normally takes up to half a day, this will then be followed by two days on site.training. The above service is carried out free of charge for new machines. Further training can be arranged with prior notice and will be charged on an hourly basis.

FOUNDATION

(Refer to foundation plan)

The machine should be sited on a solid concrete floor at least 150 mm thick. The positions of the rawbolt holes and jacking points are given on the foundtion drawing specific to the particular machine.

LIFTING AND POSITIONING

To lift the machine use suitable slings, using the lifting points (shown on page 4/2 of this manual).

Locate the machine over the foundation bolt holes and gently lower the machine into position and onto the floor plates provided. Remove the lifting bars and chains. Check that the machine is approximately level ensuring that the jacking screws are not fully tightened down so that further adjustment can be made when re-assembly is completed.

Ensure machine is placed on levelling plates, (supplied).

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FRONT VIEW

LIFTING POINT

PLAN VIEW

LIFTING POINT

LIFTING POINT

- 4 / 2 -

SIDE VIEW

LIFTING POINT

LIFTING POINTS FOR THE CC 2000
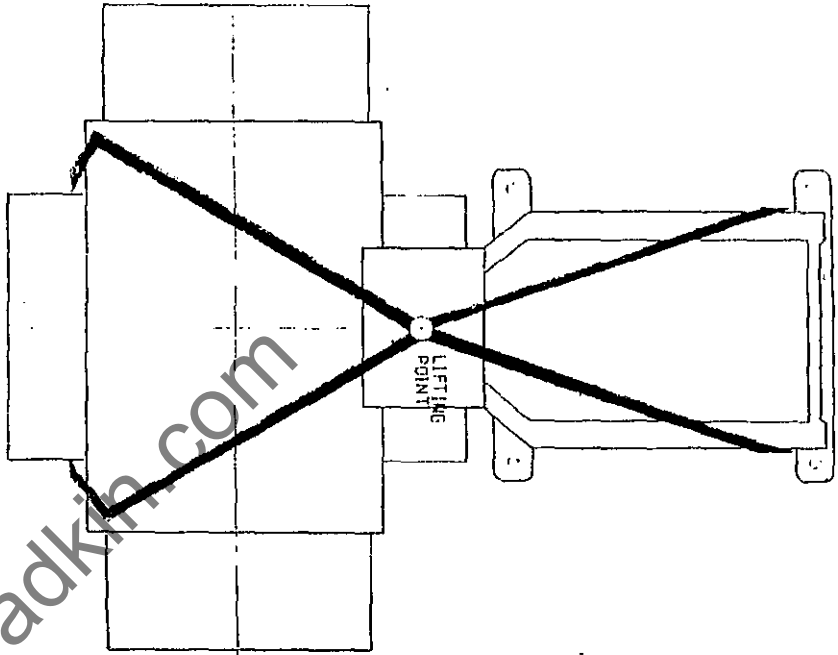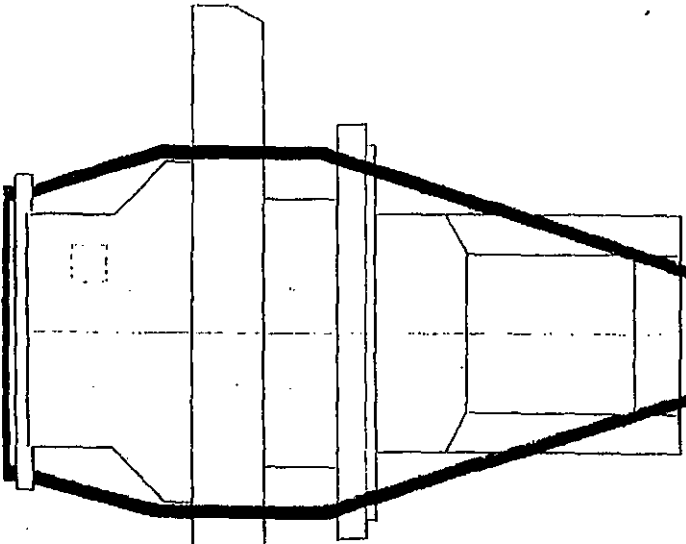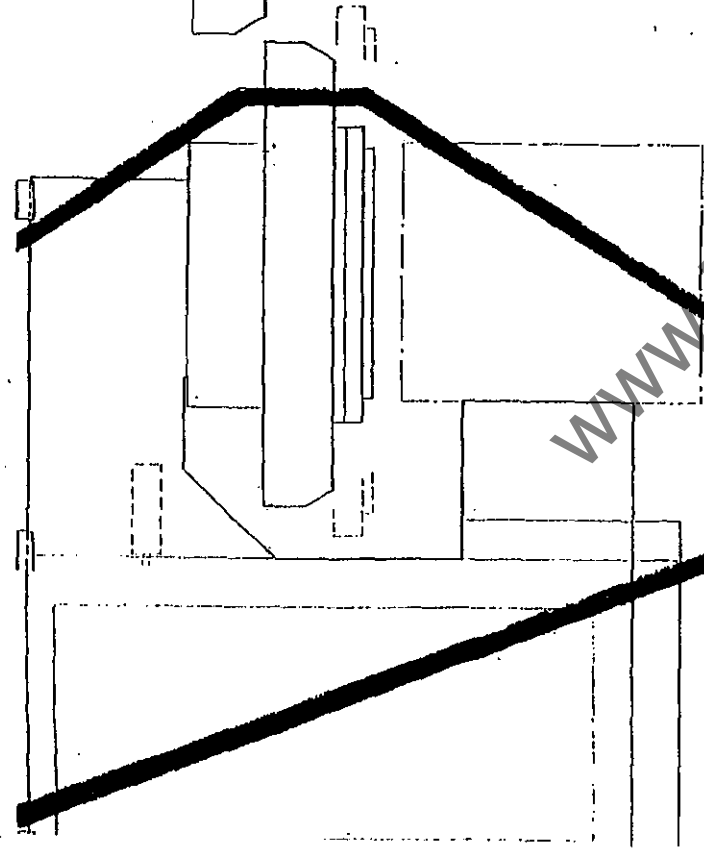
EXTRACTION

COLUMBO HEAD   (each) Air volume 850^{3}M/Hr (500 cfm) at 254 mm (10") water gauge required at extraction point.

PNEUMATICS

COLUMBO HEAD   Compressor to give 0.56 M^3 (5.3 cubic feet) free air per minute at 7 bar (100 psi).

DRILL HEAD   Approximately 0.538 M^3 (19 cubic feet) free air per minute at 5.3 bar (80 psi) lubricated air.

Maximum demand intermittently from other equipment ie. cylinder etc approximately 0.114 m3/min (4 cubic feet) at 5.3 bar (80 psi).

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SECTION 5

OPERATION

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OPERATION

INTRODUCTION

The operating instructions given in the manual are intended as a general guide for machine operators. Specific instructions for particular workpieces should be given on the operator's worksheet normally provided with each machining program. Reference should also by made to the Bosch CC 100 User Handbook for further details of system control and operating procedures.

In accordance with good workshop practice it is important that the machine, particularly the worktable and spindle, is kept clean and free from dust and chippings. Planned preventive maintenacne is also important, in that it enables the necessary short periods of downtime to be predicted, and helps avoid the possibility of a major breakdown.

Simple daily maintenance procedures may be carried out by the operator at a convenient time (beginning and end of shift). Details of these and other maintenance procedures are given in the Maintenance manual.

This manual will cross reference to the Bosch User Handbook where appropriate, but will duplicate information where considered necessary for the convenience of the reader.

The machine is operated from a pendant arm control panel.

It should be noted that some of the options described may not be applicable to your machine.

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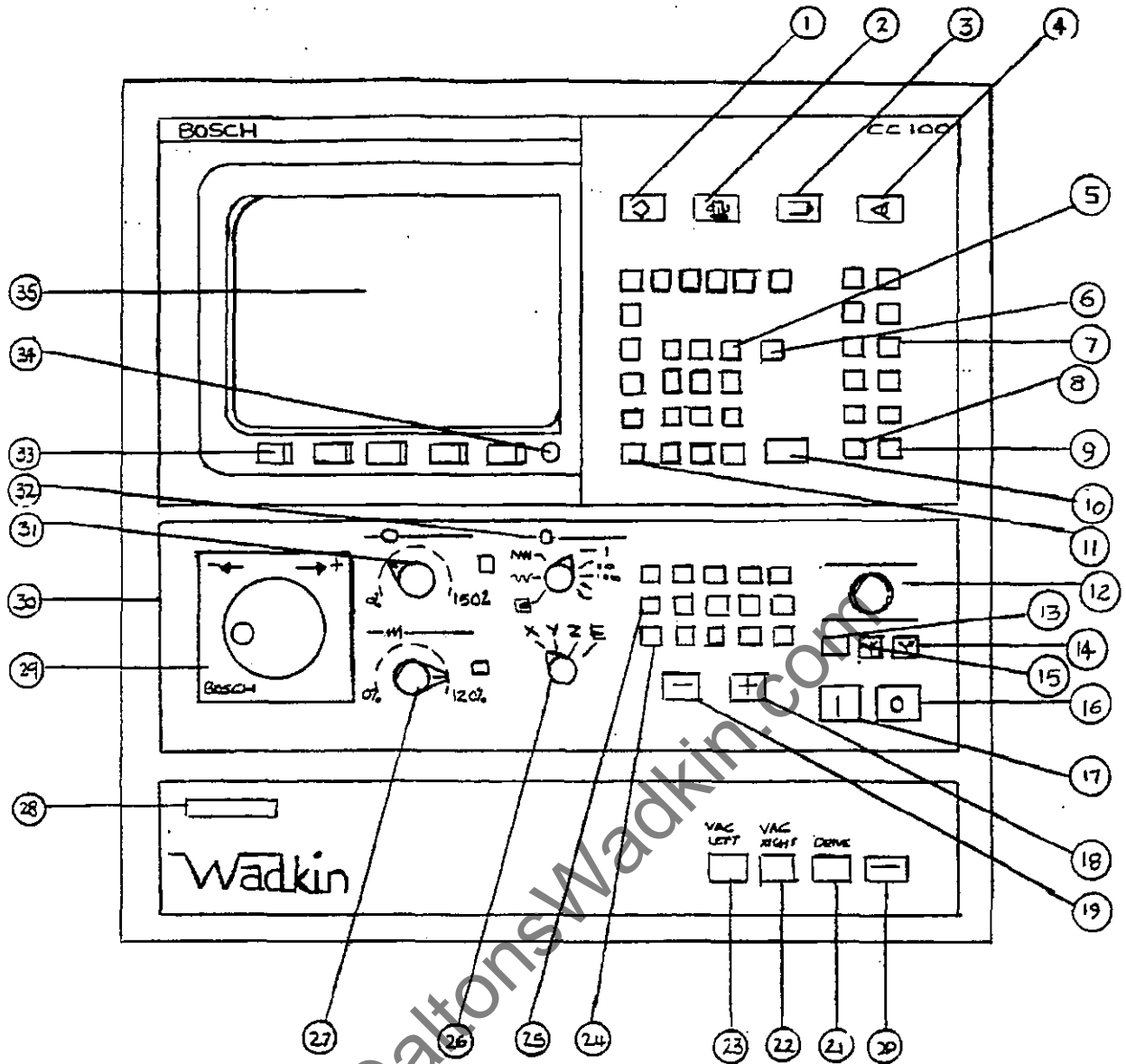
CONTROL PANEL

KEY

1. Memory Mode
2. Machine Mode
3. Automatic Mode
4. Information Mode
5. Numeric Pad
6. Delete Key
7. Address keys (A-Z)
8. Shift Key
9. Space Key
10. Enter Key
11. CPC Key
12. Emergency Stop
13. Distance To Go Button
14. Interuption Key
15. Re-entry Key
16. Cycle Stop
17. Cycle Start

18. Jog + Button
19. Jog - Button
20. Edit Allow Key Switch
21. Drives On Indicator
22. Vacuum Pump Right On Indicator
23. Vacuum Clamp Left On Indicator
24. MTB Buttons (operations vary)
25. Function Keys (F1-F10)
26. Axis Selector
27. Feed speed override Key
28. RS232 Interface (25 Pin 'D')
29. Handwheel
30. Manual Panel
31. Spindle Speed Override Key
32. Jog Selector
33. Soft Keys (5 off)
34. Page Back Button
35. Visual Display Unit (VDU)

CONTROL PANEL

The following are located on the Control Panel:-

V.D.U.
The V.D.U. (Visual display unit) or C.R.T (Cathode Ray Tube) is used to display information relevant to the currently selected operating mode, eg. tool offsets, program index, machine information page etc.

AXIS DISPLAY
The positions of all axes are displayed on the V.D.U. whilst in either Machine mode or Automatic mode. The readings on the screen are in respect to the active zero point, be it machine zero or component/fixture zero.

MODE KEYS
The mode keys are used to select the first page of each mode. These are Memory, Machine, Automatic, and Information.

SOFT KEYS
These are located on the lower part of the V.D.U. The operation performed by these keys is determined by software. A menu appears at the foot of the V.D.U. after a key is pressed a new menu appears on the screen. All the operator has to do is read the screen which is referred to as a page.

PAGE BACK
This allows a reverse of the above ie. the previous page can be displayed by pressing this key. In order to change from one mode to another it is necessary to page back to the first page of the selected mode.

NUMERIC KEYPAD
Used for entering numeric data into the control.

ADDRESS KEYS
All the addresses used by the program have their own key eg. 'F' for feedrate, 'M' for M-codes, X, Y, Z and E axes etc. These keys can also be used for typing in remarks into the program for the operator or the program name. Note:- remarks must be in a separate block and enclosed by brackets.

SHIFT KEY
This is used for access to the upper case letter on the ten address keys on the right hand side of the panel. Press the key once, release then press the required address key, the control returns to lower case after the key has been pressed, if another upper case letter is required repeat above. All the letters of the alphabet can be used.

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C.P.C. KEY	CUSTOMER PARAMETRIC CYCLE - Operates as above, but is used for access to the parametric functions most of these are the upper case on the numeric keypad although some are on the address keys.
ENTER KEY	Used to transfer entered data into storage or initiates the entered block modification or deletion.
CYCLE START	Operation of this pushbutton starts the cycle of the selected program in Automatic mode or initiates the machine to traverse to reference when in Machine mode or activates instructions for direct execution in M.D.I.
CYCLE STOP (Feedhold)	Causes the selected program or instruction to stop and the axes to stop. Pressing the cycle start button again will allow the program to continue.
CLEAR ENTRY (Delete)	Located on the numeric keypad this key deletes one character to the left of the cursor each time the key is pressed.

MANUAL PANEL

The manual sub-panel contains the axis movement controls used in the Machine mode and Teach-in option.

HANDWHEEL	Turning the handwheel in the + or - direction moves the selected axis accordingly, the jog selector switch must be on handwheel for this to operate.
AXIS SELECTOR	Allows the movement to be carried out by the selected axis X, Y, Z and E. When the handwheel is truned or one of the jog buttons is depressed.
JOG SELECTOR	Selects handwheel, low jog, rapid jog or incremental jog, axes moves the number of increments selected each time the jog button is depressed.
JOG + / JOG -	The selected axis moves in the appropriate direction whilst jog + or - is held depressed, movement ceases when button is released. This applies to low jog and rapid jog.
FEEDRATE OVERRIDE	Allows the programmed feedrate to be overridden and adjusted between 0 - 120%.
SPINDLE OVERRIDE	Allows the programmed spindle speed to be overridden and adjusted between 50 - 150%.

SPINDLE OVERRIDE	This allows the programmed spindle speed to be overridden and adjusted between 50-150%.
FUNCTION KEYS	F1 - F10 these vary from machine to machine and can be defined by the customer by programming 'M' codes in cycle 78 (MTB Buttons).
MTB KEYS	These are located below the function keys and are from right to left; vacuum pump on, vacuum pump off, vacuum table on, vacuum table off, drives on/off. The operation of these keys may vary from above definitions, in which case additional information will be supplied.
EDIT ALLOW	This keyswitch is provided to enable the programmer to protect from unauthorised tampering. Operating and running of programs is unaffected but alterations to anything stored in the memory is not possible with the key off.
VACUUM OK. LIGHT	This gives visual indication that the pressure threshold of the vacuum system has been reached. Note this threshold can be adjusted for different materials.
DRIVES ON INDICATIOR	Illuminates to show that the servo drives are switched on. Should a servo fault occur, the axes drives would be switched off automatically.
SERIAL INTERFACE (V24 RS232)	This is a 25 pin 'D' connector (known as Port 1) provided for connection to pheripheral devices ie. mini-cassette, computer etc. For direct connection to a computer a second interface connector is provided in the electrical cabinet (known as Port 2).
EMERGENCY STOP	Operation of this pushbutton switches off the machine. The heads are stopped, but remain in position, the vacuum pumps and clamping will remain on.

MODE KEYS

The following is an outline of the available selections and different pages available for the four different modes. For a more comprehensive explanation see the Bosch CC 100-M User Handbook. Most displayed options are self explanatory.

MEMORY MODE

5 OPTIONS:-

TOOLS   Allows editing of the tool length and
                         radius parameters (T1 - T48), and saving or
                         loading to a pheripheral device.

ZERO SHIFTS   Allows offsets for zero positions in X, Y,
                         Z, and E to be programmed, and saving or
                         loading to a pheripheral device.

VARIABLES   Allows editing of variable table and saving
                         and loading to a pheripheral device.

PROGRAMS   Allows editing of existing programs, entry
                         via keyboard of new programs, data input
                         and output to pheripheral device.

CYCLES   Allows editing of existing cycles, entry
                         via keyboard of a new cycle, data input and
                         output via pheripheral device.

NOTE:-   Cycles are similar to sub-routine. The
                         difference is that sub-routines must be
                         contained within relevant program files and
                         can only be used within the main program
                         file in which it is programmed.
                         A cycle, however, can be called up from any
                         main program file, by a 3 digit G-code, eg.
                         cycle 50 called by G850. Some cycles are
                         reserved and cannot be used, generally
                         these are cycles 20, 21, 22, 23, 78 and
                         79. See individual machine information for
                         exact reserved numbers.

MACHINE MODE

5 OPTIONS:-

REFERENCE AXES   Allows one or more axes to be driven to
                         their reference point.

REFERENCE CYCLE   Calls up cycle 79 which is defined by
                         Wadkin. This cycle will ensure that all
                         heads are in the up position and will
                         reference 'Z' first to avoid collision.

M.D.I.   Manual Data Input. Allows input of
                         instructions for direct execution by
                         pressing cycle start.

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TEACH-IN

Allows a program to be constructed by 'digitising' or 'teaching in'. The machine axes are positioned to each start and end point of straight lines or circles and the numerical data is stored and a program is constructed and stored in the control. On selection of 'teach-in' a file is opened called 'teach-in'. If this name already exists this program will be continued. If a new program is required the old 'teach-in' must be renamed, using rename. 'G' codes, 'M' codes and 'F' words etc can be entered via the keyboard and stored as a block by pressing the soft key 'Record', the axis or axes can now be moved to a position, pressing 'Record' stores the axis positions as a block. Note:- only the axes which have been moved will be stored, this is to save memory. If a circle is required select 'circle compute' the record soft key will now say 'record point1' press it once, it will then say 'record point 2'. Move the axes to any intermediate point along the arc and press the 'record' key, it will now say 'record point 3'. Move the axes to the end point of the arc and press 'record', the calculated block will now appear at the bottom of the screen with the necessary G2 or G3 code, this is decided by the control automatically depending on the direction of movement you have made). Press 'record' again to transfer the block into the program. If the next point is a circle press 'circle compute' and repeat the above. if the move is a straight line key in G1 and press 'record' and then move the axes to the end point and press 'record'. When the 'teach-in' is complete it can be edited in Memory mode and run in Automatic mode.

INCH/METRIC

Switches the measuring system from metric to inch or inch to metric.

AUTOMATIC

See CC 100-M User Handbook for explanation of options. After Automatic has been selected, a list of the programs in store is displayed on the screen. To select a program enter the required program number and then press enter. To run the program press cycle start.

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INFORMATION MODE

5 OPTIONS:-

MACHINE STATUS   5 more options

a) CC 100 STATUS   Shows list of active functions such as G-codes etc.
b) I/O STATUS   Shows condition of signals in main interface.
c) MESSAGE LIST   The last 10 internal errors and machine status messages are displayed.
d) AXES DISPLAY   Options for display of axes positions
e) PIC DISPLAY   Displays the current state of the machine interface and can be used for diagnosing faults in the electrical system.

SERVICE   5 more options

a) LOAD MACHINE PARAMETERS - Used to load parameters from a peripheral device.
b) LOG BOOK   The logbook is used to monitor the keys pressed by the operator. The number of key strokes stored, depends upon how much memory is assigned to the logbook (1 - 7K). The logbook can be useful in case of a fault occuring. It can be printed out and sometimes may determine why a particular problem arose.
c) SET CLOCK   Sets the time and date.
d) LOAD TEXT   Special cycles and graphics can be loaded.
e) MODE SELECTION   Do not change this setting.

MTB SERVICE   MACHINE TOOL BUILDER SERVICE, reserved for Wadkin Colne use only.

LINES SERVICE   2 more options

a) DRIP FEEDING   Uploading a mega long program, froma pheripheral device, into the control for direct running in automatic.
b) DNC SERVICE   Direct numerical control.

RESET DELETE   5 more options

a) DELETE TOOLS   Zeros the tool store
b) DELETE ZERO SHIFTS   Zeros the zero shift store
c) DELETE VARIABLES   Zeros the variable store
d) DELETE PROGRAMS   Deletes all programs, even ones with protection on.
e) CONTROL RESET   Resets the control to a model situation.

STARTING UP THE MACHINE

1. Close the main isolator, located at the back of the machine. The display will light up, automatically displaying Machine mode.

2. Ensure that the emergency stop button is reset.

3. Axis error is displayed, press cycle start, this will clear the error unless one or more of the axes is on an overtravel switch.

4. Press drives on/off button, (located bottom right of MTB buttons), hold for a second. The drives light will illuminate, and at the same time the inverter(s) will be activated. If axis error is still displayed, select low jog, select the axis which is on limit and jog off limit by using either the + or - key.

5. Before referencing make sure that all the axes are away from their switches, jog off if necessary.

6. Press the Reference Cycle softkey, and then press cycle start, the machine will drive to reference switches.

7. Press page back key to return to first page of Machine Mode.

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STARTING UP THE SPINDLE

Ensure the cutters are balanced before carrying out the instructions.

1. Ensure that the brake/spindle lock is in free position.

2. Ensure that the cutter is securely held.

3. Select Machine Mode.

4. Select M.D.I. (Manual Data Input)

5. Key in **M3 S**(plus the spindle speed you require to run at, note this value can only be four digits, ie. 18,000 rpm would be M3 S1800).

6. Press CYCLE START to activate the spindle speed.

7. Now select the head you wish to start, ie. M17 starts the left hand head or single router head, M18 starts the right hand router head. Press CYCLE START to activate the code.

A similar method for starting the head(s) is by having the able steps in the form of a program/cycle, Run in either Machine Mode or Automatic Mode.

EXAMPLE CYCLE TO RUN HAED ONE UPTO 24,000 rpm.

```
N 1    M3 S2400
N 2    G4 F1
N 3    M17
N 4    G4 F5
N 5    M2
```

Note:- G4 F, is a dwell for 'x' number of seconds.

STOPPING THE SPINDLE

There are three codes which will stop the heads.

1. M10 –   Stops heads
2. M5 –   Stops spindle
3. M3 S0 – Stops spindle

These codes can either be keyed in in MDI in Machine Mode and activated by pressing CYCLE START or they may be activated by using the Function keys (F1 – F10) on the Manual Panel if they set up to do so.

STARTING THE VACUUM PUMP

This can be done by programming M50 in the program, executing M50 in MDI and pressing cycle start, or by pressing the appropriate button on the Manual Panel function keys.

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TURNING ON THE VACUUM TABLE (CLAMP)

This can be done by programming M54 in the program, executing M54 in MDI and pressing cycle start, or by pressing the appropriate button on the Manual Panel function keys or in some cases buttons on the front of the machine table.

TURNING OFF THE VACUUM TABLE (UNCLAMP)

This can be done by programming M55 in the program, executing M55 in MDI and pressing cycle start, or by pressing the appropriate button on the Manual Panel function keys or in some cases buttons on the front of the machine table.

STOPPING THE VACUUM PUMP

This can be done by programming M51 in the program, executing M53 in MDI and pressing cycle start, or by pressing the appropriate button on the Manual Panel function keys.

SELECTING AND RUNNING A PROGRAM

Select the Automatic mode. A list of programs stored will be displayed along with a program number if the desired program is not displayed press the softkey 'next page' until the program appears (only necessary if you don't know the program number). Select the program number required to run and press enter.

Make sure the component is securely clamped, appropriate cutter compensation radius and tool length compensation value is entered in the correct tool store, and that the correct speed has been selected for the router heads.

Press the CYCLE START button to run the program, if this is the first run of a new tool length use the feedspeed override key to control the start of the program.

At any time during the cycle the feedhold button (CYCLE STOP) can be pressed to stop the axis movement.

SETTING A TOOL LENGTH (C3 MACHINE)

When a program has been written it will contain at least one tool number (eg. T01), which is used to activate the tool length compensation. Before the program can be executed a datum must be set for the tool/tools being used in the appropriate tool store number.

The following procedure must be followed for the tool length to be activated accurately.

1. Secure the desired tool(s) in the router/drill head(s).

2. Make sure the particular workpiece is vacuumed/clamped down.

3. If necessary lower the head/drill down on its pneumatic slide (this is done by the use of a 'M' code, see machine list)

4. Wind the head down, using the handwheel on the manual panel, until the tool is just touching the top of the workpiece.

5. On the screen will be a value for the tool length displayed as a Z axis reading.

6. To ensure that this is the correct figure, select M.D.I. and key in the following commands pressing cycle start after each:-

G53 T00
G92

The correct figure will now be displayed as all offsets have been cancelled.

7. Activate the following keys to store the tool length value:-

a) Page out once, (green round key)
b) Memory mode
c) Tool store, ((far left softkey)
d) Access on, (far left softkey)
e) Edit, (middle softkey)

8. This brings up the tool store page with a list of tools from 1 to 48. There are four columns for each tool store.

ie. T1   R=0   DR=0   L=0   S=0

R = Tool radius
DR = Wear factor   (seldom used)
L = Tool length
S = Spindle speed (seldom used)

To insert the tool length value, select the appropriate tool store number, as used in the program, using the arrow keys.

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9. Move the cursor across to the 'L' column and key in the value from the Z axis reading from machine mode, and then press enter. **Make sure it is a negative (−) value.** (If a positive value is entered then the program will error as the Z axis will try to go upwards instead of downwards when the program is executed).

10. Now page out and go back to Machine mode.

11. If the head/drill has been lowered via an 'M' code use the opposite code to retract the head/drill (see machine list)

12. To move the Z axis back to its top position, select M.D.I and key in G0 Z0 T00 and press cycle start.

The whole procedure should be repeated for all the tools/heads being used.

Note

When setting a tool length for a drill, key in M61 in MDI (Machine mode) and press cycle start, this will stop the drill from rotating when it is in its down position. This is cancelled by M62.

STOP AND ERROR CONDITIONS

PROGRAM STOP

A deliberate stop of the machining program can be entered in the program as required by M0. This can allow for component changing or component to be turned over etc. Machining will be resumed by pressing cycle start.

ERROR CONDITIONS

Should a machine or program fault occur, the machine stops will display error in the top right corner of the VDU. To display the error page from Automatic, press Information once or twice until Message List appears, make a note of the error and the line it occurs on if it is a program error, then repress Automatic and page out, and correct the error.

AXIS LIMITS

Under normal conditions if a movement is programmed which would cuase an overtravel condition movment ceases and a feedhold condition is forced when the axis reaches its travel limit. A message will be on the message list in Information mode to say which axis is on overtravel, also axis error will be displayed on the VDU.

To jog off the limit, select Machine mode, low jog rate and the axis which has overtravelled and then press the + or - button.

Example:- The message list says X+ overtravel, select 'X' and press the - button, the axis will move off the limit and the error will be cleared.

The reason for the fault condition should be investigated and corrected before machining is continued. Possible causes are:-

1.   Incorrect datum setting (incorrect use of G92, Zero shifts or Variable offsets).

2.   Programming error (wrong dimension).

3.   Mirror image not cancelled or incorrectly programmed.

4.   Incorrect programming of radius or length compensation.

AUTOMATIC COMPENSATION FOR HEAD CENTRE DISTANCES

When a machine is fitted with parallel heads the programmer normally would have to add or subtract the centre distance of the heads when changing from one head to another. Although this is not difficult for an experienced programmer, it can lead to programming errors and a certain amount of calculation is necessary.

By using the auto-offset program (cycle 20) a fixture offset is set up for each head so that all dimensions in the program are taken from one datum or zero point, irrespective of which head is being used. When a new head is called up the measuring system automatically compensates for the distance from the last head which was in work.

This makes programming of multiple heads simple.

HOW TO USE THE AUTO-OFFSET CYCLES

There are four cycles used, one for each head (more can be used if necessary).

Cycle 20   is used to set up offsets for all heads and also activates the offset for the left hand router head. Cycle 20 must always be used to activate a new VX and VY datum even if the left hand head is not going to be used.

Cycle 21   sets the offset for the left hand drill head and activates the drill rotation on code.

Cycle 22   sets the offset for the right hand drill head and activates the drill rotation on code.

Cycle 23   sets the offset for the right hand router head.

The offset cycles do not result in any axis movement only the referencing of the component datum point to the appropriate head.

The offset cycle can be used with inch or metric programs. The VX and VY values are always in respect of the left hand router head, ie. the position of the left hand router head over the component datum.

STANDARD AUTO-OFFSET CYCLE

```
N 1     (ALL OFFSETS RELATE TO LEFT ROUTER)
N 2     (V23 = DISTANCE FROM LEFT ROUTER TO SECOND HEAD)
N 3     (V24 = DISTANCE FROM LEFT ROUTER TO THIRD HEAD)
N 4     (V25 = DISTANCE FROM LEFT ROUTER TO FOURTH HEAD)
N 5     G53
N 6     V23=      V24=      V25=
N 7     TRF=G54 X=VX Y=VY
N 8     V20=VX-V23 V21=VX-V24 V22=VX-V25
N 9     TRF=G55 X=V20 Y=VY
N 10    TRF=G56 X=V21 Y=VY
N 11    TRF=G57 X=V22 Y=VY
N 12    G54
N 13    M2
```

CYCLE 21

```
N 1     G53
N 2     M79
N 3     M38
N 4     M62
N 5     G55
N 6     M2
```

CYCLE 22

```
N 1     G53
N 2     M79
N 3     M38
N 4     M62
N 5     G56
N 6     M2
```

CYCLE 23

```
N 1     G53
N 2     M38
N 3     M79
N 4     G57
N 5     M2
```

The cycle for each individual machine may vary slightly from the above, please check your machine specification or machine cycle memory for the correct version.

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AXIS DIRECTIONS

```
                        -Y ← → +Y
        ┌─────────────────────┐
        │       -X ←   → +X    │
        │                      │
        │      PLAN VIEW       │
        │      OF TABLE        │
        │                      │
        └─────────────────────┘
                 Z- ← → Z+
```

(Z axis moves
up and down
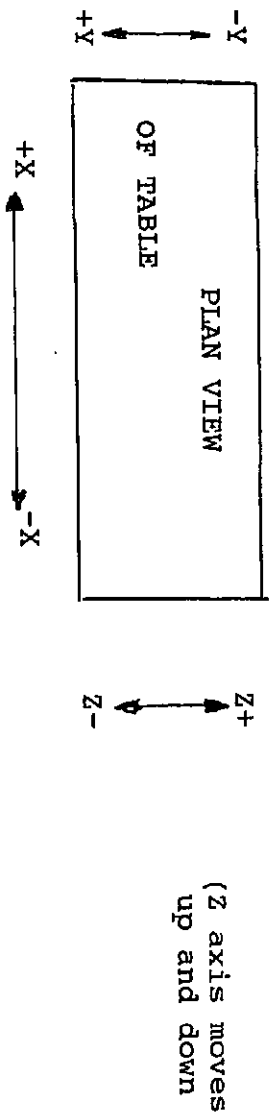
G CODES

G0 — POSITIONING AT RAPID TRAVERSE

G1 — LINEAR INTERPOLATION (WITH FEEDRATE)

G2 — CIRCULAR INTERPOLATION CLOCKWISE (WITH FEEDRATE)

G3 — CIRCULAR INTERPOLATION ANTI-CLOCKWISE (WITH FEEDRATE)

G4 — PROGRAMMED DWELL (WITH 'F' IN SECONDS)

G17 — PLANE SELECTION X,Y

G18 — PLANE SELECTION X,Z

G19 — PLANE SELECTION Y,Z

G20 — SETTING POLE FOR POLAR CO-ORDINATES

G22 — UNCONDITIONAL SUB-ROUTINE CALL UP

G24 — UNCONDITIONAL JUNP TO JUMP TARGET

G36 — ACTIVATE SCALING

G38 — SWITCH ON PROGRAMMED MIRROR IMAGE

G39 — SWITCH OFF MIRRORING

G40 — CANCEL TOOL RADIUS COMPENSATION

G41 — CALL UP TOOL RADIUS COMPENSATION TO THE LEFT OF WORKPIECE

G42 — CALL UP TOOL RADIUS COMPENSATION TO THE RIGHT OF WORKPIECE

G53 — CANCEL ZERO SHIFT OFFSET

G54 — G59 ACTIVATE COMPONENT ZERO OFFSET

G61 — SWITCH ON 'IN POSITION LOGIC'

G62 — SWITCH OFF 'IN POSITION LOGIC'

G63 — DISABLE SPINDLE AND FEEDRATE OVERIDE POTENTIOMETER

G66 — ENABLE SPINDLE AND FEEDRATE OVERIDE POTENTIOMETER

G68 — AUXILLIARY ARC ONOUTSIDE CORNERS (TOOL COMPENSATION)

G69 — STRAIGHT LINE INTERSECTION ON OUTSIDE CORNERS (TOOL COMPENSATION)

G74 — PROGRAMMED TRAVERSE TO REFERENCE

G80 — CANCEL FIXED CYCLES

G81 — DRILLING CYCLE

G82 — BORING CYCLE

G83 — PECK DRILLING CYCLE

G90 — ABSOLUTE DIMENSIONS

G91 — INCREMENTAL DIMENSIONS

G92 — SETTING COMPONENT DATUM POINT

G99 — END OF SUB-ROUTINE

M CODES

M2   - END OF MAIN PROGRAM
M30   - END OF MAIN PROGRAM WITH RETURN TO START

M3   - START SPINDLE CLOCKWISE
M5   - STOP SPINDLE

M17   - ROUTER HEAD ON
M10   - ROUTER HEAD OFF

M20   - DRILL LOWER
M38   - DRILL RAISE
M61   - DRILL ROTATION OFF
M62   - DRILL ROTATION ON

M23   - CUSTOMER DEFINED USE - ON
M24   - CUSTOMER DEFINED USE - ON
M25   - CUSTOMER DEFINED USE - ON
M26   - CUSTOMER DEFINED USE - ON
M27   - CUSTOMER DEFINED USE - ON
M67   - CUSTOMER DEFINED USE - ON
M32   - M67 OFF
M33   - M23 OFF
M34   - M24 OFF
M35   - M25 OFF
M36   - M26 OFF
M37   - M27 OFF

M50   - VACUUM PUMP ON
M51   - VACUUM PUMP OFF
M54   - VACUUM CLAMP ON
M55   - VACUUM CLAMP OFF
M93   - CODE TO STOP VACUUM UNCLAMPING DURING AUTO
M93   - CANCEL M93

M31   - ROUTER HEAD GUARD DOWN
M45   - ROUTER HEAD GUARD UP

M78   - MOVE TOOLCHANGER CAROUSEL TOWARDS HEAD
M79   - MOVE TOOLCHANGER CAROUSEL AWAY FROM HEAD
M76   - TOOLCHANGER CAROUSEL DOWN
M77   - TOOLCHANGER CAROUSEL UP

M80   - ROUTER HEAD TOOL RELEASE
M81   - ROUTER HEAD TOOL CLAMP

ADDRESSES

ADDRESS	DESCRIPTION
E	4TH AXIS POSITIONING
F	FEEDRATE (IN MM/MIN OR DWELL TIME IN SECONDS)
G	'G' CODES SEE PREVIOUS LIST
L	REPETITION OF SUB-ROUTINE (1 - 99)
M	'M' CODES SEE PREVIOUS LIST
N	BLOCK NUMBER (LINE)
P	SUB-ROUTINE CALL UP NUMBER, JUMP TARGET (G24)
R	RADIUS OF ARC
S	SPINDLE SPEED
T	TOOL NUMBER (TO1 -T48)
X	AXIS POSITIONING
Y	AXIS POSITIONING
Z	AXIS POSITIONING

SECTION 6

<u>AUTOMATIC ROTARY TOOLCHANGER</u>

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AUTOMATIC ROTARY TOOLCHANGER

This comprises of a horizontally mounted toolholding carousel with an option of four or ten tools. The tools are mounted on a single turntable and held in spring loaded grippers. The position opposite the spindle must always be empty to avoid a collision when running the tool change cycle. The first tool on a production run will generally be loaded manually leaving the tool hold position on the carousel opposite empty. On activation of a program when a tool change is required the new tool station position is selected via a 'H' number and then the tool change cycle is activated - M6, the current tool will then be loaded back into the carousel, then the new tool position will be rotated to the tool change point, loaded into the head and is ready for production.

WARNING   If a non-Wadkin toolholder is purchased it is important that the pullstuds are Wadkin.

NOTE: only use devices with the correct 'V' flange to DIN 69871 and ensure tools and holders have been accurately balanced before use. Do not use any tool holder with milled drive key slots as they will fall out of the toolchanger.

SETTING

The standard tool change carousel can hold upto 10 different tool adaptors. These are loaded into the carousel manually.

If an adaptor contains a tool which is too large to go in the carousel, then this can be loaded manually into the head, but this tool must be unloaded manually - not returned to the carousel.

The toolchanger carousel sets itself every time it passses the No. 1 position, but if ever it looses position.

When the toolchanger is used for the first time on the shift, once it has taken the tool from the head, the carousel will reference itself, before putting in the correct toolholder. Although this takes an increased amount of time, it only happens when the controller is switched on.

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PROGRAMMING

To pre-set a tool ready to put into the head, select MACHINE MODE, then MDI and type in the code 'H1' or the appropriate number (the number being the carousel position), now press cycle start.

To put a tool into the head, key in M6, then press cycle start. The 'Z' axis and head (if slide fitted) will move to the top position, the toolchanger carousel will move slideways and grip the tool in the head, the tool will then be released, the carousel will move down, then rotate to correct number, move back up, clamp the tool then the carousel will retract to stand off position.

PLEASE NOTE the tool location facing the head has always to be empty, this means that only 3 or 9 tools can be held in the carousel at any one time and 1 in the head.

So the code for tool selection is H? and for changing the tool is M6.

To select a tool in a program, the program will be as the following example.

```
G1 X1000 H6
Y1000
```

When programming it is good practice to load the first tool outside the start of the program and outside a jump target eg.

```
H1
M6
$99 M0
G90
G53 etc.
```

Then at the end of the program the same tool is called for again but this time the program jumps to $99 and misses the call up above $99.

```
G53 T00
G0 X1200 Y1000 Z0
H1
M6
G24 P99    (Jumps back to $99 at
              start)
M30
```

This ensures that the correct tool is in the head at the start of the program, and after one run of the program all the tools would be in the correct sequence.

EMERGENCY STOP ROUTINES

'E' stop during M6 tool change when a gripper is holding a tool
in the router head.

        Release E Stop
        Switch drives back on
        Delete error message in Machine Mode, press Page out, then
        cycle start
        The cycle has to be continued as follows:-
        M81 cycle start

'E' stop during tool change after replacing one tool but before
selecting next tool.

        Release E stop
        Switch drives on
        Delete error message in Machine Mode, press Page out, then
        cycle start

'E' stop during tool change after replacing tool and selecting next
tool.

        Release E stop
        Switch drives on
        Delete error message in Machine Mode, press Page out, then
        cycle start

IMPORTANT NOTES

To be able to tell what tools are in which positions, the control has
a series of temporary marker stores allocated for this purpose.

TEMP STORE   19.0 - 19.7, 19.0, 19.1   TOOLS 1-10 IN Router head.
TEMP STORE   28.0 - 28.7, 29.0, 29.1   TOOL CHANGE CAROUSEL
                                        1-10 POSITIONS

(gripper A - load gripper)
(gripper B - unload gripper)

To check the temporary stores go into Information Mode and then
follow the next sequence by pressing the softkeys detailed:-

                        MACHINE STATUS
                        PICPLC DISPLAY
                        TABLES
                        I/O TEMP STORE

Now you should have three tables displayed on the screen headed
INPUTS, OUTPUTS and TEMP STORE. Press the TEMP STORE softkey and key
in 20, press enter, the temp store display will now show the area you
need to check.

eg.   If the tool change carousel was at position 5, Tool 9, in the
router head and both grippers open, then temp store 28.4 (tool change
carousel at position 5) and 20.0 (tool 9 in router head) would both
be high.

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SECTION 7

ROUTINE SERVICING

03/92

INTRODUCTION

The maintenance procedures outlined in this manual are intended as a guide to the amount of maintenance required to keep the machine in good working order. The periods stated assume single hour shift working, and should be reduced accordingly if the machine is being used on a 2 or 3 shift system. All maintenance carried out should be recorded as this enables future needs to be anticipated and maintenance practices to be modified with experience on a particular machine.

Most daily checks may be carried out by the machine operator, but all other maintenance should be performed by appropriately skilled technicians.

When carrying out maintenance or repairs, the following points should be considered.

(1)   All exposed pipe or hose ends should be blanked off to prevent dirt entering the system.

(2)   When checking for electrical faults ensure that all equipment leads and instrument probes are suitably insulated.

(3)   When carrying out major repairs or dismantling ensure that the machine is isolated from the electrical supply. If possible remove the main fuses, so that the machine cannot be switched on inadvertently.

(4)   Always keep the doors of cabinets containing electrical equipment closed to prevent the ingress of chips and dirt.

        NEVER USE AIRLINES TO CLEAN THE ELECTRICAL CABINET.

MAINTENANCE

Daily Maintenance

(a)   Thoroughly clean the machine using a suitable vacuum cleaner to remove all dust and chippings. Pay particular attention to the table area and the slideways and head.

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Weekly Maintenance

(a)   Multi-head machines only.
       Apply two shots of Shell Tonna T68 to the headslide (four
       points, on either side of the headslide).

(b)   Check the level of the oil in the airline lubricator. Top up
       if necessary with Shell Tellus 37.

(c)   Inspect the X and Y axis ballscrew covers for damage. Replace
       if necessary.

(d)   Grease wipers points on X and Y axes.

(e)   Vacuum System only.
       Check the pipework for leaks or damage.
       Empty the intake and exhaust filter jars and check the
       filters. Replace if necessary.
       Clean the filters.

Monthly Maintenance

(a)   Clean the external surfaces of electric motors.

(b)   Grease dust caps on X and Y axes with shell Alvania R3 or
       similar.

(c)   Oil the bearings on the drill head and/or veining head.

Half Yearly Maintenance

(a)   Check all the axes ballnut fixings for security.

(b)   Check the router head fixing bolts for security

(c)   Clean the contacts of the motor contactors on the electrical
       panels. Do not fill the contacts - this only accelerates the
       wear.

       WARNING - Ensure that the machine is isolated from the
                 electrical panels. Do not allow dust and chippings
                 to enter the electrical enclosure.

(d)   Check the operation of the axis travel limit switches. (Refer
       to Section 6 - Fault Finding for electrical details).

(e)   Check the brake pad for wear.

(f)   Check the axis drive motor belt tension (Y and Y axes). The
       maximum deflection allowed at the centre of the belt (thumb
       pressure only) is 5 mm. If a greater deflection is obtained,
       the belts may be tensions by loosenings the four bolts in the
       slotted holes on the motor mounting plate and sliding the
       plate and motor to obtain the correct tension. Tighten the
       bolts securely after adjustment has been carried out.

(g)   Check servo motor brushes for wear.

Yearly Maintenance

(a)   Remove ball bushings wash and re-pack with grease.

(b)   Vacuum pump only. .
        Check the vacuum pumps vanes for wear.   (Refer to the
        manufacturer's literature provided.

(c)   Replace intake and exhaust filters.

(d)   Check servo motor brushes for wear.

(e)   Change CC 100 battery

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LUBRICATION

Lubrication Schedule

ITEM	LUBRICANT	APPLICATION METHOD	FREQUENCY
BALLSCREWS			
X & Y NUT	SHELL ALVANIA R3	SCREW IN GREASE NIPPLE PACK NUT (FULL)	3500 HRS
X & Y BRG HOUSINGS	SHELL ALVANIA R3	PACK FULL USING GREASE GUN	1750 HRS
(250) Z – NUT	SHELL ALVANIA R3	MOVE Z–AXIS TO REF.POS. & PACK USING GREASE GUN	1750 HRS
(350) Z – NUT	SHELL ALVANIA R3	PACK USING GREASE GUN	1750 HRS
(250) Z – BEARING HOUSING	SHELL ALVANIA R3	PACK USING GREASE GUN	1750 HRS
(350) Z – BEARING HOUSING	SHELL ALVANIA R3	PACK USING GREASE GUN	1750 HRS
LINEAR BEARINGS			
CIRCULAR BUSHINGS X & Y	SHELL ALVANIA R3	CLEAN AND REPACK	3500 HRS
NYLON WIPERS X & Y	SHELL ALVANIA R3	PACK USING GREASE GUN	320 HRS
(350) Z – AXIS	SHELL TONNA T68 (OIL)	1 CM^3 USING OIL GUN	320 HRS
ROUTER HEADS			
COLUMBO HEAD		DO NOT LUBRICATE	
HEAD SLIDES	SHELL TELLUS 27 (OIL)	0.5 CM^3 TO EACH POINT	12 HRS
HEAD OPTIONS			
MULTI-DRILL UNITS	LIQUID GREASE ESSO S420 E-DIN51826 & DIN 51502	1 CM^3 TO EACH POINT	500 HRS *
SERVO-INDEXING UNITS			
AIR DRILLS	SHELL TELLUS 27 (OIL)	0.5 CM^3 TO EACH POINT	320 HRS
VEINING HEADS	SHELL TELLUS 27 (OIL)	0.5 CM^3 TO EACH POINT	320 HRS
HEAD ADAPTORS			
RIGHT ANGLE GEAR-BOXES	LIQUID GREASE ESSO S240	1 CM^3 TO EACH POINT	500 HRS *

* 500 RUNNING HOURS – DO NOT OVER LUBRICATE

3.4 LUBRICANT EQUIVALENTS

Note:- The grades listed below may be direct 'Equivalents'. If in doubt
consult your lubricant supplier for advice.

MOBIL	B.P.	CASTROL	ESSO	GULF	SHELL	TOTAL
Mobilplex 45	Energrease FG00-Ep	Impervia MMO	Esso fluid grease	Track roller grease	Alvania R2	Rolls N-O
Mobilplex 48	Energrease LS3	Shpeerol AP3	Beacon 3	Gulf crown grease No.3	Alvania R3	Multis special 3
Vactra oil No. 2	Maccurat 68	Magna BD68	Febis K68	Slideway 68	Tonna T68	Drosera VG68
DTE 24	Energol HLP 32	Hypsin AWS32	Nuto 32	Harmony 32AW	Tellus 37	Azolla VG32
DTE BB	Energol CS220	Alpha SP150	Spartan EP150	Harmony 220E	Macoma R150	Azolla VG220
DTE heavy medium	Energol HLP68	Hypsin AWS68	Nuto H68	Harmony 68	Tellus 68	Azolla VG68
DTE light	Energol HLP 32	Hypsin VG32	Nuto H32	Harmony 32	Tellus 37	Azolla VG32
Mobilarma 522	Energol protective 10	Storage oil 10	Rustban 335	Oilcoat TD	Ensis oil 1	HD1BIOW
Mobil Almo 525	Energol HLP 22	R.D. oil 32	Nuto H15	Harmony 32AW	Tellus R10	Azolla VG22
Mobilgrease special	Energrease L21M	Spheerol LMM	Beacon Q2 Moly	Gulflex Moly	Alania grease 2+MOS2	Multis MS2
DTE 13	Energol HLP 22	Hypsin AWH32		Hyrasil Multi	Tellus T37	Equivis VG22

SECTION 8

ELECTRICAL TROUBLE-SHOOTING (CC100-M CONTROL)

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GENERAL

The machine installation is very important and no further servicing should be carried out until certain basic elements have been checked.

Most faults associated with any computer are usually caused by the mains supply or earth being noisy or unstable. We cannot stress enough the importance of a good clean earth and stable, noise free supply.

It is important that the supply voltage to the machine falls within the limits of the voltage specified when the machine was ordered. In general AC Drive machines will operate on either 380 volts or 415 volts AC +/- 10%. If the supply voltage falls outside these limits then a transformer will be required in the mains supply to ensure the correct voltage levels are achieved.

eg. If the supply voltage of a machine is rated at 415 V AC but is supplied with say 450 volts. The voltage to the control will rise to 128 volts AC. This could result in the control to function incorrectly and may damage the control if sustained. The same could apply if under voltage was supplied. This is more likely to cause persistent servo errors and the control may intermittently shut down.

Machine Air Supply

The machine air supply should conform to the specified standard on the machine foundation plan (supplies vary depending on drill heads configuration). If a separate compressor is used and is not capable of the correct supply the mains air pressure switch will shut the machine off when the pressure falls below 35 p.s.i. Again, the machine may cut well until the drill is used and the pressure drops due to the exhaust on the drill.

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Encoders (closed loop positional feedback system)

The encoder unit is the measuring instrument used to ensure that the axis has moved to the correct position as commanded by the control.

The encoder type used is usually a rotary type and is usually fastened to the none drive end of the axis motors. On encoder being used per axis.

Depending on the design of the machine the encoder may be fastened directly to the ballscrew or alternatively a linear encoder may be used. In all cases the encoder still operates in the same way by sending back to the control information relating to the position of the axis.

The sending out from the control of commands and the receiving of the information back from the encoder is called the closed loop positional feedback system.

If this loop or circuit is broken in any way then it will normally result in the control shutting down the drives. The faults outlined in this section are some of the more common experienced and are set out as a fault and remedy listing and this should act a guide if problem occurs.

Fault No. 1 - Creeping

Symptom No. 1   Machine creeps in one or more axes in both auto or manual regardless of feedrate override.

Fault   a) Broken wires in encoder harness.
Remedy   a) Replace broken wires with spares or renew entire harness.
Fault   b) Badly adjusted offset (s).
Remedy   b) Display actual position via axes display and ensure readouts are stable at zero when axes are stopped. Adjust via offset pots on regulator cards.
Fault   c) Bad grounding on encoder circuit.
Remedy   c) Check grounding on encoders. Encoder can should be connected to pin 11 on encoder plug. NB: This problem could also cause tape reader problems when the drives are on.
Fault   d) Encoder plugs/sockets not made correctly.
Remedy   d) Check security of encoder plugs/sockets and conditions of pins etc, especially on Control conenctions.
Fault   e) Faulty encoder.
Remedy   e) Fit new encoder.
Fault   f) Axis readout moving slowly round on all axes.
Remedy   f) Check with message page for either servo error or interpolator stop, ie. drive on signal missing.

Fault No.2 - Mispositioning

Symptom No. 1 Axis goes to wrong position during program but readout show correct position.

Fault a) Low voltage to encoder lamp from Control.

Remedy a) Check voltage to encoder. Adjust if necessary or find point of lost voltage.

Fault b) Encoder coupling, loose or rubbing on flange inside motor.

Remedy b) Check encoder coupling.

Symptom No. 2 Axis references in wrong place.

Fault a) -
Remedy a) - As Symptom No. 1
Fault b)
Fault b) -
Fault c) Operator sending machine to reference position whilst on ultimate limit switches.

Remedy c) Jog off limit positions in all 3 axes (or 4 axes) before referencing.

Fault d) Waste material fouling table limit switches or loose limit swithc trigger cams or broken limit switches.

Remedy d) Check operation and function of table limits and triggrer cams.

Check parameters are the same as on your sheet with machine.

Fault No. 3 - Axis Take off

Symptom No. 1 When drives switched on, axis creeps slowly and the takes-off or accelerates and trips servo error. Servo error when drive is switched on.

Fault a) -
Remedy a)
Fault b) - As Symptom No. 1, Fault No. 2
Remedy b) -
Fault c) Encoder shaft coupling loose.
Remedy c) Tighten coupling. Make sure coupling is not broken. Sometimes they break and cause intermittent mis-positioning since they will still drive through friction between the two parts.

Symptom No. 2 Axis takes-off in manual as soon as manual mode is selected.

Fault a) -
Remedy a)
Fault b) - As Symptom No. 1, Fault No. 2
Remedy b) -
Fault c) Faulty manual panel.
Remedy c) Replace manual panel.

Symptom No. 3   Axis appears to perform short take off movements
                during program while G1 F---- is active then returns
                to normal.
Fault   a)   Intermittent   break   in encoder harness which is
                re-making before servo distance (30 mm) is achieved.
Remedy   a)   Replace faulty wire(s) with spare core(s) or renew
                harness.

If encoder fault exists, the control will usually display:-
'? Axis measuring system disconnected' on message page.

TACHOS (CLOSED LOOP SPEED FEEDBACK SYSTEM

Fault No. 1 - Take off

Symptom No. 1   One or more axis take-off when drive-on is
                activated. Machine trips and displays servo error.

Fault   a)   Tacho wires connected wrong way round or motor wires.
Remedy   a)   Invert tacho connections or motor wires.

Smptom No. 2   Axis takes-off after activating manual mode and
                pressing either + or - jog buttons.
Fault   a)   Short circuit or open circuit on tacho.
Remedy   a)   Trace cause of short or open circuit and rectify. If
                no resistance or infinate resistance is present on
                motor tacho terminals, replace motor.   NB: This
                condition will be indicated by the illumination of
                the red tacho monitoring LED on the amplifier power
                supply card.

CONTROL PROBLEMS

Fault No. 1 - No M-functions

Symptom No. 1   M-code not activated when called up in manual or
                automatic.
Fault   a)   No 110V AC supplied to M-code system.
Remedy   a)   Rectify cause of 110V AC supply failure and restore.
Fault   b)   Parameters are corrupted.
Remedy   b)   Eliminate cause of corruption eg. faulty battery and
                re-load parameters.

Fault No. 2 - Interface will not work

Symptom No. 1   Tapes cannot be input or data output via equipment
                known to be in working order.
Fault   a)   Break in extension cable between pendant and Bosch CC
                unit.
Remedy   a)   Locate broken core(s) and rewire.

Fault No. 3 - MTB buttons will not work

Symptom No. 1 MTB button not activated when called up.

Fault   a) Incorrect mode selection.
Remedy   a) Select Machine mode
Fault   b) Incorrect or non-existance o f cycle 78.
Remedy   b) Enter desired operation of buttons in cycle 78.

MANUAL PANEL

Fault No. 1 - No Manual operation

Symptom No. 1 No movement is possible in manual. Feedhold not
              present.
Fault   a) Manual panel not connected to Control. (Plug X5)
Remedy   a) Ensure connection of manual panel.

Fault No. 2 - Poor manual operation

Symptom No. 1 'X' axis moves in manual although 'W' axis selected,
              or any such combinations of axes.
Fault   a) Damage to manual panel or ingress of foreign material
              into manual panel.
Remedy   a) Identify cause of damage and eliminate.
              Replace manual panel.

Symptom No. 2 Feed irregular and/or lumpy when in handwheel mode.

Fault   a) Driving too fast in handwheel mode.
Remedy   a) Turn feedrate down on percentage switch.
Fault   b) Damage to manual panel and/or ingress of foreign
              material into manual panel.
Remedy   b) Identify cause of damage and eliminate.
              Replace manual panel.

Symptom No. 3 Slow jog runs at 12 m/min as high jog or visa versa.

Fault   a) Damage to manual panel or ingress of foreign material
              into manual panel.
Remedy   a) Identify cause of damage and eliminate.
              Replace manual panel.

ELECTROMECHANICAL HARDWARE AND MACHINE WIRING

The following represents a cross-section of the most common machine wiring faults and component failures.

FAULT NO. 1 - FAULTY DRILL ADVANCE SOLENOIDS

Symptom No. 1   Drills will not advance even though voltage is present to solenoid.
Fault   a) Solenoid action interfered with by ingress of dust.
Remedy   a) Remove, clean or replace solenoid valve.
Fault   b) Solenoid winding broken down. This is usually accompanied by a slight burning smell.
Remedy   b) Replace solenoid.
Fault   c) Solenoid spring broken.
Remedy   c) Replace spring or solenoid.

The above refers to all solenoid operated functions such as drills, vacuum clamp/unclamp, air clamps etc.

Fault No. 2 - Faulty head limit switch

Symptom No. 1   Head fails to start although all standard pre-conditions have been met.
Fault   a) Head limit switch faulty.
Remedy   a) Test for continuity through limit switch. Replace if necessary.
Faulty   b) Head limit switch not closing when brake released.
Remedy   b) Limit switch out of position. Reposition limit switch or relieve cut-out on brake mechanism.

Symptom No. 2   Head does not stop when brake pressed.

Fault   a) Limit switch out of position. Check I.O. table.
Remedy   a) Reposition limit switch so it opens when brake pressed or lock on.
Fault   b) Limit switch faulty - not opening.
Remedy   b) Check continuity through limit switch and replace if necessary.

Fault No. 3 - Faulty three phase suppressors

This normally causes motor fuses to rupture.

Symptom No. 1   3 Phase suppressor burnt, bulged.

Fault   a) Faulty suppressor.
Remedy   a) Replace suppressor.

Symptom No. 2   3 Phase unit (eg. vacuum pump) will not start.

Fault   a) Faulty suppressor.
Remedy   a) Disconnect suppressor. Unit will start. Replace suppressor. Check fuses in motor circuit.

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Fault No. 4 - Faulty limit switch

Symptom No. 1 Machine ignores limit switch under controlled feed conditions.
Fault a) Limit switch not breaking. Check operation of limit switch by looking at I.O. status.
Remedy a) Repair or replace limit switch.
Fault b) Dog out of position and tripping switch.
Remedy b) Reposition trip dog.

Symptom No. 2 Machine references in wrong place although encoders and wiring all ok.
Fault a) Limit switch loose on limit switch body.
Remedy a) Tighten limit switch mounting fully down or replace limit switch if threads stripped.
Fault b) Dog loose in track or incorrectly adjusted.
Remedy b) Tighten Allen screws. Adjust by moving dog forward or back 5mm.
Fault c) Reference limit switch jammed in.
Remedy c) Release with penetrating oil. Check operation with I.O. status.

Fault No. 5 - Intermittent tripping of 3-phase unit

Always first check to see that full supply voltage is present on all 3 phases if not work back from motor terminals to determine where problem is eg. overload, topside of contactor, fuses.

Symptom No.1 3-phase unit (eg. head, vacuum pump) trips intermittently then restarts without pressing overload reset.
Fault a) Loose fuse holders in fuse carriers.
Remedy a) Tighten fuse holders in fuse carriers.
Bad connection on connector plugs in base. (Vacuum pumps only).
Loose connections on contactor or motor terminals.
Faulty head limit switch.

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AC DRIVES

The main difference encountered when using AC drives is the introduction of permenantly excited brushless motors and their supply and control units which are of modular construction.

The Servo Motors are permenantly excited and brushless and are used with positional and velocity servo loops.

They have a three phase stator winding and a rotor excited by permanent magnets. A brushless tacho generator is incorporated for velocity feedback. The switching of the currents from phase to phase is controlled in the associated axis module with the aid of the rotor position feedback monitor.

The control and supply units are modular and can be broken down into individual units.

VM Module = In this unit the mains supply voltage.

> ie. 3 x 380 - 3 x 415 volts +/- 10% is rectified to give a DC voltage. This module also works in conjunction with

Capacitor Module   which helps to smooth out the rectified voltage into a smooth DC supply which is then used by the control modules.

SM Modules   this controls the axis drive motors and interprets the command signal sent out from the control into actual movements of the axis motor in direct proportion to the value of the command signal.

In conjunction with the rotor positional feedback and the brushless tacho the SM Module regulates the motor torque and speed.

ASM Modules   in this unit with the aid of a DC/AC converter it generates a 3 phase voltage systems of variable frequency and amplitude from the DC Link. This allows speed regulation of high frequency heads required for router motors.

Optimization Card   Care needs to be taken to keep the optimization cards with the correct axis to which they have been designated. Each card is set up when the machine is commissioned and is dedicated to its own axis.

The card is really very similar to the optimization card on the DC drive unit except most of the setting is done by using D.I.P switches. It also has three adjustment potentiometers, offset pot, tacho adjustment and command adjustment all being available.

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DIAGNOSTIC MODULES SM UNITS

IMPORTANT TURN OFF MAINS SUPPLY BEFORE FITTING CARDS.

The diagnostic module on the SC-TC units are a simple plug in module. Usually only one diagnostic unit is required per machine and can be fitted into any axis with a problem to help fault finding.

It can be unplugged and moved into another axis switch off drives before changing position of diagnostic unit.

The seven segment display indicates possible fault causes refer to Fault Code Sheet provided.

ASM FAULT DIAGNOSTIC UNIT

This unit is again a plug in module and gives out a display via a series of LED's Reference to the diagnostic fault display list would then help to diagnose the fault.
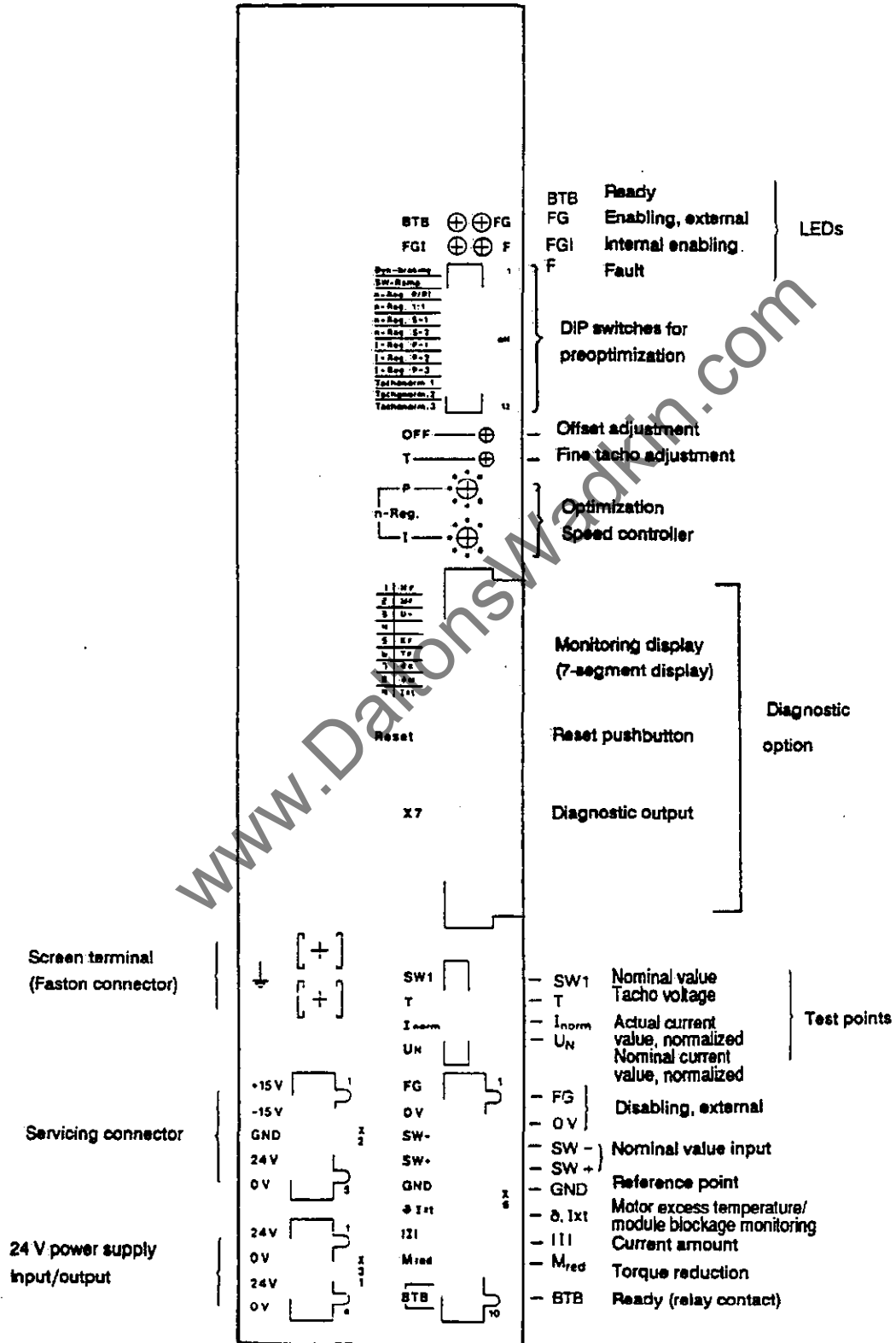
The diagnostic unit plugs into the ASM unit.

Usually only one diagnostic unit is supplied and in the case of mulitple ASM units it can be swopped to the appropriate unit with suspected fault.

To fit the unit to the ASM. See the attached drawing.

    (i)   Remove the optimization card.

    (ii)   Remove the connectors X6 and X1

    (iii) Remove the ASM front plate.

    (iv) Plug in diagnostic card in position shown.

    (v)   Refit ASM cover, connectors and optimization card.

    (vi) On diagnostic card Plug X31 connect cables to 24v and 0v on VM unit.

    (vii) Diagnostic module should now work and indicate via LED on fault conditions. Note: this module can also be fitted to a VM unit.

**Front panel
designations on the SM**

BTB	Ready
FG	Enabling, external
FGI	Internal enabling
F	Fault

LEDs

DIP switches for preoptimization

Offset adjustment
Fine tacho adjustment

Optimization
Speed controller

n-Reg.

Monitoring display
(7-segment display)

Reset pushbutton

Diagnostic output

Diagnostic option

Screen terminal
(Faston connector)

SW1	Nominal value Tacho voltage
T	
I_{norm}	Actual current value, normalized
U_N	Nominal current value, normalized

Test points

Servicing connector

FG	Disabling, external
0 V	
SW –	Nominal value input
SW +	
GND	Reference point
ϑ Ixt	Motor excess temperature/ module blockage monitoring
IΣI	Current amount
M_{red}	Torque reduction
BTB	Ready (relay contact)

24 V power supply
input/output

+15 V, -15 V, GND, 24 V, 0 V, 24 V, 0 V, 24 V, 0 V

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X7 Pin Allocation

X7.1 Reset Input RES

Stored fault signals can be reset via the reset input (H-level, +24V) or with the 'RESET' button on the module.

X7.3 Module Fault M_F

The signal goes from +24V to LOW when overcurrent is produced in the module. The red LED M_F comes on. Ready 2 (BTB 2) is cancelled.

X7.4 Heat Sink Temperature OK

The signal goes from +24 V to LOW when the heat sink temperature in the module rises aboe a set maximum limit due to overload, high ambient temperature or fan failure.
The yellow LED OK will come on. Ready 1 (BTB 1) is cancelled.

X7.5 Module Overload I x t

The signal goes from +24V to LOW as soon as the current limit value is reached. The yellow LED I x t comes on. Ready 1 (BTB 1) is cancelled.

X7.6 Current Limit I_{gr}

The signal goes to LOW when the unit limit current is being exceeded in the event of a failure.
The yellow LED I_{gr} will come on.

X7.8 Frequency Comparison fi = fs

The signal goes from +24V to LOW when the unit limit current is exceeded in the event of a failure.
The yellow LED I_{gr} will come on.

7.9 Power Supply Fault N_F

The signal goes from +24V to LOW when the +/- 15V supply voltages for the electronics lies outside the tolerance range. The red LED N_F will come on. Ready 2 (BTB 2) is cancelled.

Terminal Strip
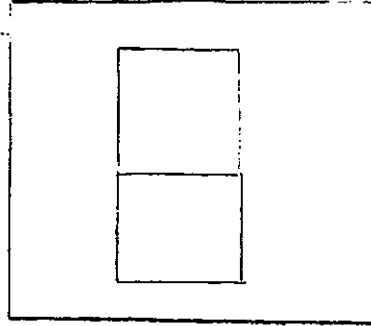
X31 Voltage Supply for Diagnostics Card

X31.1 + 24V
Maximum load 100 mA per output X7, plus 80 mA for internal supply.

X31.2 0 V
Reference potential for X31.1 (+24 V).

7-Segment display

LED Qty.	Des.	Fault type	Possible cause	Effect
1	NF	Power supply unit fault	External 24V supply voltage outside the permissible tolerances a) Wrong transformer b) Wrong voltage (or excessive ripple) c) Connection fault, d) Module defective (24 V overloaded) Internal =/– 15 V logic voltage outside the permissible tolerance: a) Overload on interface terminals, wiring fault b) Module defective	No BTB ('ready') No FG1 ('internal enabling') (RESET by pushbutton or 24 V signal)
2	M_F	Module fault	Load current too high, motor not turning despite activation a) Load short circuit b) Load connection fault c) Module defective	No BTB (ready) No FG1 ('internal enabling') (RESET by pushbutton or 24 V signal)
3	U>	Excess voltage	DC link voltage too high a) Mains voltage too high b) Ballast limit reached (due to extreme braking) c) Ballast switch defective operating without ballast switch d) Module defective	No BTB (ready) No FG1 ('internal enabling') (RESET by pushbutton or 24 V signal)
5	K_F	Commutation fault	Rotor position signal defective a) Tacho connector not plugged in or plugged in incorrectly b) Connection fault, short circuit, tacho cable discontinuity c) Tacho electronics in the motor or module defective.	No BTB (ready) No FG1 ('internal enabling') (RESET by pushbutton or 24 V signal)

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LED Qty.	Des.	Fault type	Possible cause	Effect
6	T_F	Tacho fault	Motor rotating, but no tacho voltage a) Tacho connector not plugged in or plugged in incorrectly b) Connection fault, short circuit, tacho cable dicontinuity c) Tacho electronics in the motor or module defective	No BTB (ready) No FG1 ('internal enabling') (RESET by pushbutton or 24 V signal)
7		Heatsink temperature	Heatsink temperature of the power section (> 80 degrees centigrade) a) Inadequate or obstructed air supply b) Fan not fitted or not or not connected (SM 15/30 and 25/50) c) Environment too warm d) Module load too high e) Module defective	Display for approximately 1 minute without effect followed by FG1 ('internal enabling') and BTB ('ready') inhibited. (RESET by pushbutton or 24 V signal)
8	M	Motor temperature	Motor winding temperature too high (> degrees centigrade) a) Motor is overloaded b) Air supply inadequate c) Motor underdimensioned d) Temperature sensor or sensor line defective, module defective, motor winding temperature < - 10 degrees centigrade	Display for approximately 1 minute without effect followed by FG1 ('internal enabling') and ('ready') and inhibited (RESET by pushbutton or 24 V signal)
9	1xt	Blockage monitoring	Overload at low speed $n < 3.3$ rmp at $n_N \leq 300$ rpm $n < 5.0$ rpm at $n_N > 300$ rpm a) Standstill torque too high b) Axis at mechanical stop c) Module defective	1 max. is reduced by approximately 50% to nominal current (Reduction remains until blockage is eliminated)

GENERAL PREVENTATIVE ELECTRICAL MAINTENANCE

Many problems can be avoided by general maintenance.

The main points to look out for are:-

(i) The control relies on battery back-up when the CNC is switched off. THe battery should be changed every twelve months. (See ?.?.? for battery maintenance).

(ii) Many problems are caused by the ingress of foreign materials. All the electrical cabinets should be kept shut and periodically cleaned. Cleaning should be done by vacuuming, never by blow-line (this blows dirt and water into the contactors). All seals should be replaced as they perish.

(iii) External influences (eg. scrap boxes) should not be allowed to interfere with any moving harnesses.

(iv) Limit switches etc. should be kept free from pieces of wood or other materials.

(v) Damaged cables or electro-mechanical units should be immediately replaced.

(vi) Router heads, vacuum pumps should be periodically cleaned to ensure the correct operation of cooling fans (all motors employed are T.E.F.V).

(vii) Weak fuses should always be renewed (eg. when an overload has occured and the fuse has 'blued' but not blown).

(viii) Check cooling fan filter on CC 100 end rack.

PNEUMATIC

The pneumatic connection should be made to the main air valve on the regulator / lubricator mounted on the left hand side of the machine. Set regulator to 80 p.s.i. if drill heads are fitted the maximum volume of air required is 20 c.f.m.

TO CHANGE BATTERY ON CC100M CONTROL

(i)   Ensure programs, cycles, parameters and auto-offsets are backed up a peripheral device ie. mini-cassette, computer etc.

(ii)   Swtich off mains isolator.

(iii)   Mechanically hold limit switch closed on left-hand door of main control panel.

(iv)   Switch on mains isolator.

(v)   On CP Mem card rack, remove cover marked CP Mem on left-hand card in rack.

(vi)   This reveals the battery.

(vii)   Remove the old battery and install the new one.

(viii)   Refit the cover.

(ix)   Return door limit switch to normal condition.

(x)   Check program, cycles, parameters and auto-offsets are okay.
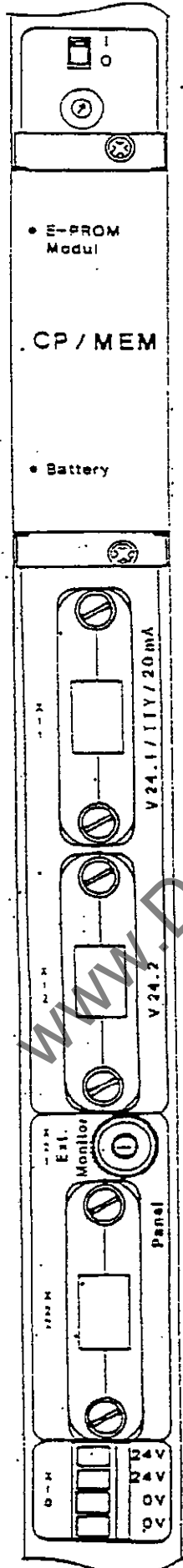
CP/MEM	Overwrite protection switch for machine parameter area.
	I = protected
	"Start up" test during the runup phase:
	switch position 1 = test active
battery	Buffer battery for data in RAM.
	The battery must be replaced yearly.
	The battery voltage is checked automatically in a 24 hr cycle and
	each time the control is switched on. If undervoltage is detected
	an error is signalled.
	With normal battery discharge (no defect on PCB) a further buffer
	period of at least 14 days is guaranteed after the first error signal.
	The CP/MEM incorporates a capacitor for the temporary buffering
	of the RAM data. If the battery is changed with the control switched
	off the period for which the supply is interrupted must not exceed 5 min.
	To change the battery the battery cover must be opened;
	the battery is fastened to the cover by means of a mounting.
	Battery: 4.5 V alkali battery, part no. 107 - 913 572.
	The executive system software is contained on a plug-in PCB
	(soft-board) under the cover.
	To change the software remove the battery cover and
	withdraw the soft-board. (POWER OFF first!)
	Serial Data Interfaces
	Interface 1
X11	V.24 or 20 mA
25-pole	
	Desired characteristics selected by pin allocation.
	Connector: sub-miniature D-type socket.
	Interface 2
X12	V.24
25-pole	Second voltage interface; can be connected in addition to X 11.
	Connector: sub-miniature D-type socket.
	Ext. VDU monitor (BAS signals)
X21	Connection for an additional VDU with 75 Ohm.
	Connector: BNC socket.
	Operating panel connection.
X22	Connection between control system and CC operating panel.
20-pole	Connector: sub-miniature D-type socket with integral coaxial connector.
	External 24 V logic DC supply (to supply the VDU in the operating panel)
X10	Connector: Weidmüller terminal strip.
4-pole	Max. cable size 1.5 mm²

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RIETSCHLE VACUUM PUMPS TR...V

Models

This section covers models TR...V, see name plate (N), which consists of 3 sizes from 40 up to 80m^3/h. (Fig. I: TR40, III: TR 80, ii: TR40 in single phase version).

Application

These dry running vacuum pumps are suitable for use with normal humidity and dry gases up to an absolute pressure of 100 mbar.

Please note:

The ambient temperature may not exceed 40 degrees centigrade. At higher temperatures please contact us.

No dangerous mixture (ie. solvent), excessive humid ari, water vapour, or aggressive gases or traces of oil or grease in the air can be sucked in.

Location

Filter housing (G) and lubrication point (L) must be easily accessible. There must be space enough to disassemble end cover (c) for exchanging the rotor blades. Also the cooling air inlet (E) and outlet (F) must be positioned so that there is unrestricted movement of air (Fig.I and III)

Starting Up

(i)   Compare current, voltage, frequency of the incoming supply against the motro name plate (N).

(ii)   If a direct on line Motor starter is fitted check the overload settings against the full load current on the motor name plate.
        Electrical connections may only be made by electro-specialists.

(iii)   Check that the direction of rotation of the pump is correct by switching the unit on and off for a short period. (see label (O)).

(iv)   Vacuum connection at poisition (A). Exhaust silencer (exhaust port) (B). Instead of an exhaust silencer teh exhausted air may be ducted away by a pipe.

        Note: If the suction line is longer than 3 m we recommend the fitting of a non return valve (ZRK).

(v)   The vacuum can be regulated by regulation valve (C) (Fig. I and III).

Service

Air filtration:

Filter cartridges (f) on the suction side shouldbe cleaned
every month and replaced every year. Service intervals depend
up on the level of contamination.

Changing the filter cartridges: remove the thumb scres (s)
and pull of the filter lid (g) complete with gasket (d),
loosen the securing nut (m) and remove the filters. Pull off
the filters (f) and clean. Use compressed air or knock out
manually. (Fig. IV)

Lubrication

Lubrication point (L), Excessgrease outlet (K). The bearings
should be greased after every 5000 operating hours, or at the
latest at yearly intervals. They can be greased until the
grease comes out from (K).

We recommend: Chevron SRI Grease 2 (see label (M)). Please
note: TR 40V is equipped with sealed for life bearings and
need no greasing.
       (Fig. III)

Blades

Model Range TR...V has six carbon blades. TR 40 V: first
check blades after 5,000 hours and then after 1,000 operating
hours. TR 60-80V: first check blades after 3,000 operating
hours and then after 500 operating hours.

Blade replacement:

Remove the end cover (c) and take out the blades (a) for
checking. All the blades in the pump should have a minimum
height (X) as follows:

Type	X (minimum height)
TR 40 V	36 mm
TR 80 V	40 mm
TR 80 V	45 mm

Before refitting blades blow out the cylinder and rotor
slots. Place the blades in the slots with the radius outwards
(Y) such that the bevel is in the direction of rotation (O)
and corresponds with the radius of the cylinder (Z). Refit
the end cover (c). Before restarting the pump check the free
movement of the blades by rotating the motor cooling fan (r),
by removing the fan cowl (l) (Fig. V).

Ⅲ

Ⅳ

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l/r

Ⓥ

a

c

Z

Y

X

0
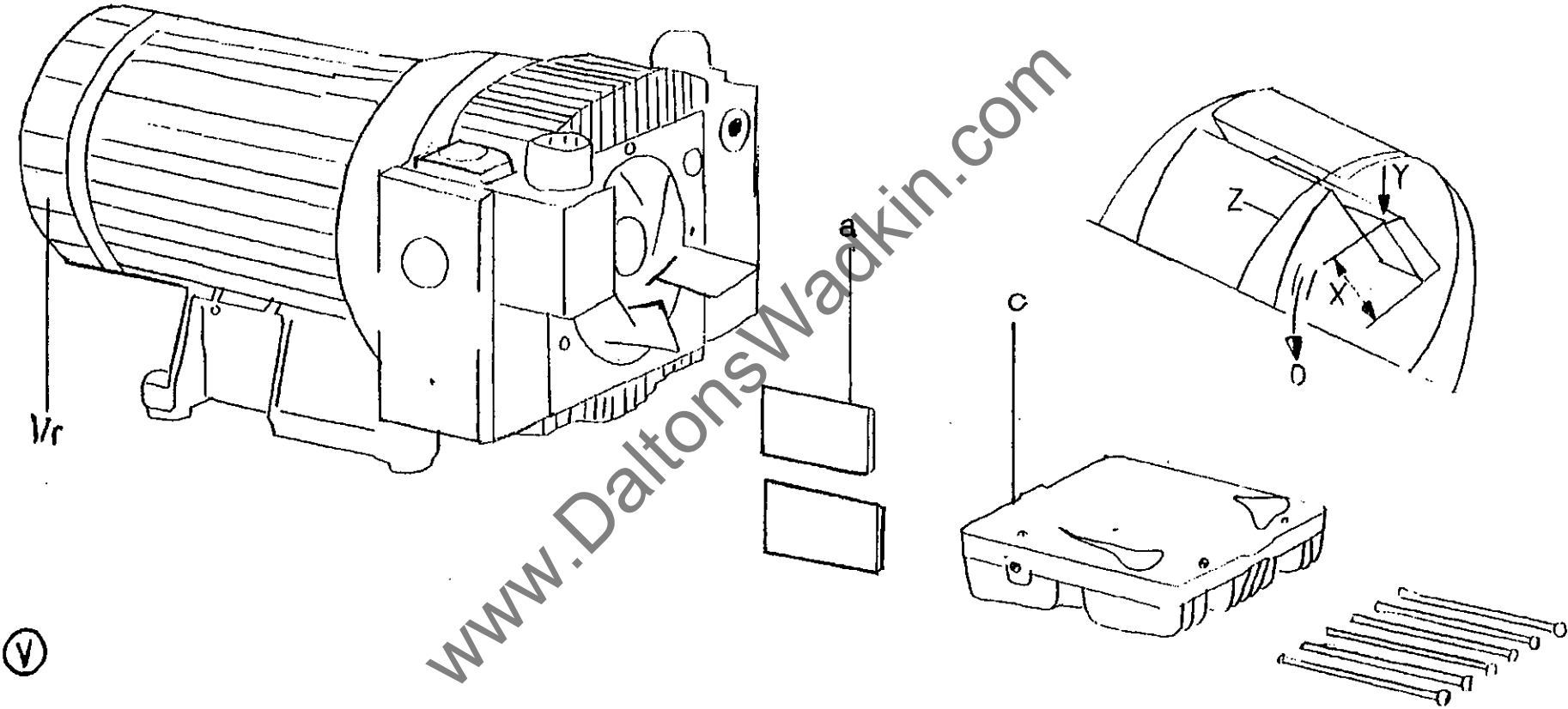
SECTION 10

ILLUSTRATED PARTS LISTS

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X-AXIS ASSEMBLY PARTS LIST

REF. NO.	DESCRIPTION	PART NO.	QUANTITY
1	'X' AXIS SCREW	C 104	1
2	TIMING BELT PULLEY	C 109	2
3	BEARING HOUSING DRIVE END	C 110	1
4	BEARING HOUSING THRUST CAP	C 111	1
5	BEARING HOUSING GREASE RETAINER	C 112	1
6	MOTOR MOUNTING PLATE	C 113	1
7	* MOTOR MOUNTING PLATE KEY	C 114	2
8	LINEAR BEARING HOUSING	C 115	4
9	CAM TRAY FOR X AXIS	C 116	1
10	BEARING HOUSING NON-DRIVE END	C 118	1
11	BEARING HOUSING PACKING PLATE	C 119	1
12	NUT HOUSING (32 MM DIA) SPEC.	C 121	1
13	NUT HOUSING PACKING PLATE	C 122	1
14	'X' RUNWAY 50 X 42 X 1666	C 125	2
15	JACKING SCREW WASHERS	C 131	6
16	* 'X' AXIS DUST EXCLUDER	C 133	2
17	HEAD FRAME JACKING SCREW	C 55	6
18	HEAD FRAME JACKING LOCKNUT	C 56	6
19	SADDLES FOR 'X' AXIS	C 137	1
20	LINEAR BEARING SHAFT 'X' AXIS	C 139	2
21	'X' AXIS APRON A011812	C 141	2
22	APRON BOX LEFT HAND	C 143	2
23	APRON BOX RIGHT HAND	C 144	2
24	BNS 519-B-Z-R-12-62-11	K7040632	2
25	SWITCH DOGS BNN 502VB 25	K7040637	3
26	TIMING BELT 240 H 100	K7018633	1
27	* BUSH 1315 X 16 MM	K7019079	1
28	* BUSH 1315 X 18 MM	K7019080	1
29	BEARING ARNB 2052	K7012565	1
30	BEARING 6303 2RS	K7012055	1
31	LOCKNUT KM 4	K7012308	2
32	LOCKNUT WASHER MB 4	K7012208	1
33	* LOCKNUT KM 3	K7012306	1
34	* LOCKNUT WASHER MB 3	K7012206	1
35	LINEAR BEARING'S SUPER-20-OPN	K7012940	4
36	* OPNS 1250	K7013180	8

* NOT SHOWN ON DRAWING
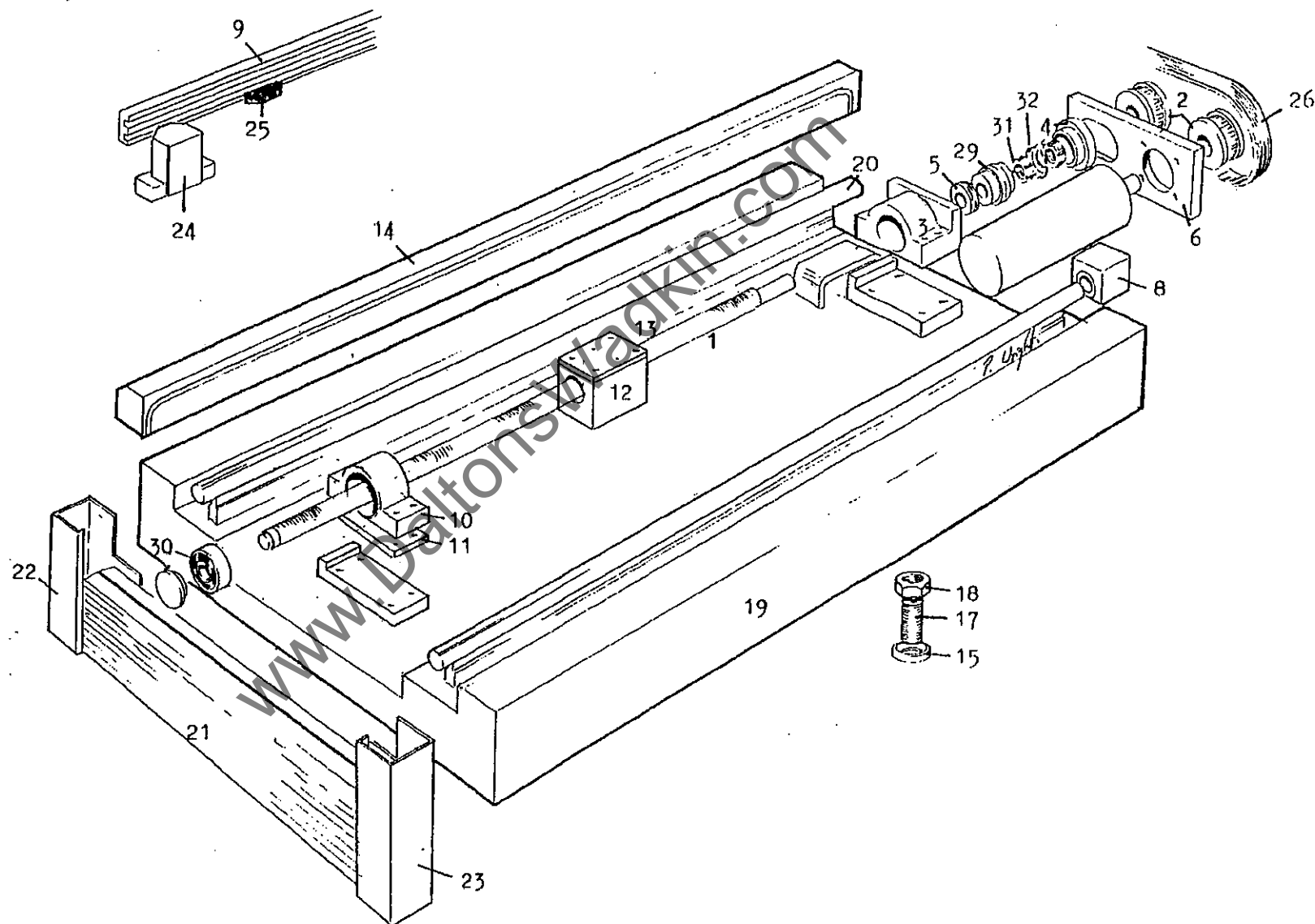
'Y' AXIS ASSEMBLY PARTS LIST

REF. NO.		DESCRIPTION	PART NO.	QUANTITY
1		'Y' AXIS SCREW	C 105	1
2		TIMING BELT PULLEY	C 109	2
3		BEARING HOUSING DRIVE END	C 110	1
4		BEARING HOUSING THRUST CAP	C 111	1
5		BEARING HOUSING GREASE RETAINER	C 112	1
6		MOTOR MOUNTING PLATE	C 113	1
7	*	MOTOR MOUNTING PLATE KEY	C 114	2
8		LINEAR BEARING HOUSING	C 115	4
9		CAM TRAY FOR 'Y' AXIS	C 117	1
10		BEARING HOUSING NON-DRIVE END	C 118	1
11		BEARING HOUSING PACKING PLATE	C 119	1
12		NUT HOUSING (32MM DIA) SPEC.	C 121	1
13		NUT HOUSING PACKING PLATE	C 122	1
14		'Y' RUNWAY 50 X 39 X 1206	C 126	2
15	*	'Y' AXIS DUST EXCLUDER	C 132	2
16		SADDLE FOR 'Y' AXIS	C 138	1
17		LINEAR BEARING SHAFT 'Y' AXIS	C 140	2
18		'Y' AXIS APRON A011911	C 142	2
19		APRON BOX LEFT HAND	C 143	2
20		APRON BOX RIGHT HAND	C 144	2
21		ALUMINIUM TABLE	C 202	1
22		VACUUM TABLE 970 X 670 X 25	C 203	1
23		T-SLOT TABLE	C 205	1
24		BNS 519-B-Z-R-12-62-11	K7040632	2
25		SWITCH DOGS BNN 502VB 25	K7040637	3
26		TIMING BELT 240 H 100	K7018633	1
27	*	BUSH 1315 X 16 MM	K7019079	1
28	*	BUSH 1315 X 18 MM	K7019080	1
29		BEARING ARNB 2052	K7012565	1
30		BEARING 6303 2RS	K7012055	1
31		LOCKNUT KM 4	K7012308	2
32		LOCKNUT WASHER KB 4	K7012208	1
33	*	LOCKNUT KM 3	K7012306	1
34	*	LOCKNUT WASHER MB 3	K7012206	1
35		LINEAR BEARING'S SUPER-20-OPN	K7012940	4
36	*	OPNS 1250	K7013180	8

* NOT SHOWN ON DRAWING

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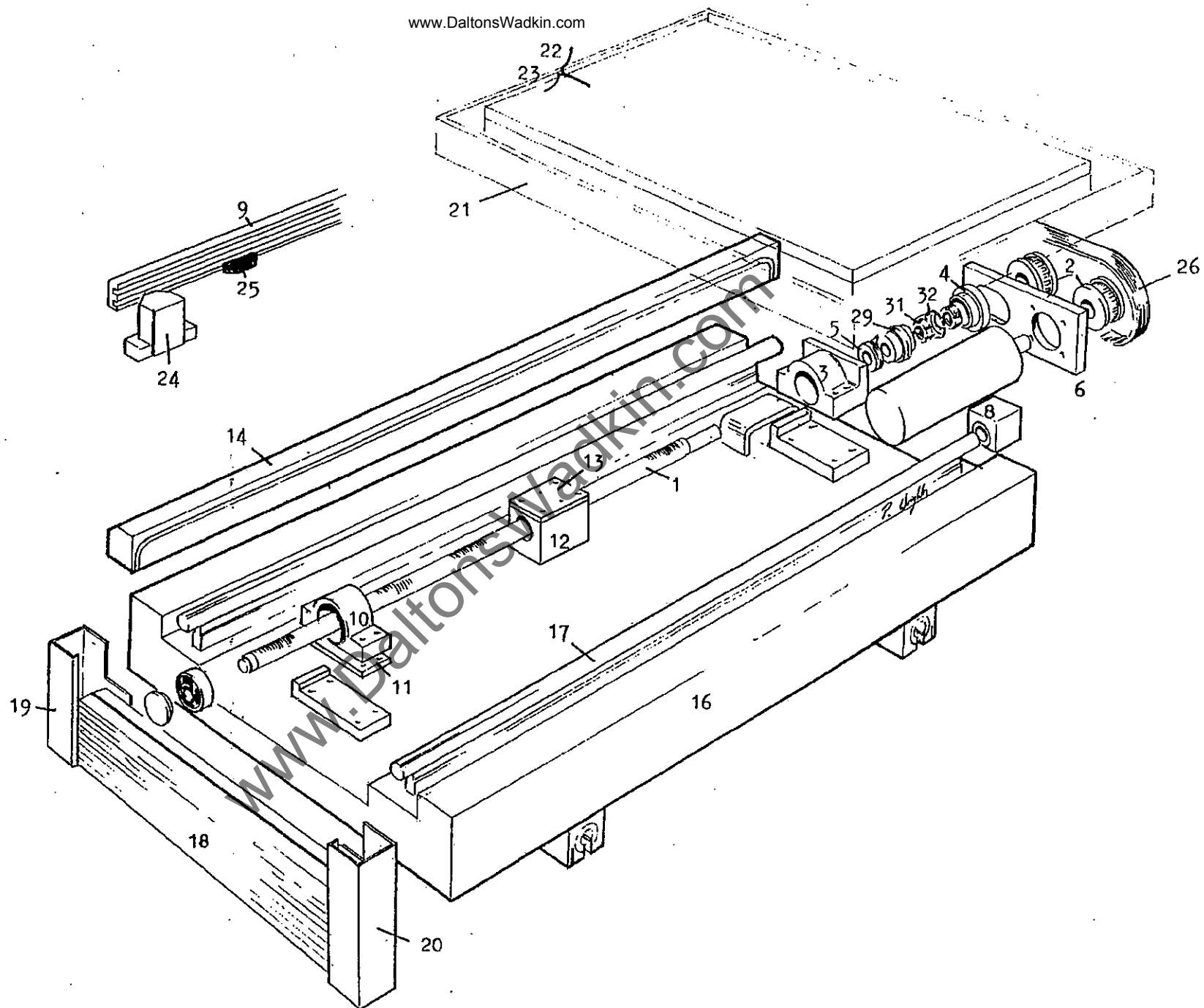
Z-AXIS ASSEMBLY PARTS LIST

REF. NO.		DESCRIPTION	PART NO.	QUANTITY
1		'Z' AXIS BALLSCREW	C 36	1
2		'Z' AXIS BEARING SPACER	C 38	1
3	*	'Z' AXIS LOCKNUT SPACER	C 39	1
4		'Z' AXIS HOUSING TOP END CAP	C 42	2
5		HEAD FRAME JACKING SCREW	C 55	4
6		HAED FRAME JACKING LOCKNUT	C 56	4
7		COUNTER BALANCE WHEEL	C 57	1
8		LINEAR BEARING SHAFT 'Z' AXIS	C 77	2
9		'Z AXIS NUT HOUSING	C 78	1
10		'Z' AXIS BEARING HOUSING	C 79	1
11		COUNTER BALANCE MOUNTING BLOCK	C 80	1
12		COUNTER BALANCE SHAFT	C 81	1
13		COUNTER BALANCE CYLINDER BLOCKS	C 82	2
14		'Z' AXIS MOTOR MOUNTING PLATE	C 84	1
15		HEAD LIMIT SWITCH CAM TRAY	C 97	1
16		JACKING SCREW WASHERS	C 131	4
17	(A)	SINGLE HEAD FRAME (IF CC 2000-S)	C 85	1
	(B)	TWIN HEAD FRAME (IF CC 2000-D)	C327	1
18		COUNTER BALANCE ADJUSTER	C 508	1
19		COUNTER BALANCE CLEVIS	C 509	1
20	*	'Z' AXIS TOP LEFT NUT SPACER	C 512	1
21		SWIVEL FOR ADJUSTER	C 513	1
22	*	BEARING RETAINING WASHER	UX 1112	1
23	*	BUSH 1315 X 18 MM	K7019080	1
24	*	BUSH 1315 X 16 MM	K7019079	1
25		TIMING BELT 240 H 100	K7018633	1
26		TIMING BELT PULLEY	UX 3148	2
27		LOCKNUT KM 4	K7012308	2
28		LOCKNUT WASHER MB 4	K7012208	1
29		7304 BEARING	K7012084	2
30		'Z' AXIS COUNTER BALANCE WIRE ROPE	C 47	1
31		ALUMINIUM SWITCH BNS 519 C4R16211	K7040635	1
32		SWITCH DOGS BNN 502VB 25	K7040637	3
33		OIL LIGHT BUSH FBM 18 X 15 MM	K7061318	2

* NOT SHOWN ON DRAWING.
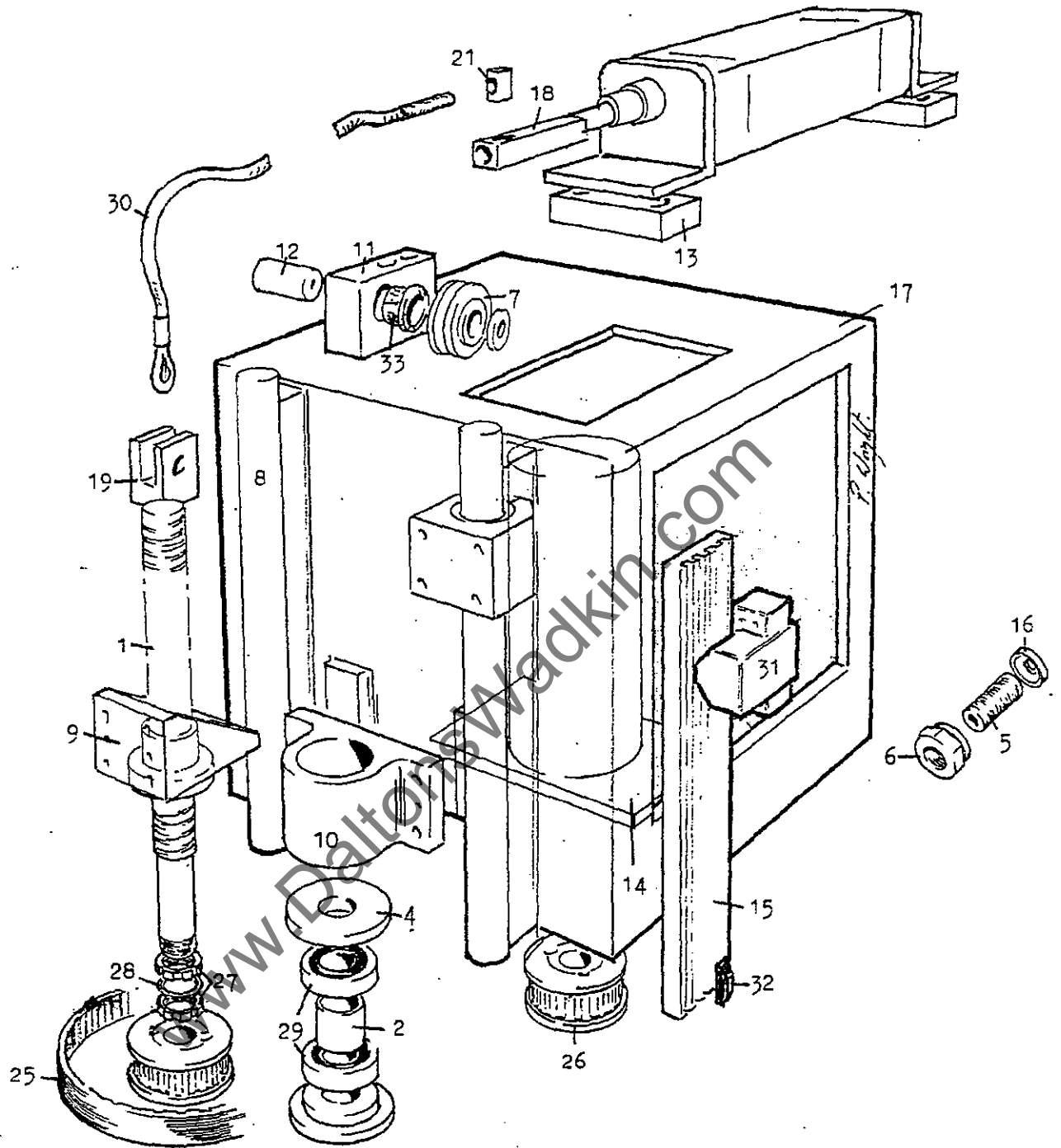
SECTION 11

RECOMMENDED SPARES

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INSTRUCTIONS WHEN ORDERING SPARE/REPLACEMENT PARTS

The undermentioned information should be given with all orders requesting spare/replacement parts.

(i)   Machine type.

(ii)   Machine serial number

(iii)   Part number of required parts, as stated in the instruction manual.

(iv)   If no manual available, as full a description as possible of the required part including location within the machine.

(v)   Order number and full company address.

(vi)   Company account number with Wadkin, if known.

(vii)   All telephone orders must be followed by an official order, clearly marked 'Confirmation Order'.

RECOMMENDED MECHANICAL SPARES

QUANTITY	DESCRIPTION	PART NO.
1	X OR Y AXIS TIMING BELT	
1	Z AXIS TIMING BELT	
1	BALLSCREW DRIVE END BEARING	
1	BALLSCREW FLOAT END BEARING	
2	TAB LOCKING WASHERS D.E.	
2	TAB LOCKING WASHERS F.E.	
4	LINEAR BEARINGS	
1	SOLENOID VALVE	
1	GLASS FILTER JAR	
1	VACUUM PUMP SERVICE KIT (FOR GAS PUMP ONLY) (COMPRISES 4 VANES 1 MAIN BODY GASKET 2 BEARINGS 2 FILTERS)	K350

RECOMMENDED ELECTRICAL SPARES

QUANTITY	DESCRIPTION	PART NO.
1	FUSE PACK (3 OF EACH SIZE OF FUSE)	FP CC 2000
2	LED INDICATORS	*
1	CONTACTOR	K7040143
1	CONTACTOR	K7040210
1	CONTACTOR	LC1-D258-A65
1	OVERLOAD UNITS	K7040225
1	OVERLOAD UNITS	K7040215
1	OVERLOAD UNITS (CC2000-D ONLY)	K7040230
1	11 PIN 110V AC RELAY	*
1	11 PIN BASE	K7024893
1 SET	CHANGER BRUSHES	*
1 SET	SERVO MOTOR BRUSHES	*
1 SET	TACHO BRUSHES	*
1	3 PHASE SUPPRESSOR	K7030665
1	1 PHASE SUPPRESSOR	K7030565
1	INDICATOR HOLDERS	S1-040-005

For items marked * please quote description and machine model and serial number when ordering these items.

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