ABEM

Instruction Manual

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ABEM TERRALOC MARK 3 SYSTEM

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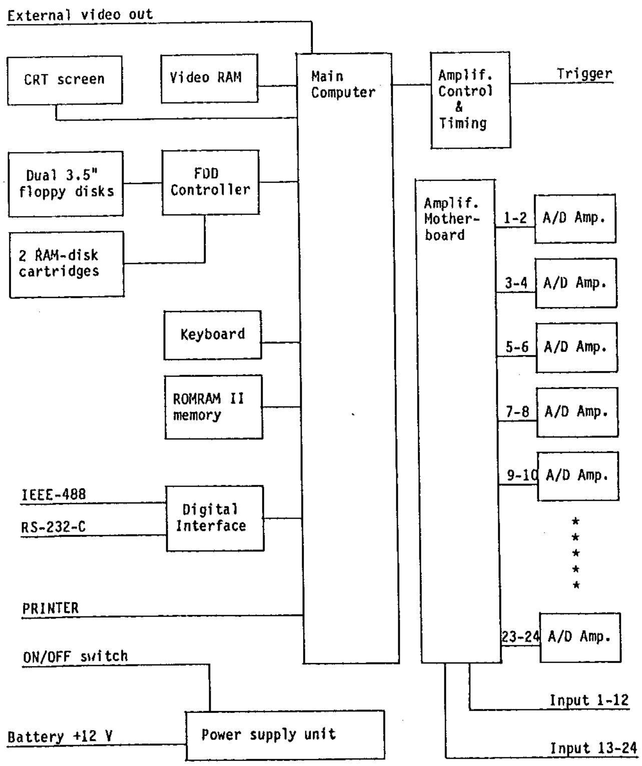
This service manual contains a technical description of the design and operation of the ABEM TERRALOC Mark 2 Seismograph.

The manual is devided into sections containing descriptions on the different main system components and the individual circuit boards themselves. At the end of the manual there is a section containing circuit diagrams and components placement drawings.

SERVICE MANUAL



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INDEX TO THE TERRALOC Mark 3 Service Manual

1. GENERAL

This service manual contains a technical description of the design and operation of the ABEM TERRALOC Mark 3 Seismograph.

The descriptions and drawings in this manual are checked to be accurate at the time of writing. There may however still be inaccuracies that have escaped our thorough review. Futhermore there may also be differences between this manual and the actual hardware delivered due to design changes made after printing this manual. If you have any problems while servicing a TERRALOC please contact ABEM either direct or via our representative. We will then do our best to help you.

The manual is divided into sections containing descriptions on the different main system components and the individual circuit boards themselves. At the end of the manual there is a section containing circuit diagrams and component placement drawings.

2. THE TERRALOC Mark 3 SEISMOGRAPH

2.1 SYSTEM DESCRIPTION

The TERRALOC seismograph combines in a single unit the following main parts: (see block diagram in Fig. 2.1-1)

- Microcomputer for instrument control and processing
- Memory unit with program memory and stack memory
- Video RAM unit with CRT controller and memory
- CRT video display
- Dual channel seismic amplifiers with A/D-converter and memory
- Amplifier control unit with delay timer and data aquisition control circuits
- Floppy disk and RAM disk controller unit
- Digital data storage on 3.5" floppy disks or RAM disks
- Power supply
- Digital interface unit for communication with external computers
- Keyboard for operator control

When a measurement is made the signals from the geophones are amplified and digitized in the seismic amplifiers. The sampling process is controlled by the amplifier control unit which has previously been set up for the proper timing by the computer. After all samples have been collected and stored in the memory on the amplifier units the computer reads all channels down into the stack memory. The stack is located in the RAM part of the ROMRAM memory unit.

When display of traces is requested the computer will process the selected traces in the stack memory according to the display mode set by the operator. (Enhance, Average, Normalize and AGC.) The result of the calculation is stored in the now idle RAM memory on the amplifier units which act as display buffers. Then a graphic program transforms the signals into visible traces by calculating which bits to set in the Video RAM memory. This memory area is continuously displayed on the CRT monitor in a bit mapped 512x256 pixels format.

When the RECORD key is pressed a program is initiated that stores all menu variables and stack content on the selected disk drive.

To enable communication with an external computer there is a digital interface unit. With this the electrical interface for both RS-232C and IEEE-488 standards are accomplished.

All operator communication is processed through the front panel keyboard which is decoded by circuitry on the computer board.

To supply power for the seismograph a power unit is included that transforms the battery voltage into the different system voltages needed for operation. Also located on the power unit is a digital voltmeter circuit which monitors the voltages so that the computer can warn the operator of the need for battery recharge.

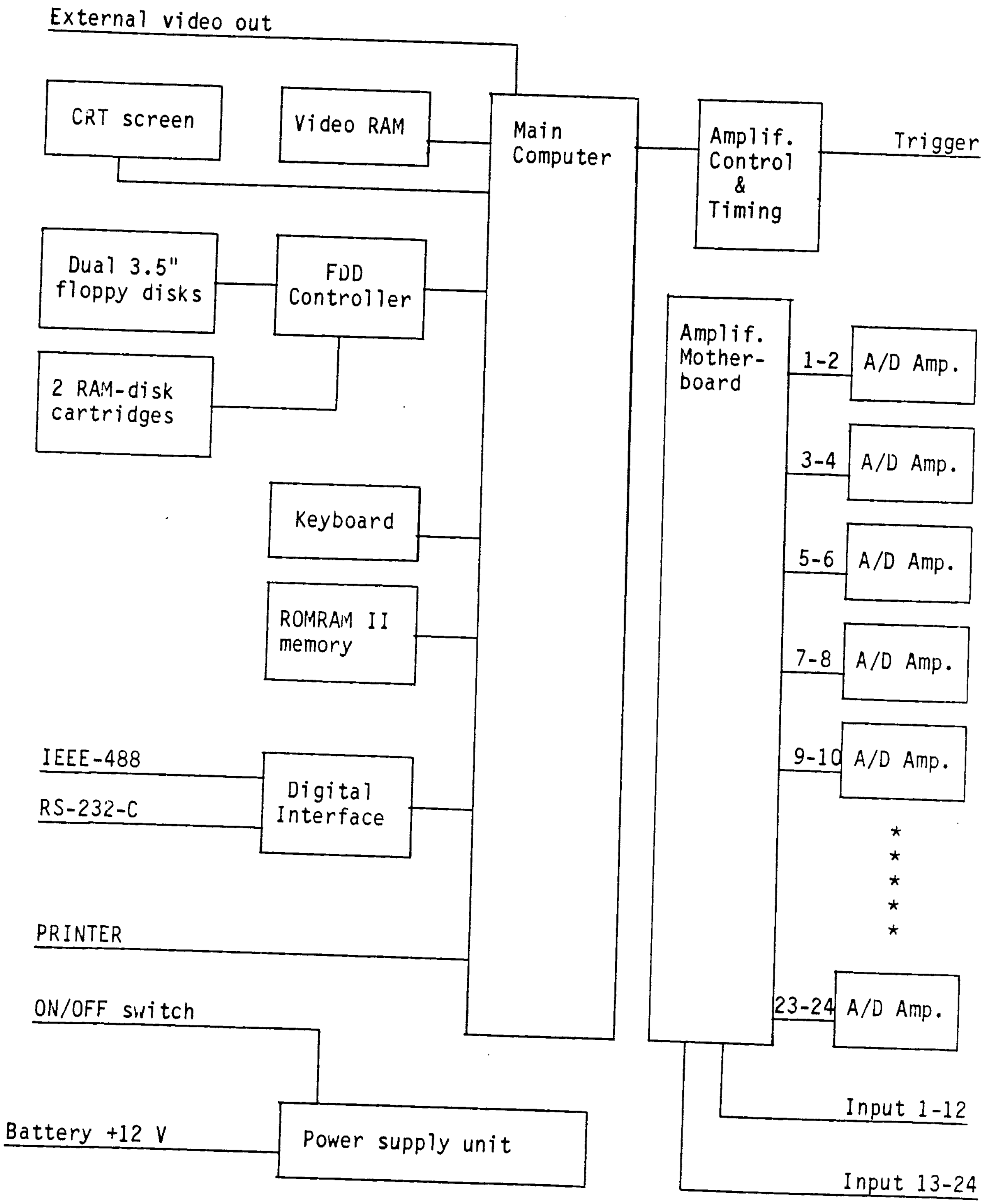


Fig. 2.1-1 Block diagram showing the TERRALOC electronics.

2.2 CIRCUIT DESCRIPTIONS

This section contains technical descriptions of all circuit boards with explanations on their design and operation.

2.2.1 MAIN COMPUTER

The TERRALOC computer is built around an MC68B09 microprocessor (U28) running at a frequency of 1.23 MHz. This is obtained from a 12.6608 MHz clock oscillator via divider U29. The addresses and data are buffered by circuits U25-U27. The control signals E, Q and R/W are buffered by U24 and a signal called VMA is generated as the logic OR of E and Q.

On the main computer board there is a bus area with four slots for the ROMRAM, VIDEO RAM, FLOPPY DISK INTERFACE and DIGITAL INTERFACE units. To these slots the whole computer bus is connected as well as a few special select signals for the different units.

The peripherals on the board are used as follows:

- Keyboard encoder U8, code converter ROM U9 and port A of VIA U7 transfer the keyboard entries to the computer.
- Port B of VIA U7 transmits data to the TERRALOC printer
- The timer section of VIA 120 is used as the operating system real time clock generator. It is transmitted to the processor over the IRQ line. The pulse frequency is 100 Hz.
- VIA U4 is used mainly to read the quarz calendar clock U3 but some spare pins are also used for the watchdog clock, BUSY input, VIDEO ENABLE signal and to output the beep signal over transistor Q1. It also supplies the control signal to switch off the CRT monitor during disk operations and to switch the printer on and off.
- PPI U2 is used for amplifier control signals and power supply control (port A). Port B is used for bank switching of the system memory map and port C reads voltage values from the power supply digital voltmeter.

Also on the computer board is a battery backed CMOS RAM (U16) for storage of user entered settings and a multiply/divide mathematics IC (U10). This unit speeds computations considerably for divide operations.

The power-down monitor consists of transistor Q3 with zener diode D8 connected to its base. It will guarantee that the RAM U16 cannot be accessed if the main power is less than 4.3 volts or if a reset signal is given.

A watchdog circuit is included on the computer board. It is built around oscillator/counter U13 and will cause a nonmaskable interrupt if it is not pulsed at least every 6 seconds. During normal program execution this will always be the case but if something fails this circuit will restart the computer within 6 seconds.

A small relay will start the TERRALOC field printer whenever a print operation is requested. The relay is operated from bit 7 of VIA U4 port B (pin 17).

2.2.2 ROMRAM II MEMORY UNIT

On this cicuit board the main memory functions of the TERRALOC system are located.

The ROM portion consists of six 8K EPROM:s for a total of 44K code space. They are selected on addresses $4000 to $7FFF and $9000 to $FFFF. The lower range is bank switched at the same addresses as the video RAM. Within a 256 byte segment from $EF00 to $EFFF the EPROM:s are deselected since this address space is used for the peripheral circuits. The RAM portion is 64 kbytes addressed in seven banks of 8 kbytes each from address $2000 to $3FFF. In address space $0000 to $1FFF bank 0 is always accessible and is used to hold the operating system variables. It is built with 64kx1 dynamic RAM:s using the E low part of the machine cycle for hidden refresh. The timing (delays RAS-MX-CAS) is controlled by RC delays.
The ROM portion may also be equipped with 16 k EPROMS (27128). Selection between the types is done with switch 700/1-8.

2.2.3 VIDEO RAM UNIT

This unit consists of a 16 kbytes RAM bank built with 16kx1 dynamic RAM:s and a CRT controller (410) with associated LSTTL circuits.

The RAM content is mapped by the CRTC (410) into a 512 bits by 256 rows image area on a standard video signal (European standard: 312 lines 50 Hz field rate). Available as outputs are 1 V composite positive video, TTL level video and sync and also horizontal and vertical drive signals.

The RAM is accessed by the CRTC during processor E low time. During E high time the processor has access to the memory for write or read operations when needed. The RAMs are refreshed by the continuous access from the CRTC.

2.2.4 INPUT AMPLIFIER

The amplifier unit consists of two indentical sections on each board. Each will handle one channel. The components in channel 1 use 100-numbers and channel 2 uses 200-numbers. Channel 1 is described below, substitute 2XX for 1XX to get the correct component for channel 2.

The signals are passed through isolating transformers to a preamplifier with a gain that can be set at 0 dB or 30 dB by FET switches.

The amplified signals are filtered in a low-cut active filter. The cutoff frequency of the filter can be set at 8 different values by paralleling the frequency setting resistors in different combinations using the analog switches U102, U103 and U104. The base frequency of the filter is 50 Hz and this can be raised in steps of 50 Hz to a maximum of 400 Hz when all resistors are parelleled.

Both preamplification and filtering is performed by the dual op amplifier U101. The filtered and unfiltered signals are applied to the analog selector U107 where the filter selection is made.

After the selector follows two gain stages built around op amplifiers U105 and U107. Their gains are controlled in binary steps by the analog selectors U106 and U109 which select the proper feedback voltage from an R-2R ladder network.

To enable testing of the gain steps of the second gain stage the first stage can be forced to a gain of 1 by shorting pins P101 together with a jumper.

After the second gain stage there is a bandwidth limiting filter consisting of RC combination R125 and C102. The cut-off frequency is about 2000 Hz (high cut). This filter reduces high frequency noise and acts as a gentle anti-alias filter.

The filter is followed by a track-and-hold circuit with a gain of two consisting of analog selector U107, hold capacitor C110 and MOS operational amplifier U110. The gain of the amplifier can be calibrated in this stage using trimpot R134 which gives a 10 % control range.

The amplifier signals are then fed to the analog-to-digital converter U111 which produces an offset binary output code with a conversion time of 16 us. The A/D converter is externally clocked. The clock signal is enabled by the busy signal from the converter through the buffer U3.

The system offset is zero trimmed using the trimpot R131 from the positive reference voltage +Vref, nominally at 8.5 volts. The negative reference -Vref is nominally at 8.0 volts.

The conversion sequence is governed by external signals CS1, CS2, CSRAM, RDAD and ADCLOCK. After a conversion is complete (both converters operating in parallel) the data is read from each converter in succession into the memory U4. The memory contents can be read by the computer via buffer U5 if SELECT and ABUF are both low.

To control the gain of the amplifier and to select the analog filter frequency, the computer can store control words in the control latches U113 and U213 which are reset to zero at power-up (lowest gain and no filter selected). Note that U213 controls the filter frequency selection bits FS0 to FS2 and that selection of the filter is made by U113 for both channels (FILTER ON).

2.2.4.1 ADJUSTING THE AMPLIFIER OFFSETS

If the amplifier offsets are too high at power-on the TERRALOC computer will detect this and display a warning message on menu 0 indicating the faulty amplifiers with asterisks (*). This check is done by computing the average signal in the amplifiers with the gains set to zero. The average must be within +/- 2 bits from zero if the amplifier is to pass the test.
Note however that this offset level may still be too high for stacking so the offset adjustment described below should be performed if the display on menu 2 shows offset errors.

The amplifiers in the TERRALOC are zeroed with the 20 turn trimpots accessible through holes in the cover lid of the amplifier box in the back of the instrument. Turn the power on and set all amplifier gains at 00. Do <u>not</u> connect anything to the input connectors. Watching menu 2 you can adjust any amplifier that displays a noise level bar so that the bar disappears into the zero line. Turn the trimpot clockwise and continue about 5 degrees after the bar has disappeared.

It is important that this adjustment is done carefully since any residual offset value will cause the traces to wander about the screen when in the enhance mode. The offset is always added to the signal with the same polarity and so never cancels out.

2.2.5 AMPLIFIER CONTROL UNIT WITH TRIGGER AND TIMING CIRCUITS

This unit acts as an interface between the seismic amplifiers (up to 12 of them) and the TERRALOC computer.

It will receive and process the trigger pulse. There are three inputs for the trigger to this unit on connector 1020.

The tone detector input is routed via a limiting amplifier (400) over a zero crossing detector (200) to a missing pulse detector (timer 410). This detector is kept triggered by an input tone of 2000Hz. If a positive zero crossing is missing for more than 600 us the detector times out and the output returns to 0V. This transition is fed into the trigger detector circuits over capacitor 690.

The geophone and switch inputs are similar but with different gains in the following amplifier. The switch input is also supplied with a +5V bias over a 1 Kohm resistor.

Any input signal is amplified and full wave rectified by the following two operational amplifiers (400). The last amplifier 400 is connected as a schmitt trigger which has an input trip voltage set by resistors 870 and 850 to about -50mV. Hysteresis is about 5mV.

When the schmitt trigger trips it will clear flip-flop 210 provided it was set (armed) by the computer. This causes the reset signal to disappear from counters 130 and 360 which start counting the clock frequency of 1MHz generated by the freerunning counter 360. It is fed with 4MHz from an oscillator formed by an inverter and a crystal (600).

The clock frequencies produced are 500 kHz and 5 kHz which are fed to the programmable timer 110 to give the time reference for the delay timeout (section 1 of the timer) and the sampling interval timeout (section 2 of the timer).

After the delay has timed out the sampling frequency section outputs a square wave of the right frequency as programmed by the computer. Each positive transition will initiate the conversion process where a sample of the signal is taken and digitized. The conversions are counted by timer section 3 and after a predetermined number of samples have been taken (1000) the timer will output a pulse that will set flip-flop 210 to end the whole sequence.

The timing of one conversion is determined by the shift registers 170 and counters 150 with associated gates. After initiation of a conversion a hold command is given and after 4 us a conversion is started by simultaneously pulsing CS1 and CS2 low when RDAD is high. 16 clock cycles are output as ADCLOCK for the A/D circuits on the seismic amplifier units. The sequence is ended by pulsing CS1 and CS2 low in succession with RDAD low. This will write the converted signal values from the A/D converters into the memory on the amplifier boards.

The addresses for storage in the memory are counted up from zero in counter 160 and applied to the amplifier address bus during the RDAD low time. At all other times the ordinary computer addresses A0-A10 are applied to the bus. To enable computer control of the sampling process the inputs CONV, MPUTRG and TRGBLK are connected to an output port IC and the BUSY signal to an input port. The signals have the following functions:

CONV — if pulsed high will cause one conversion to be made.

MPUTRG — can trigger a complete recording, it will use all circuitry for trig detection. This function is used during the self test sequence.

TRGBLK — inhibits recognition of a trig signal if high. It must be pulsed high between each shot.

BUSY — indicates that a recording is in progress.

When the collected data are to be read by the computer it will issue a select code S0-S3 to select one amplifier board for computer communication. The code is translated by decoders 340-350 into a select signal fed to one of the twelve amplifiers AS0-AS11).

2.2.6 FLOPPY AND RAM DISK CONTROLLER

The FDD-RAM interface consists of 2 sections: FDD-interface and RAM-control.

Tne FDD section uses an LSI Controller/Formatter 2797 (U11) which includes controller, write precompensation and analog phase lock loop. A Buffer memory 8k x 8 bytes (U12) stores the data that is to be transferred between the controller and the computer.

The floppy disk drive uses 3.5" DS-DD diskettes. Data are written according to standard MS-DOS format and each disk can store 720 kbytes.
7 kbytes is used for administration of data which leaves 713 kbytes of seismic data storage.

Drive control is obtained via registers U4, U3 and registers in U11. These registers are either written to or read by the computer.

The registers are:

CMD (U4): Command register. Address $EFA0

bit	0	WRWM:	disables OE on RWM U12
	1	RES:	resets address counters U7, U8
	2	WRSE:	enables automatic read from RWM (U12) into (U11) for write on disk
	3	RESE:	enables automatic write into RWM from (U11) during disk read
	4	DS0:	Drive select 0
	5	DS0:	" 1
	6	DS2:	" 2 RAM unit 1
	7	DS3:	" 3 RAM unit 2

STAT (U3): Status register. Address $EFA4

bit 0	IRQ:	Interrupt request from controller after completed command
1	RET:	Return signal from selected RAM unit.
		0: Selected UNIT responds
		1: No response from unit i.e. no unit inserted

U11 contains 5 registers

STCMD: Status/command register. Address $EFAC
Command when written, STATUS when read

TREG: Track register. Address $EFAD
Contains current track number. TREG is automatically incremented and decremented by the controller

SEREG: SECTOR register. Address $EFAE
Contains current sector no.

DREG: DATA register. Address $EFAF
Contains the byte to be written to disk or the byte read from disk

When the controller is given a command it will complete it without the assistance of the computer.

The operations performed are:

Read sector	from disk to buffer
Write sector	from buffer to disk
Write track	from buffer to disk
Seek track	move head to selected track
Restore	Move head to track zero

The DRQ signal goes high when assembled data is present in the data register (DREG). This also means that data has to be read within one byte time 4us. Instead of forcing the computer to service the controller the DRQ signal itself generates a read pulse.

When the DRQ signal goes high it is clocked through a two-stage shift register U22 using the E system clock.

The select pulse AE for RWM U12 is produced in gate U15/10. When AE goes low it increments the address counter. AE disables the A0 and A1 input buffer thus selecting the FDC data register since pull-up resistors set A0 and A1 high.

If the command is a read command a FDC read pulse is also produced to read the data register of the controller. This resets the DRQ signal.

The read pulse is formed into a WE signal to the RWM in gates U16 and U15. The data just read from the data register of the FDC is then written into memory.

When the last byte has been transferred from the disk sector the INTRQ signal goes high signalling to the computer on the STAT reg bit 0 that the command is completed.

The computer now reads the status register checking for errors and can either read the data from the memory or give another command to the controller.

Write commands are processed similarly with the exception that the RWM memory is loades with data first.

If the DRQ is not serviced in time the Data Lost bit is set in the status register. When this happens an error message "Interface error" indicates that there is a hardware error on the FDD-RAM interface.

The RAM-control section contains only an address selector (U6) and a busdriver (U2).

The select signals are:

BS: Bank select. Address $EF90
Data is written into reg U3 on the RAM Control Module. Selects memory chip (M0-M22)
Write only

HIA: Hi Address. Address $EF91
Data is written into reg U2 on RAM Control Module. Sets Address (A9-A14)
Write only

DATA: Data. Address $EF92
DATA increments counter and enables OE when Read and WE when Write. Data values are read from or written to the RAM disk on this address.

CR: Counter Reset. Address $EF93
CR pulse resets address counter

2.2.6.1 ADJUSTING THE FDD CONTROLLER

For correct operation the floppy disk controller hardware must be adjusted. This is done at ABEM but following a repair it may be neccessary to perform in the field.

Controller adjustment procedure:
(Bare board connected to +5 V and ground)

1. Turn on power
2. Strobe reset
3. Connect a jumper between pins 4 and 5 on P6
4. Adjust the write pulse width (WPW) on P6 pin 1 with R4 to the desired precompensation value (300 ns)
5. Adjust the read pulse width (RPW) on P6 pin 2 with R3 to the desired value (500 ns)
6. Adjust the data rate frequency on P6 pin 3 with capacitor C24 to 250 kHz
7. Remove the jumper on P6

All internal timing in the controller is based on the 4 MHz crystal X1 divided down to 1 MHz. The frequency can be observed on P11 and must be +1% accurate.

2.2.7 TERRALOC RAM DISK

The RAM disk consists of two circuit boards. One contains the 23 RAM IC:s and a capacitor. The other contains all the necessary logic circuits. The two boards are plugged together on top of each other using two rows of pins and sockets along the board edges.

The RAM board connects all 23 RAM IC:s together pin wise in parallel except for the chip select signals (CS0-CS22) which are brought out separately.

The logic board contains an address counter (U1) for sequentially addressing of 512 bytes of RAM (one sector). This counter is reset with the signal "CR" from the floppy and RAM disk controller board (2.2.6). It is incremented by pulses on the DATA line which appear each time a write or read is performed on the RAM disk.

The RAM circuits are selected for I/O by a bank select word loaded into U3 (6 bits). The selection is made via three octal decoders U4-U6 and brought out to the RAM array board via connector P2.

Each RAM IC will hold 64 sectors of data (32 kbytes). Sector selection within a RAM IC is made with a high address word (6 bits) loaded into U2 and brought to the RAM board on connector row P1.

Which of the two RAM disks that will respond for I/O is determined by the select signals SEL1 and SEL2 and (X). The X line is set high by the Floppy and RAM disk controller board but the cable carrying this signal is cut between RAM disk 1 and 2 so that on disk 1 X is high and on disk 2 X is pulled low by R1. The X level is compared to the SEL1 and SEL2 lines by gates U7 and U8. SEL1 selects the disk with X low. Whenever the disk is selected the select LED D7 lights up. It is visible through the front panel label on the RAM disk cartridge.

Power for normal operation of the RAM disk is supplied by the computer via diode D6. Standby power for data retention is supplied from a bank of four Lithium batteries (Z1-Z4) each provided with a protection diode.

In standby mode the RAM disk power drain is so low that the batteries will last for several years or even decades.

2.2.8 POWER SUPPLY

The TERRALOC Power Unit converts the input voltage from the external battery to the system voltages needed internally.

On the power unit board there is on/off circuitry (U1, Q1, Q2 etc.) which is powered from the on/off switch on the front panel. When switched on this circuitry checks the voltage and polarity of the battery and if correct (range 8-20 Volts, positive) the power relay is operated.
If for some reason the voltage checking circuitry should fail it can be bypassed by a jumper (P21).

When the power relay is activated three DC/DC converters are started. The first is built around IC U2 and supplies the +5V logic voltage. The other two are built with IC:s U4 and U9, drive transistors, transformers and output rectifiers. They supply all other voltages.

The U4 converter generates +13V (Vmon) for the CRT monitor, floppy disk drive and digital interface, -5V for the trig reception amplifier and -12V for the keyboard encoder and digital interface. It is feedback stabilized and adjusted with trim potentiometer R45. The secondary voltages -5 and -12 volts are set by IC regulators U3 and U5 respectively, and are not adjustable.

The U9 converter is used to generate the voltages needed for the amplifier section of TERRALOC (+12V, -12V, $+V_{ref}$ and $-V_{ref}$). The voltages are stabilized with IC regulators U10 and U11 (+/- 12 V). To minimize power dissipation in the regulators the converter secondary voltage is set with trim pot R49 to a value of 14.5 V.
For +/- V_{ref} special circuitry is built around op amplifier U13. The reference voltages are adjusted with R67 ($+V_{ref}$) and R68 ($-V_{ref}$). Nominal voltages are +8.5 V and -8.0 V.

In order to check the values of all these voltages a DVM circuit is included on the board. It is read by the computer and the voltage values are displayed on menu 5. It consists of analog selector U14 and A/D converter U15. The voltages to be measured are conditioned by resistive dividers to give a DVM range of 20 V.

The computer can select any voltage by driving the proper selecter address lines. This causes the selected voltage to be applied to the A/D input. After conversion the value is held during the computer read process by means of the "Hold" signal (U15 pin 6) from the computer. The voltage value is output one digit at a time in BCD coded format on the lines V0-V3 and at the same time one of the digit select lines MSD, NSD or LSD is activated (=0V).

2.2.8.1 POWER SUPPLY ADJUSTMENTS

The voltage measuring A/D converter is adjusted with potentiometers R74 (zero offset) and R75 (full scale gain). The adjustment is made in the following sequence with the CRT displaying menu 5 where all measured voltages are shown:

1. Short circuit test pins P22.
2. Connect a DVM across test pins Vbat (TP1) and GND.
3. Adjust the zero pot R74 until voltage No. 1 on menu 5 reads 0.0.
4. Adjust the gain pot R75 until the battery voltage on menu 5 reads equal to the voltage measured by the DVM.
5. Remove the short circuit and the DVM.

To assist in troubleshooting the power unit a check circuit consisting of comparators U6 and U7 driving LED D5-D12 is included on the board. If you push the test button S3 the LEDS will light up if all voltages are above a preset limit which is about 90% of nominal. Each LED corresponds to a certain voltage, which is labelled on the board adjacent to the LED and a test pin for that voltage.

The voltages can be adjusted using the following trim pots:

Voltage	trimmer	adjust to
+5 V	R150	+ 5.2 V
V_{mon}	R45	+13.0 V
V_{analog}	R49	+14.5 V
$+V_{ref}$	R67	+ 8.5 V
$+V_{ref}$	R68	- 8.0 V

2.2.9 DIGITAL INTERFACE UNIT (IEEE 488 / RS232C)

The digital interface unit consists of two sections, one for RS 232C serial communication and one for IEEE-488 parallel bus communication.

The RS232C section uses an ACIA with built-in baude rate generator (pos 350). The baudrate and transmission parameters are set by the computer via information entered on menu 5. Data Set Ready and Data Carrier Detect signals can be disconnected using switch 125.

Data flow control is provided by the flip-flop (310) which is set false when TERRALOC is not ready to receive data on the serial interface. If high speed transfers (4800 baud and above) are required the RS232C cable has to include this signal and the computer has to observe the status of the line before transmitting the data.

The IEEE-488 section uses an LSI integrated circuit (360) for most of the interface logic functions. The outputs and inputs to the bus circuit are buffered by the buffer circuits 270, 280. Talker/listener addresses are set by the computer via menu 5.

2.3 DISASSEMBLING THE TERRALOC

Before any attempt is made to remove some part of the TERRALOC seismograph the following descriptions of how to access the inner parts of the instrument should be carefully studied. Refer also to figure 2.3-1 showing the position of the different parts.

2.3.1 ACCESSING THE AMPLIFIER BOARDS

The seismic amplifiers are located inside a black metal box in the TERRALOC. To get there the followin steps shall be followed:

1 Remove the instrument box lid (12 hex screws).

2 Remove the top lid of the amplifier box (7 M3 Phillips screws). NOTE: Be careful not to drop any screw into the instrument!

3 The amplifier boards are inserted according to the print on the lid with 2 channels per board. They can be pulled straight up and removed.

2.3.2 ACCESSING THE COMPUTER PERIPHERAL BOARDS

The peripheral boards are located in a small crate on the main computer board in the TERRALOC. In this crate you will find the following four boards:

ROMRAM MEMORY	This board contains the system RAM and the programs running the TERRALOC. Whenever you receive a software update from ABEM you will have to insert the PROM circuits on this board.
VIDEO RAM	This board contains the video controller and the graphic memory for the display.
FDD INTERFACE	This is the board controlling the operation of the disk drive and RAM disks.
DIGITAL INTERFACE	This board is the communication gateway for the TERRALOC to an external computer.

As an example, to access the Digital Interface Board the following steps shall be followed:

1 Remove the instrument box cover (12 hex screws).

2 Remove the two clamp retainers from the crate top by loosening the 4 screws. NOTE: The screws need not be removed completely.

3 Remove the 26 pole flat cable from the Digital Interface board (located closest to the instrument box wall).

4 Pull the board up from the crate. Be careful not to damage the remaining flat cable.

5 Remove the 10 pole flat cable from the board.

To reassemble the unit, proceed in the opposite order.

2.3.3 REPLACING A DISK DRIVE

If a disk drive has to be replaced the operation is fairly easy to do if the following steps are observed:

1 Remove the instrument box lid (12 hex screws).

2 Remove the two clamp retainers from the circuit board crate top by loosening the 4 screws. NOTE: The screws need not be removed completely.

3 Disconnect the 10 pole flat cable going from the front panel to P2 on the power supply board.

4 Disconnect the 2 flat cables from the Floppy disk interface board (third board from the left).

5 Remove the 8 hex screws holding the front cover to the instrument box.

6 Carefully lift the front cover off the box. LIFT ONLY SOME 50 TO 80 mm SO THAT THE CABLES ARE NOT DAMAGED INSIDE.

7 Disconnect the keyboard cable from the main computer board.

8 The front is now free to be completely removed. Place it face down on a work table.

9 Remove the wide flat cable from both disk drives. Note the connector polarity and the cable direction.

10 Remove the narrow (4-pole) flat cable (power) from the drive to be replaced. Be careful not to damage the cable or the drive, this connector is latched and must be worked loose by the use of a narrow screwdriver before removal.

11 Unscrew the 4 screws holding the disk drive to the disk drive chassis. Pull the drive out.

12 Fasten the new drive with the four screws to the chassis.

13 Reassemble the TERRALOC by repeating the above steps in reverse order.

2.3.4 REMOVING THE INTERNAL CHASSIS FOR SERVICE

When the need arises for service of some other part of the TERRALOC than the plug-in printed circuit boards the chassis must be removed from the instrument box. This can be done following the steps below but is not recommended for an inexperienced operator. Damage done to the instrument while dismantling the TERRALOC is not covered by any guarantee or warranty from ABEM.

1 Remove the instrument box lid (12 hex screws).

2 Remove the two clamp retainers from the circuit board crate top by loosening the 4 screws. NOTE: The screws need not be removed completely.

3 Disconnect the 10 pole flat cable going from the front panel to P2 on the power supply board.

4 Disconnect the 2 flat cables from the Floppy disk interface board (third board from the left).

5 Remove the 26 pole flat cable from the Digital Interface board (located closest to the instrument box wall).

6 Pull the Digital Interface board up from the crate. Be careful not to damage the remaining flat cable.

7 Remove the 10 pole flat cable from the Digital Interface board.

8 Reinsert the Digital Interface board in the crate.

9 Remove the top lid of the amplifier box (7 M3 Phillips screws). NOTE: Be careful not to drop any screw into the instrument!

10 Pull up the Amplifier Control board (located closest to the power supply board) and remove the 10 pole flat cable. Reinsert the board.

11 Remove the 8 hex screws holding the front cover to the instrument box.

12 Carefully lift the front cover off the box. LIFT ONLY SOME 50 TO 80 mm SO THAT THE CABLES ARE NOT DAMAGED INSIDE.

13 Disconnect the keyboard cable from the main computer board.

14 The front is now free to be completely removed. Place it face down on a work table.

15 Remove the cable going from the main computer board to the input connector panel (printer output).

16 Remove the 4 hex screws in the bottom of the instrument.

17 Remove the lower 2 rubber feet from the bottom. The chassis is now attached to the box only by the screws in the remaining two feet. Be extra careful when handling the instrument in this condition!

18 Position the instrument on its bottom on a worktable so that the feet can be removed from the underside.

19 Reposition the instrument so that there is a free area of the table of about 70 cm in front of the opening.

20 Carefully pull the chassis partly out of the box. Lift the front top of the box so that it flexes out when the amplifier box passes.

21 Remove the signal cables from the 6 flat cable connectors in the back of the amplifier box assembly. Note how they are connected so that the channels are not mixed up when you reassemble the unit.

22 Disconnect the power cable coming from the input panel. It is plugged into connector P1 on the power supply board.

23 The inner chassis is now completely free for further access to the different parts.

The TERRALOC can be run in this condition provided that the power cable stays connected (step 22) and a battery is connected. You need also to reconnect the front panel to the power supply (step 3) and the keyboard to the main computer (step 13). Thh front panel has then to be positioned in front of the chassis. The external video and printer will not operate and the digital interface is also disconnected.

2.3.5 REMOVING THE POWER SUPPLY BOARD

The power supply board in TERRALOC Mark 3 is fastened in such a way as to be very easy to remove for servicing. It is held in place by only two screws and can be removed by following the steps below:

1 Remove the instrument box lid (12 hex screws).

2 Disconnect all cables going to the power supply board first noting their placement.

3 Remove the two screws holding the power supply board. A ball tipped hex screwdriver that fits these screws can be found in the tool bag that came with the TERRALOC.

4 Carefully lift the board out from the chassis.

2.3.6 INSTALLING DISK DRIVES IN A TERRALOC Mk II

This installation is performed when a TERRALOC Mk II is to be upgraded to the Mark 3 level (not including the amplifiers). The items needed for the conversion are contained in an upgrade kit which includes the following:

No.	Description
1	Disk system metal chassis with RAM DISK cable attached.
2	3.5" floppy disk drives, marked 1 and 2 respectively.
1	Floppy and RAM disk interface board.
1	Floppy disk 34 pole flat interface cable with three connectors.
1	Floppy disk 8 pole flat power cable with three connectors.
1	Insulated jumper wire for connection on the main computer board.
6	EPROM integrated circuits containing new TERRALOC software.
2	Cover plates for the RAM DISK slots.
1	Label for identification of drive numbers.
2	3.5" demo disks containing selected records and interface software.
1	5.25" demo disk containing selected TERRALOC software for IBM-PC.
2	User's manual for the TERRALOC Mark 3.
2	Short form instruction booklet for the TERRALOC Mark 3.
1	Service manual
1	Box of 10 empty 3.5" diskettes.
1	Package containing selected screws and other mounting hardware.
1	Tool kit with hacksaw blade and file.

To install the disk drives in the TERRALOC Mk II you proceed in the following way:

A. Start by removing the TERRALOC chassis from the instrument case in the following sequence:

1 Remove the instrument box lid (12 hex screws).

2 Remove the two clamp retainers from the circuit board crate top by loosening the 4 screws. NOTE: The screws need not be removed completely.

3 Remove the 26 pole flat cable from the Digital Interface board (located closest to the instrument box wall).

4 Pull the Digital Interface board up from the crate. Be careful not to damage the remaining flat cable.

5 Remove the 10 pole flat cable from the Digital Interface board.

6 Set all switches on the Digital Interface board except DS to the OFF position. Then put the board aside.

7 Disconnect the battery from the power supply board. It is connected with a 4 pole connector on a short cable.

8 Remove the 8 hex screws holding the front cover to the instrument box.

9 Carefully lift the front cover off the box. LIFT ONLY SOME 50 TO 80 mm SO THAT THE CABLES ARE NOT DAMAGED INSIDE.

10 Disconnect the 6 pole cable going to the power switch.

11 Disconnect the 26 pole flat cable from the tape recorder.

12 Disconnect the flat keyboard cable from the main computer board.

13 The front is now free to be completely removed. Put it face down on a work table.

14 Disconnect the cables going from the main computer board to the input connector panel and the loudspeaker.

15 Remove the 4 hex screws in the bottom of the instrument.

16 Remove the lower 2 rubber feet from the bottom. The chassis is now attached to the box only by the screws in the remaining two feet. Be extra careful when handling the instrument in this condition!

17 Position the instrument on its bottom on a worktable so that the remaining two feet can be removed from the underside.

18 Reposition the instrument so that there is a free area on the table of about 70 cm in front of the opening.

19 Carefully pull the chassis out of the box. Lift the front top of the box so that it flexes out when the amplifier box passes. Pull it out only so far as is allowed by the remaining cables.

20 Remove the remaining circuit boards from the computer crate and put them aside.

B. With the TERRALOC now disassembled proceed by removing the tape drive from the front panel. Unscrew the 4 screws holding the drive to the panel. Remove the tape drive.

C. Now you have to fit the disk drive chassis to the front panel:

1 Use the hacksaw blade to remove the corners of the fastening fins for the tape drive closest to the CRT screen. See fig 2.3.6-1.
Break sharp edges with the file.

2 Fit the disk chassis into the hole in the front panel. Use the file to trim a little metal off the corners of the chassis if neccessary to get a snug fit. See fig 2.3.6-2

3 Secure the disk chassis to the front panel using the countersunk screws and metal spacers supplied. See fig. 2.3.6-3.

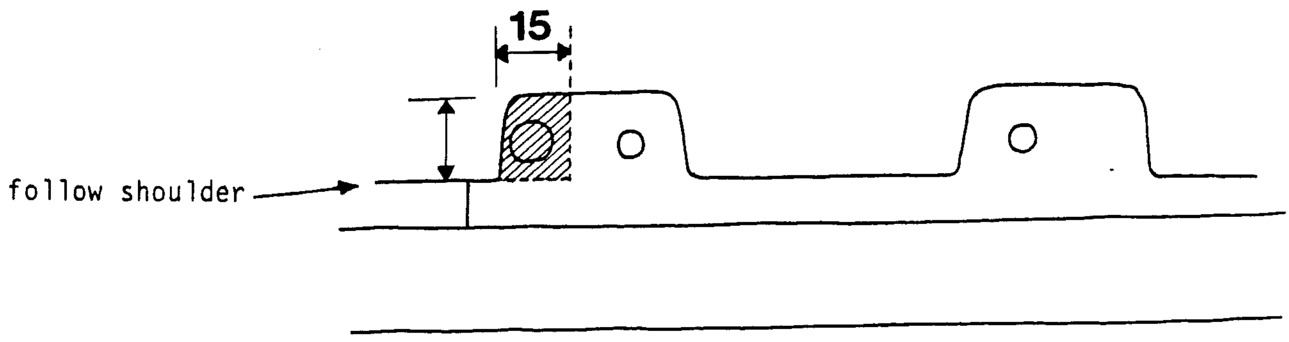


Fig. 2.3.6-1 Remove two corners from the tape drive holder.

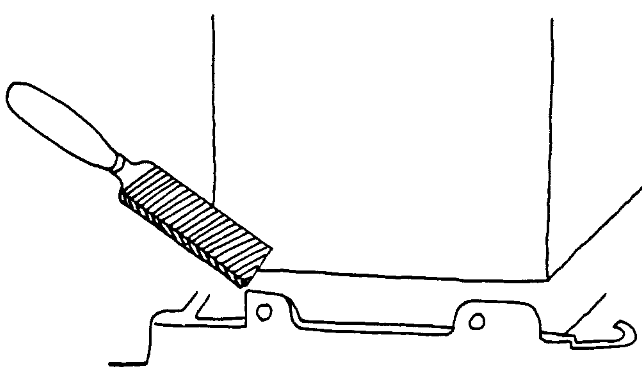


Fig. 2.3.6-2 Fit the disk chassis to the front panel.

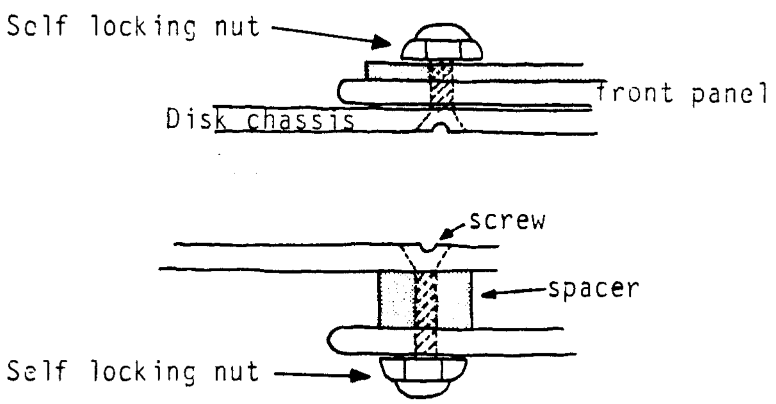


Fig. 2.3.6-3 Mount the disk chassis using countersunk screws and spacers.

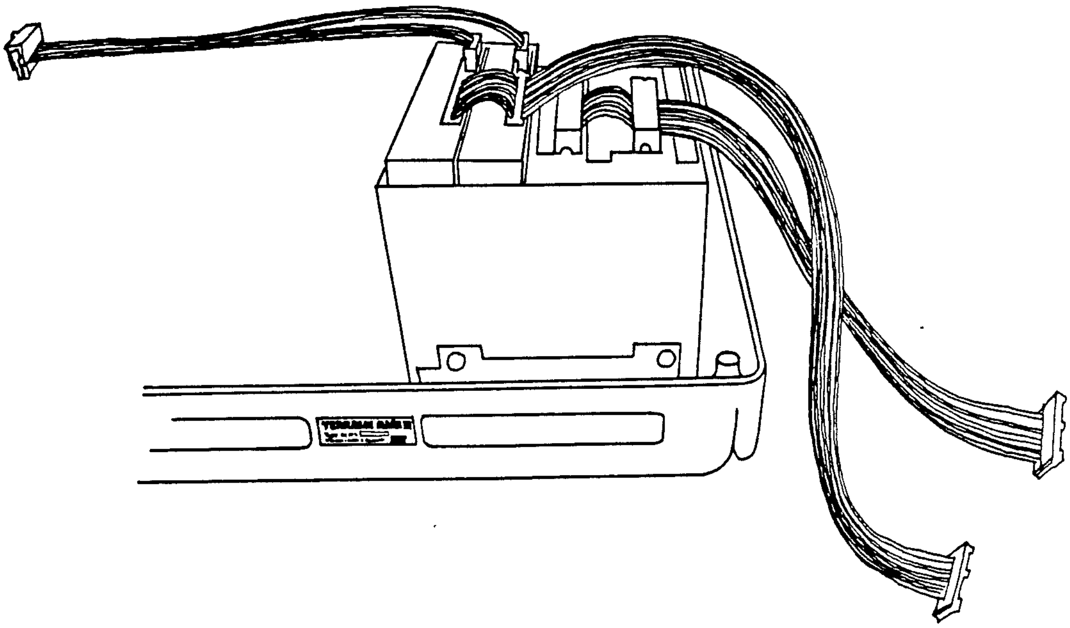


Fig. 2.3.6-4 Disk chassis from behind showing placement of the cables.

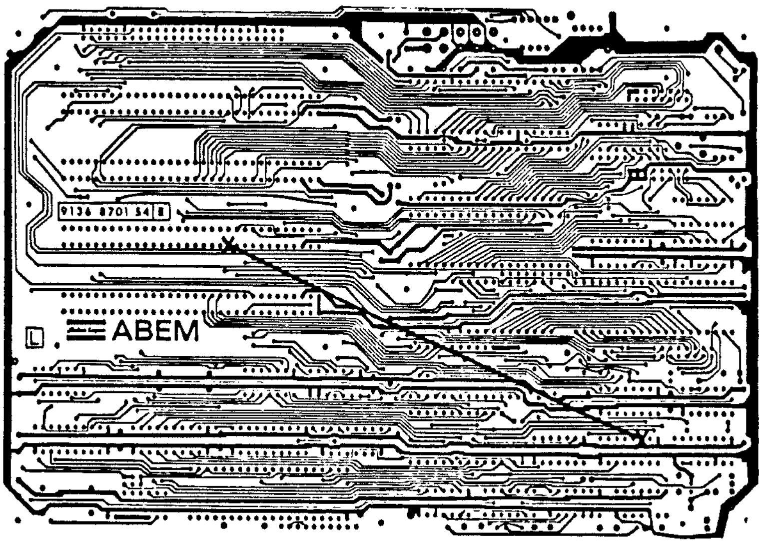


Fig. 2.3.6-5 Position of the jumper wire on the main computer board.

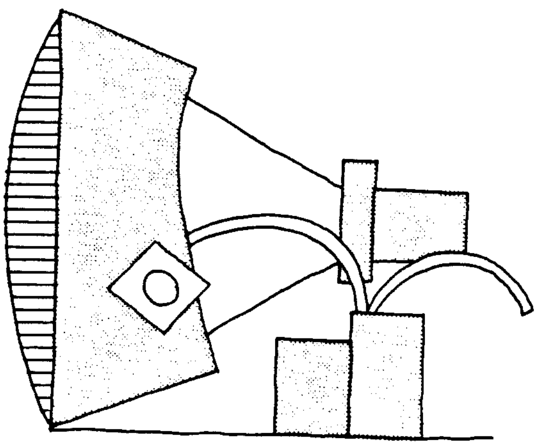


Fig. 2.3.6-6 New placement of the loudspeaker on the CRT monitor.

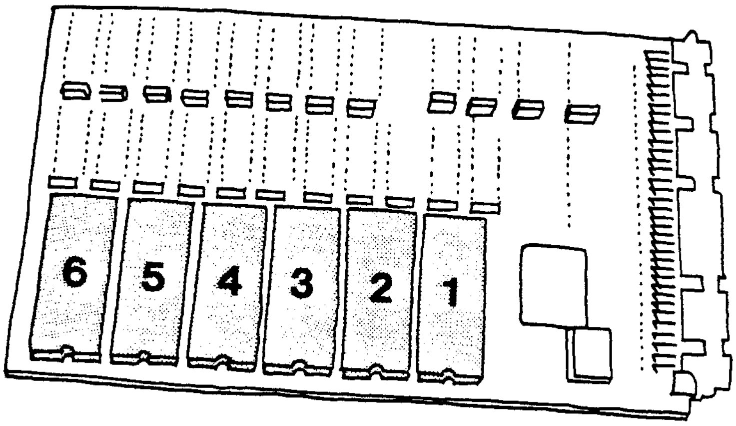


Fig. 2.3.6-7 Placement of the PROM:s on the ROMRAM board.

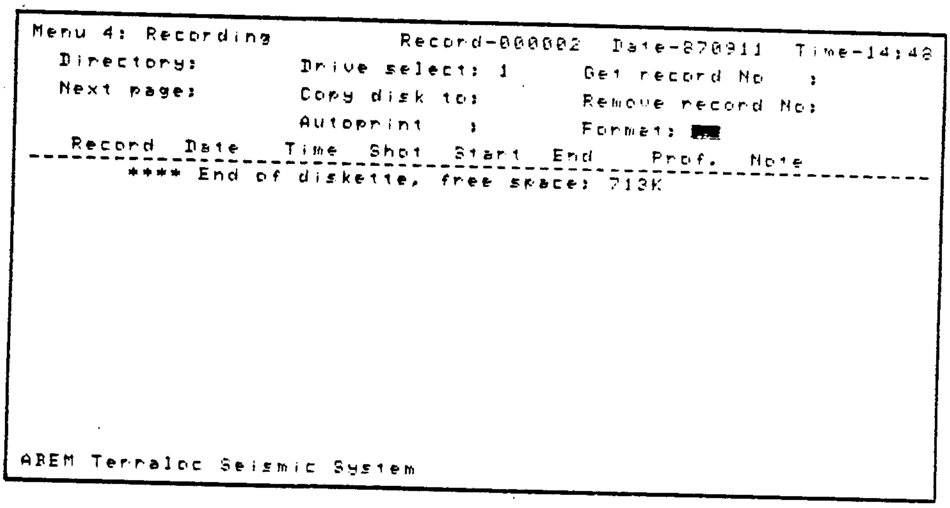


Fig. 2.3.6-8 Screen after successful format operation.

4 Insert the disk drives from the back and fasten them with the short 3 mm screws. Note that the drives are marked 1 and 2 respectively. Drive 1 is to be mounted closest to the CRT screen.
The drives are identical except for the select switch setting. The select code is 0 for drive 1 and 1 for drive 2 and can be set on the small switch accessible on the rear side edge of the drive. The switch is not accessible once you have mounted the drive in the chassis.

5 Attach the interface and power cables to the drives as in fig 2.3.6-4

6 Fasten the RAM DISK cover plates over the RAM DISK slots. They are snap-in and need no screws.

D. Now you have to modify the main computer board so that it recognizes the RAM disks. This is done by the installation of a jumper wire of 150 mm length between IC310 pin 14 and the "tape interface connector" pin 12a.
The loudspeaker mounted on the card crate has also to be moved so that it does not collide with the disk drives.
Proceed as follows:

1 Remove the main computer board from the chassis (7 screws).

2 Turn the board over and locate the two points to be jumpered. See fig. 2.3.6-5.

3 Carefully solder the jumper wire between the two points taking care to expose as little bare wire as possible at both ends and to use as little heat and solder as possible. This is a delicate operation and it should only be performed if you are quite certain that you can manage it properly. If incorrectly done it may destroy the operation of the computer board completely.

4 Remove the loudspeaker from the crate. It is fastened with four 3 mm screws and nuts which you don't need anymore.

5 Fasten the loudspeaker on the side of the CRT monitor chassis using the two B4 sheet metal screws supplied. See fig. 2.3.6-6.

6 Replace the computer board on the chassis using the same seven screws that held it in place. If any screw shows signs of damage use a replacement from the kit.

E. You now have to reassemble the inner chassis into the instrument box. Use the steps A15 - A19 in reverse order.

F. Reinstall the digital interface board in the crate. Note that the narrow flat cable must be attached when the board is not fully inserted. Install the remaining flat cable from the input connector panel on the top of the digital interface board.

G. Mount the front panel on the case:

1 Position the front panel in front of the case and feed the disk cables in and up towards the crate opening.

2 Connect the keyboard cable to the main computer board.

3 Connect the 6-pole cable from the front panel switches.

4 Mate the front panel to the case and secure the 8 hex screws.

5 Install the floppy disk interface board next to the digital interface board. Connect the three cables from the disk assembly to the corresponding connectors on the board. Note that the board must be partly pulled out to complete this task.

H. Complete the electronics installation by:

1 Reinstall the VIDEO RAM board next to the digital interface board in the crate.

2 Remove the PROM:s from the ROMRAM memory board using a small screwdriver to pry them loose from the IC socket connectors.

3 Install the PROM:s delivered in the kit on the ROMRAM memory board with the lowest number towards the edge connector and with the small notches in the PROM:s facing towards the board edge. See fig. 2.3.6-7 NOTE: this operation is very delicate and needs to be done properly. Be careful to discharge any static electricity before handling the PROM:s. Make sure that no PROM pin is bent or damaged before or after insertion into the sockets. Make sure that all pins make proper contact in their socket.

4 Install the ROMRAM memory board in the crate next to the VIDEO RAM board.

5 Mount the clamp retainer to hold the boards in place.

6 Reconnect the battery cable.

I. You are now ready to start the TERRALOC and check the installation. Make sure that the power connections are right and switch ON.
The selftest program shold now tell you that all is working OK after the new software is installed. During start up after the installation it is normal that a few beeps are emitted from the TERRALOC.

1 Set the Record No., Date and Time on menu 1.

2 Move on to menu 4. Insert an empty disk from the box delivered with the kit in each drive.

3 Select drive 1. Move to the Format field and enter a "." followed by ENT. This will start a format operation on drive 1. Check that the lamp on this drive lights up. After about 1-2 minutes the screen will light up again and you will get a message telling you the available storage space on the diskette. It should read 713 kbytes. See fig. 2.3.6-8.

4 Select drive 2. Repeat the remaining parts of step 3 to format the disk in drive 2.

5 Remove the disk in drive 2. Insert a demo disk in drive 2. Make a directory of this disk.

6 Read any of the records on the demo disk into the TERRALOC memory.

7 Remove the demo disk and reinsert the empty formatted disk in drive 2.

8 Push the RECORD key. Note that the screen goes blank and that the lignt on drive 2 is on. After about 15 seconds the screen should come back on again.

9 Make a directory to check that there is now one record on the disk in drive 2.

10 Select drive 1. Make a directory to check that this disk is empty.

11 Push the RECORD key. Note that the screen goes blank and that the light on drive 1 is on. After about 15 seconds the screen should come back on again.

12 Make a directory to check that there is now one record on the disk in drive 1.

13 Clear the TERRALOC memory with the keys CLR ENT.

14 Go to menu 4. Make a directory of disk 1. Play back the record on this disk and check that it looks all right.

K. If you have a RAM disk you can now check that the RAM disk slots operate correctly by formatting the RAM disk in the two drive slots. The format program will check the RAM disks in the process and any errors will be reported.

L. The installation is now complete and you can close the TERRALOC by replacing the top lid and securing the 12 hex screws. Don't forget the plastic washer on each screw!

3 TERRALOC FIELD PRINTER

3.1 SYSTEM DESCRIPTION

The TERRALOC field printer is a separate unit which is connected to the seismograph with a 15 lead data cable. Power is supplied directly from a battery with a power cable.
The printer consists of two main electronic parts: the print mechanism and the printer control circuit board. The control board is mounted beneath the metal chassis and contains all communications and power conversion circuits as well as the control computer needed for the printer to operate.

3.2 CIRCUIT DESCRIPTIONS

3.2.1 PRINTER CONTROL COMPUTER

The printer control unit is a microcomputer board mounted in the printer chassis beneath the print mechanism. It consists of a computer built with an MC68B09 microprocessor and EPROM and RAM circuits.
For communication with the TERRALOC port A of VIA 640 is used together with its handshake lines. Port B is not used.
In VIA 640 also resides a shift register which outputs the data INPA for the graphic printer over pin CB2 (640/19). The shift clock pulses appear on 640/18 and are conditioned in register 660 before they are output to the printer as the CP pulses.
Eacn time a row of dots are to be printed a burn pulse ENE is sent to the printer. ENE is generated by the timer section of VIA 650 in response to a request, SPU, from the printer mechanism. The burn pulse is 1.3 ms active low.

ACIA 630 on the circuit diagram is not used.

Power for the printer is nominally 12 V from an external battery or mains power supply. The input voltage can vary considerably, a range of 10 to 20 volts is permissible.
The printer is normally switched off waiting for a print command from the TERRALOC. When called upon to print the power circuitry is switched on by the power relay which is pulled from the TERRALOC. The software in the TERRALOC closes a small relay about one second before printing starts. This closure is brought to the printer over the data cable (leads 6 and 7) and pulls the power relay. When the printing is over the printer power is again switched off to conserve battery capacity.

To convert the input voltage into the regulated voltages needed internally there are two converters on the printer control board. One is a simple +5 V regulator (530) which produces 5V for the computer circuitry. The other is a switch regulator which converts the input voltage to +22.5 V used by the print mechanism. This voltage is heavily loaded during printing so a powerful converter is needed. It consists of IC (710) which is a complete switch regulator in itself but in this case it is power boosted by the power transistor (520).

The current limiting is set by pot (190) and output voltage by pot (270). These controls are set so that the printer prints black variable area records even at low battery voltages.

The paper takeup motor is supplied via circuitry that pulse width modulates the supply voltage via IC (700) and transistor (500).
The purpose of this circuitry is to adjust the torque of the takeup motor. This is done with trimpot 275 (accessible trough a hole in the chassis). By the use of a pulse width modulation technique the power loss in the regulating circuitry is negligible.

3.2.2 PRINT MECHANISM FOR THERMOSENSITIVE PAPER

The print mechanism (an Olivetti type PU 1840 unit) is a lineprinter for thermosensitive paper employing a printhead with 80 equally spaced heating elements. By vibrating the head across the paper the elements are sequentially scanned over the full linewidth of 560 dots, 7 dots per heat element. The print information is stored in shift registers on the printer board and deposited to the paper by means of carefully timed burn pulses.
By correctly loading the shift registers with bit patterns both alphanumeric and graphic data can be printed. The mechanism itself contains synchronizing contacts that produce timing information for the control board to coordinate the printhead movements and data transfers.

3.3 TERRALOC-TO-PRINTER COMMUNICATION

The printer is commanded to print by data sent to it from the TERRALOC. The data are sent over a connection cable with 8 data bits in parallel using two handshake lines. The operation of the handshake procedure is described below and the pulse diagram of the transfer handshake can be seen in Fig. 3.3-1 below.

Handshaking is accomplished with the use of signals DATA READY and DATA TAKEN as shown in the figure. TERRALOC first outputs data on the data lines and then the DATA READY (STROBE) line is pulsed low for about 1 us. When the pulse is detected by the printer circuitry the data lines are read and the signal DATA TAKEN (ACKNOWLEDGE) is pulsed low. When the TERRALOC computer discovers that the data have in fact been read by detecting the DATA TAKEN pulse from the printer the next byte of data is output and the cycle repeats.

If the printer does not respond to the DATA READY signal within a few seconds then the TERRALOC will exit from the printing operation and output an error message.

The printer will receive data in ASCII format and buffering will take place on a line by line basis. When a complete line of text has been received the ending <LF> (linefeed) character will cause the printer to print that line. No printing action will take place unless the <LF> character is sent. An automatic carriage return <CR> will be generated after every 80 characters so new data will overwrite old text on the same line if it is not first printed out with the <LF> character. The correct end-of-line sequence is <CR><LF>.
When the printer is in ASCII mode it will not accept data with the msb set to 1. All such characters will simply be disregarded.

The printer can also be put in a graphic mode where the data are not treated as ASCII characters but rather as the bit pattern of a horizontal line consisting of 560 dots. The graphic mode is entered by the transmission of the ASCII characters <ESC> and G as the first two characters of a new line. This switch code causes the printer to interpret the following 70 bytes as the bit pattern of one graphic line. The least significant bit of the first byte will be printed at the leftmost margin of the paper and the most significant bit of byte number 70 will be printed at the right margin.
The printer will automatically print the line as soon as all 70 bytes have been received and then revert back to ASCII mode for the next line.
Note that graphic mode is only available on a basic matrix line-by-line basis.

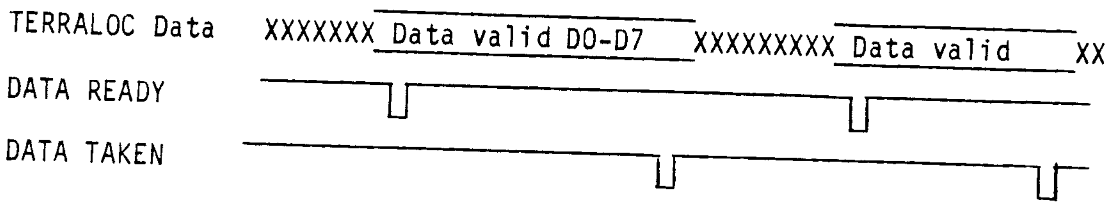


Fig. 3.3-1 TERRALOC-printer handshake pulse diagram.

3.4 TERRALOC-TO-OFFICE PRINTER COMMUNICATION

The TERRALOC can use a standard dot matrix office printer as well as the field printer for printing records. The printer type to use is set on menu 5 (see section 3.7.3 in the main manual). When an office printer is used the graphic codes used for printing the traces and copying the screen to the printer are different from the ones used by the field printer. The timeout to determine if the printer activity is halted is also longer than when using the TERRALOC field printer. The office printer mode supports three graphic densities: 120, 60 and 80 dots per inch. These are selected with printer codes 1-3 on menu 5.

3.4.1 MATRIX PRINTER GRAPHICS CONTROL CODES

A matrix printer must understand the escape codes below correctly if it is to be used with the TERRALOC. If in doubt you can either try the different settings with your printer or you can consult the printer technical manual.

The following codes must be recognized by all printers:

<ESC> 3 <23>	used to set line spacing for graphics to 23/216 inches.
<ESC> A <12>	Used to set line spacing back to 12/72 inches (6 lines per inch, standard text spacing).

The graphics control codes used are:

Printer type 1, 80 columns (120 dots/inch density):

<ESC> L <128><2>	Sets double density graphics at 120 dots per inch. The graphics line used is 640 dot columns.

Printer type 2, 132 columns (60 dots/inch density):

<ESC> K <48><2>	Sets single density graphics at 60 dots per inch. The graphics line used is 560 dot columns.

Printer type 3, PC mode (80 dots/inch density):

<ESC> * <4><72><2>	Sets medium density graphics at 80 dots per inch. The graphics line used is 584 dot columns. This mode is the least widely supported printer mode.

3.4.2 MATRIX PRINTER INTERFACE

The ordinary TERRALOC printer connector can be used also for connection to a dot matrix office printer. You must then use the TERRALOC office printer cable available as an accessory (order code 9136 0001 51) to make the connection. It contains the following interface circuits:

Use	Terraloc pin	Printer pin	Description
DATA1-8	1-4, 9-12	2-9	data from TERRALOC.
STROBE	5	1	pulsed low by TERRALOC.
ACK	13	10	(acknowledge) pulsed low by the printer.
GROUND	14	30	signal return line.

These circuits make up a reduced set of the so called "Centronics" printer interface widely used by many printer manufacturers. The TERRALOC can not detect the other signals such as BUSY, PAPER OUT and so on. Instead any problem in the printer that stops it from receiving data is detected by TERRALOC by means of a timeout in the transmission program. If the printer stops for 10 seconds the TERRALOC will beep and display a "Printer error" message on the bottom line of the screen. You must then fix the printer problem and repeat whatever printer command you had issued.

3.5 DISASSEMBLING THE PRINTER

If the printer has to be repaired the inner chassis should be removed from the case. In order to do this properly you have to proceed in the following way:

1 Remove the metal cover over the input connector panel. This is fastened with 2 screws.

2 Install an empty paper bobine in the paper takeup position.

3 Remove the three screws holding the chassis from the bottom side of the case.

4 Lift the chassis out using the bobine as a handle and put it onto a table.

5 Remove the main metal cover, 6 screws.

6 If the printer control board mounted beneath the cassis is to be removed 3 screws (hexagonal) have to be unscrewed from the top side.
NOTE! Do not unscrew the corresponding Phillips screws on the bottom side since this will not loosen the board.

To reassemble proceed in opposite order. Please check all connectors for proper seating!

4. OFFICE POWER SUPPLY AND CHARGER

There are two models of office power supply delivered with the TERRALOC. One is only equipped with outputs to power the TERRALOC and printer in the office whereas the other is made in such a way that the printer power output can also be used as a charge output for rechargeble batteries. These must be of the lead acid type with a nominal voltage of 12 V.

The two models differ in outside appearance in the following ways:

Body colour:	orange - power supply
	black - power supply/charge
Front panel:	Printer output also marked Charge output on power supply/charge

4.1 CIRCUIT DESCRIPTIONS

4.1.1 POWER SUPPLY

This supply is simply a rectifier fed from a mains transformer. The transformer primary is equipped with multiple taps and voltage selector for 110/220 V selection.

The rectified output is filtered by a very large electrolytic capacitor before being fed to the output terminals.

4.1.2 POWER SUPPLY/CHARGER

This unit is equipped with a toroidal mains transformer with multiple taps and a mains voltage switch.

The secondary is rectified and filtered and then fed to two separate high power regulator IC:s. These are adjusted to give 14.3 V output at up to 7 A current.

They are separately powering the TERRALOC and printer/charge outputs.

Since the output voltage is regulated to 14.3 V the supply can be used as a battery charger for lead batteries.

The only servicing neccessary is to check and if needed adjust the output voltage to 14.3 V using the two trim potentiometers located inside.

5. TROUBLESHOOTING

The TERRALOC seismic system is designed to be reliable and easy to use. If a problem should develop the following guide may come in handy.

PROBLEM	CAUSE	REMEDY
The TERRALOC keeps on shutting down	Drained batteries	Charge the batteries or connect a new power source
or	Input voltage too high or low	Check voltage from power source
The TERRALOC will not switch on	On/off electronics has failed	Connect jumper P21 on power board. The input voltage guard is now bypassed
After PRINT or COPY keys are pressed the error message "PRINTER ERROR" appears.	Bad connection to the printer or power not switched on.	Check cable and/or printer power switch
	The paper supply has run out	Insert a new roll of paper in the printer
After the "TAPE" key has been pressed the error message "CHECK DISK" appears	Diskette not installed in selected drive	Reselect drive or insert new diskette
	Selected drive out of order	Reselect drive and repair drive
After the "TAPE" key has been pressed tne error message "DISK FULL" appears	Diskette storage is full	Insert new diskette or remove unwanted records
TERRALOC beeps when playing back disk made on a different TERRALOC.	Unequal number of installed channel amplifiers in the two systems.	This is no fault, the system merely removes all incorrect assignments on menu 1.
Signal monitor on menu 2 shows constant signal deflections even with low gain and no signal connected	Amplifier offset adjust incorrectly set	Open top lid and adjust the offset trimmers for the channels in question according to section 6.1.1
The TERRALOC keeps on triggering when the ARM key has been pressed even though no shots have been made	Too high sensitivity on the trig geophone input, trigger occurs on ground noise	Reduce the sensitivity with the "volume" control in the connector recess
	Bad connections to a normally closed trig switch causes circuit breaks	Check your wiring to the trig source

PROBLEM	CAUSE	REMEDY
The error message "WRITE PROTECTED" appears	The write protect tab is in the "write protect" position or is removed	Slide tab into right position or cover opening with a piece of tape
The error message "DISK UNFORMATTED" appears	Diskette unformatted	Format diskette
	Bad diskette	Use new diskette
Printouts sometimes come without the header and on striped paper.	The signal on pin 1 of the connecting cable is broken.	Check the continuity of the cable. Check the printer circuitry as well. Repair as neccessary.
After pressing "COPY TO" the error message "DISK UNFORMATTED"	Target disk not empty	Insert new disk or reformat old disk
The error message "READ ERROR" appears	Faulty diskette	Remove diskette

6. REFERENCE SPECIFICATIONS

6.1 TERRALOC SEISMOGRAPH

6.1.1 HARDWARE:

Sampling intervals:	24, 48, 100, 200 and 500 us. 1, 2 and 5 ms.
Record length:	1000 samples per trace.
Record time:	24 to 5000 ms.
Delay time:	0 to 9999 ms.
Amplifier gain:	6 to 126 dB in steps of 6 dB, from geophone input to A/D converter input.
Gain accuracy:	± 3 %.
Input impedance:	600 ohms ± 10 % (measured at 400 Hz).
Input transformer:	Balanced input transformer reduces line noise.
Crosstalk:	Less than -120 dB at 1000 Hz between adjacent channels.
Noise level:	Less than 0.7 uV RMS over passband, referred to amplifier input.
Frequency range:	1 Hz to 2000 Hz (<3 dB).
Analogue filters:	Low-cut, 18 dB/octave, Bessel type.
Filter frequencies:	50, 100, 150, 200, 250, 300, 350 and 400 Hz.
Max. input signal:	Input protected by fast acting circuitry that limits signals to ± 4 V. Amplifier clipping level depends on gain settings and is ± 4 V at 6 dB gain. Below 10 Hz, derate to ± 2 V at 5 Hz and ± 1 V at 2.5 Hz (transformer saturation).
A/D converter:	8 bits (256 levels).
A/D range:	± 8 V
Step size:	62 mV at A/D converter input. 30 nV at system input (maximum gain).
Memory (input):	Each amplifier board contains 2048 bytes of memory, 1000 bytes are used for each channel.
Memory (stack):	1000 16-bit words for each trace stack.

Storage:	Two standard 3.5" floppy disk drives and slots for two optional RAM-disks.
Disk format:	Standard MS-DOS, can be read by IBM and compatible PCs with 3.5" disk drives.
Disk capacity:	720 Kbytes per disk, equal to 14 24-channel records or 28 12-channel records.
CRT screen:	9" diagonal daylight visible with green phosphor.
Screen format:	Graphic output system with 512x256 pixels.
Video output:	Standard composite video 312 lines, 50 frames per second. 1.0 V_{p-p} at 75 ohms impedance.
Video connector:	Standard BNC 75-ohm coaxial connector.
Time and date:	Internal quartz clock, backed up by board-mounted lithium and standard 9 V battery.
Hours-in-use:	Monitored and displayed.
Digital I/O:	RS-232 serial interface, 75 to 19200 baud. IEEE-488 parallel talk/listen interface. All instrument functions can be remotely controlled via these interfaces. Interface parameters are set from the keyboard.
Interface functions:	10, including SEG-1 communication protocol.
System triggers:	Geophone trigger with sensitivity control on instrument side. Switch input internally biased to +5 volts. Accepts either make or break contacts or saturated NPN transistor. Ignition current detector circuit triggers on blasting current. Tone detector input triggered in response to interruption of 2000 Hz tone. Minimum level, 50 mV. Front panel pushbutton switch.
Power:	12 V external battery or office power supply operating from mains voltage 110/220 V, 50/60 Hz (only for indoors use).
Power consumption:	Less than 48 W.
Fuses:	Main power fuse: 5 A.
Battery monitor:	Continuous voltage check by microcomputer. Warning issued when recharge required. Battery voltage displayed on power-up menu and system hardware menu.

Weight: 20 kg (24 channels).

Dimensions: 25 x 53 x 57 cm.

Temperature range: -10 to +70°C (RAM disk should be used at extreme temperatures).

6.1.2 PROCESSING:

Signal stacking: Incoming signals are added to 16 bit wide signal stack. The stack will hold up to 255 full resolution shots before saturation.

Display processing: Display can be set in different modes to enhance certain signal features. All display processing is done on the signal values stored in memory without changing them.

Enhance	Shows straight stack sum with clipping.
Average	Signal average displayed.
Normalized	Maximum signal size normalized to user entered value (1 to 99% of display range). Can operate over the whole trace or a shorter window and with or without clipping.
Digital AGC	Calculates display size depending on average energy within user set window. Scaling size set by user.

Trace types: Variable area (pos or neg).
Wiggle trace.
Dotted trace.

Signal level warning: System warns against excessively high or low input signals.

Gain adjustment: Automatic gain adjustment to optimum setting based on test shot.

Collection modes:

Preview	protects the stack from bad signal by letting the operator decide which signals are to be added.
Autostack	adds all records to the stack and displays the result on the CRT screen.
Fast stack:	adds all records, but they are not displayed on the CRT.
Stack once	works as autostack but stacks only once. Safeguards against multiple triggerings.

Noise gate: Noise monitor function that operates in the autostack and fast stack collection modes. Rejects records that were preceded by noise bursts above a user-preset level. In the autostack mode, the user can enter rejected records manually into the stack after checking the waveforms on the CRT screen.

Noise gate level: Selectable from 1 to 99% of A/D converter range.

Polarity:	Additive or subtractive stacking can be selected by the user via the keyboard. Can be set individually for all traces.
Locking:	Any trace stack can be protected from modification by setting stacking to off for that trace. This also protects the data during the clear operation.
Trace selection:	Displayed traces can be turned off individually. This does not affect the trace data which is still kept in the stack memory.
Field notes:	Six note areas (for survey parameters) are provided for records-keeping. Data entered here are stored along with the record on disk.
Record numbering:	Automatic record numbering is provided to give each record a unique identification. The 6-digit record number can be set at any convenient starting point by the user.
Programmable memory:	The user can enter up to 10 sets of gain profiles into the battery-backed CMOS memory for fast retrieval. 10 sets of trace/channel/display assignments can also be entered. Also available are 5 fixed sets of assignments to speed standard layout setting.
Digital filters:	99 low-cut and 99 high-cut filters which operate on the signals after they have been recorded can be engaged from the keyboard. These filters operate from memory to the display and do not destroy original data. Slope: 12 dB/octave. Phase shift: None for stationary signals.
Scroll of traces:	When time-enlarged traces are shown on the CRT, they can be scrolled up and down by the user.
Time line:	Movable time line plus digital display of associated time ensures easy, accurate time picking.
Arrival picking:	First arrivals can be automatically picked and manually adjusted. Time marks on the traces show position of arrivals. Report with arrival times and field notes can be displayed on screen and printed. Also accessible via the digital interface for direct output to analysis programs.
Voltage readout:	Actual input voltage for user-specified sample of any trace calculated and displayed on screen.
Self-check:	Circuitry and battery are checked at every power-up. Service menu displays internal voltages. Error messages alert operator if fault is found.

System control:	Special system hardware menu for: - Monitoring of the supply voltages. - Setting of the digital interface parameters. - Initiating hardware tests. - Selecting printer type and print format.

6.2 TERRALOC FIELD PRINTER

Printer type:	Thermal printer, ASCII and graphic.
Line width:	560 dots or 80 ASCII characters.
Print modes:	ASCII characters and graphic dotline.
Data transmission:	8 bit parallel with handshake lines. Reduced "Centronics" interface.
Line width (ASCII):	80 characters dot matrixed 5x8 in 7x9 box.
Line width (graphic):	560 dots individually printable.
Print width:	198 mm
Paper width:	214 mm
Paper roll length:	30 m
Control:	Automatic power switch-on from TERRALOC.
Printout length:	366 mm (trace section, at full length printing).
Print speed:	30 s typ.
Copy speed:	8 s typ.
Power:	12 V.
Current drain:	0.7 A (idle), 1.5 to 4 A (printing).
Dimensions:	12 x 33 x 63 cm.
Weight:	6 kg with paper.

6.3 TERRALOC RAM DISK

Capacity:	720 kbytes (713 kbytes for data) stores up to 14 24-channel records.
Data format:	MS-DOS compatible, same as 3.5" floppy disk.
Connector:	25 pin female D-sub connector.

Power:	Internal lithium batteries (2-4) supply voltage for data retention. During operation power is supplied from TERRALOC.
Battery life:	Each lithium cell can supply power for backup during two years in normal room termperature (20°C).
Dimensions:	120 x 100 x 30 mm.
Weight:	280 g.
Temperature:	-15 to +70°C operating.

6.4 TERRALOC OFFICE POWER SUPPLY

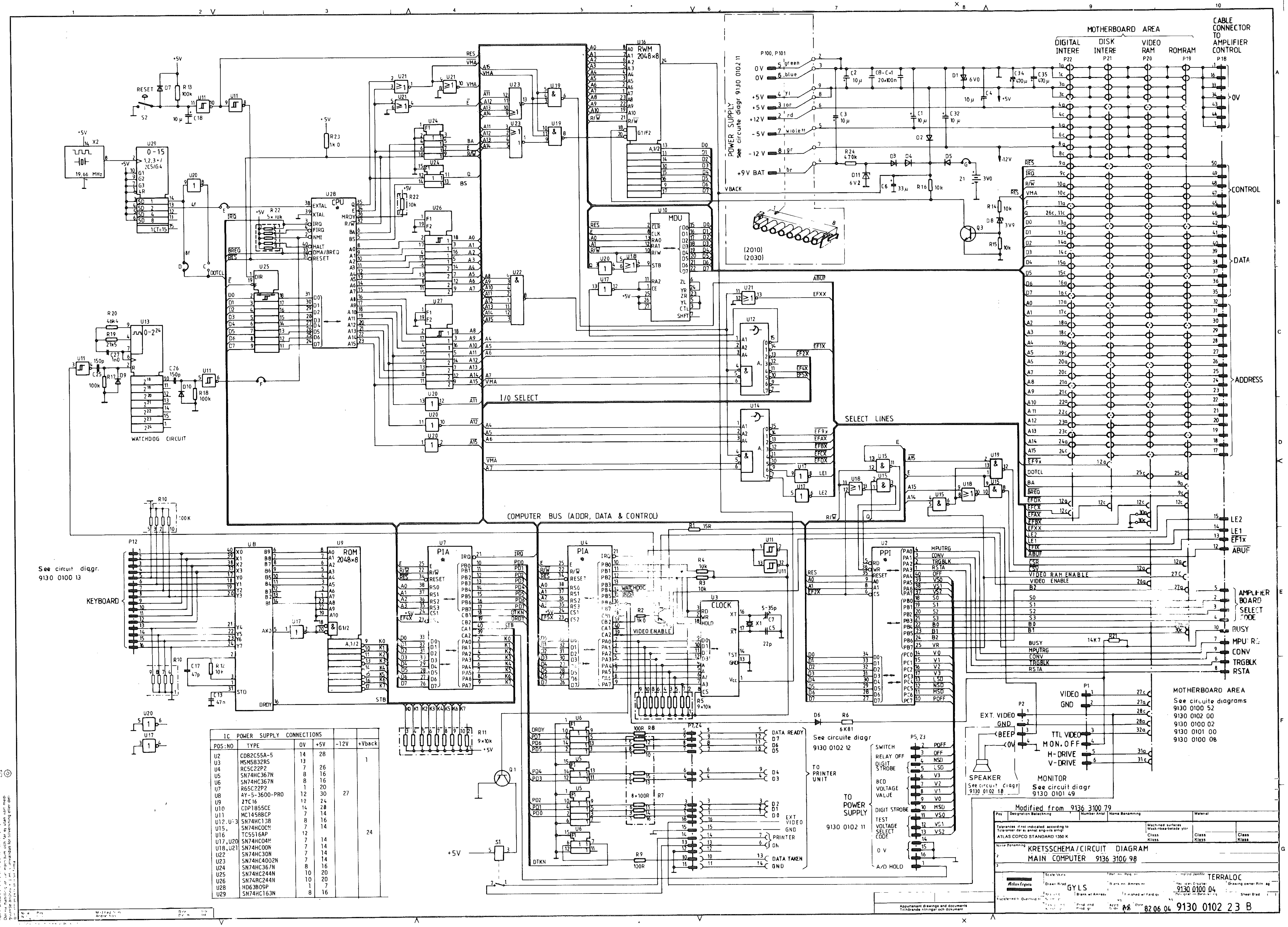
Input voltage:	Selectable 110 V or 220 V, 50/60 Hz. Voltage tolerance +/- 10 %.
Output voltage:	Min 10 V DC at 10 A load.
Output regulation:	None, voltage varies with mains voltage fluctuations and load level.
Output connectors:	One for TERRALOC and one for printer, both internally connected to the same output.
Indicators:	Mains voltage, output voltage (amp).
Fuses:	Mains fuse and automatic output fuse.

6.5 TERRALOC COMBINATION OFFICE POWER SUPPLY AND CHARGER

Input voltage:	Selectable 110 V or 220 V, 50/60 Hz.
Output voltage:	14.3 V DC.
Output regulation:	+/- 0.2 V over full load range.
Output connectors:	Separately supplied outputs for TERRALOC and printer.
Charge:	Can charge lead batteries from printer output connector.
Charge method:	Constant voltage (14.3) with current limiting.
Indicators:	Mains voltage, output voltage lamps.
Fuses:	Mains fuse only. Output is electronically current limited to about 7 A per connector.

7. CIRCUIT DIAGRAMS

Diagram showing	CIRCUIT DIAGRAM	COMPONENT LAYOUT
Main computer	9130 0102 23	9130 0500 17
ROMRAM memory unit	9130 0101 00	9130 0500 10
Video RAM memory unit	9130 0100 02	9130 0500 02
Seismic A/D amplifier	9130 0102 05	9130 0500 15
Amplifier control unit	9130 0100 08	9130 0500 08
Floppy disk controller	9130 0102 00	9130 0500 12
Disk interface	9130 0102 09	9130 0500 13
RAM board	9130 0102 10	9130 0500 14
Power supply	9130 0102 11	9130 0500 16
Digital interface	9130 0100 52	9130 0500 09
Amplifier motherboard	9130 0102 14	9130 0500 05
Printer control unit	9130 0102 08	9130 0500 38
CRT monitor	9130 0101 49	9130 0500 44
TERRALOC INTERNAL CABLES:		
Power cable connections	9130 0102 26	
Terraloc Trig system	9130 0102 32	
Signal cable 12 and 24	9130 0100 15	
Digital I/O Cable	9130 0102 19	
GPIB Cable	9130 0100 58	
RS-232C cable	9130 0100 59	
Printer internal cables	9130 0102 12	
Ext. power supply cable	9130 0102 17	
Battery clip adapter	9130 0102 20	
Outside Trig Systems	9130 0102 31	
Printer cable	9130 0102 15	
Office printer cable	9130 0102 22	
Cable RS-232C to IBM PC/AT	9130 0102 27	
Cable RS-232C to IBM PC/XT	9130 0102 28	



IC POWER SUPPLY CONNECTIONS					
POS:NO	TYPE	0V	+5V	-12V	+Vback
U2	CD82C55A-5	14	28		
U3	MSM5832RS	13			1
U4	RC5C22P2	7	26		
U5	SN74HC367N	8	16		
U6	SN74HC367N	8	16		
U7	R65C22P2	1	20		
U8	AY-5-3600-PRO	12	30	27	
U9	27C16	12	24		
U10	CDP1855CE	14	28		
U11	MC1458BCP	7	14		
U12, U13	SN74HC138	8	16		
U15,	SN74HC00N	7	14		
U16	TC5516AP	12			24
U17, U20	SN74HC04N	7	14		
U18, U21	SN74HC00N	7	14		
U22	SN74HC30N	7	14		
U23	SN74HC4002N	7	14		
U24	SN74HC367N	8	16		
U25	SN74HC244N	10	20		
U26	SN74HC244N	10	20		
U28	HD6380SP	1	7		
U29	SN74HC163N	8	16		

Modified from 9136 3100 79

Tolerances if not indicated, according to
Toleranser där ej annat angivits enligt
ATLAS COPCO STANDARD 1350 K

KRETSSCHEMA / CIRCUIT DIAGRAM
MAIN COMPUTER 9136 3100 98

Atlas Copco

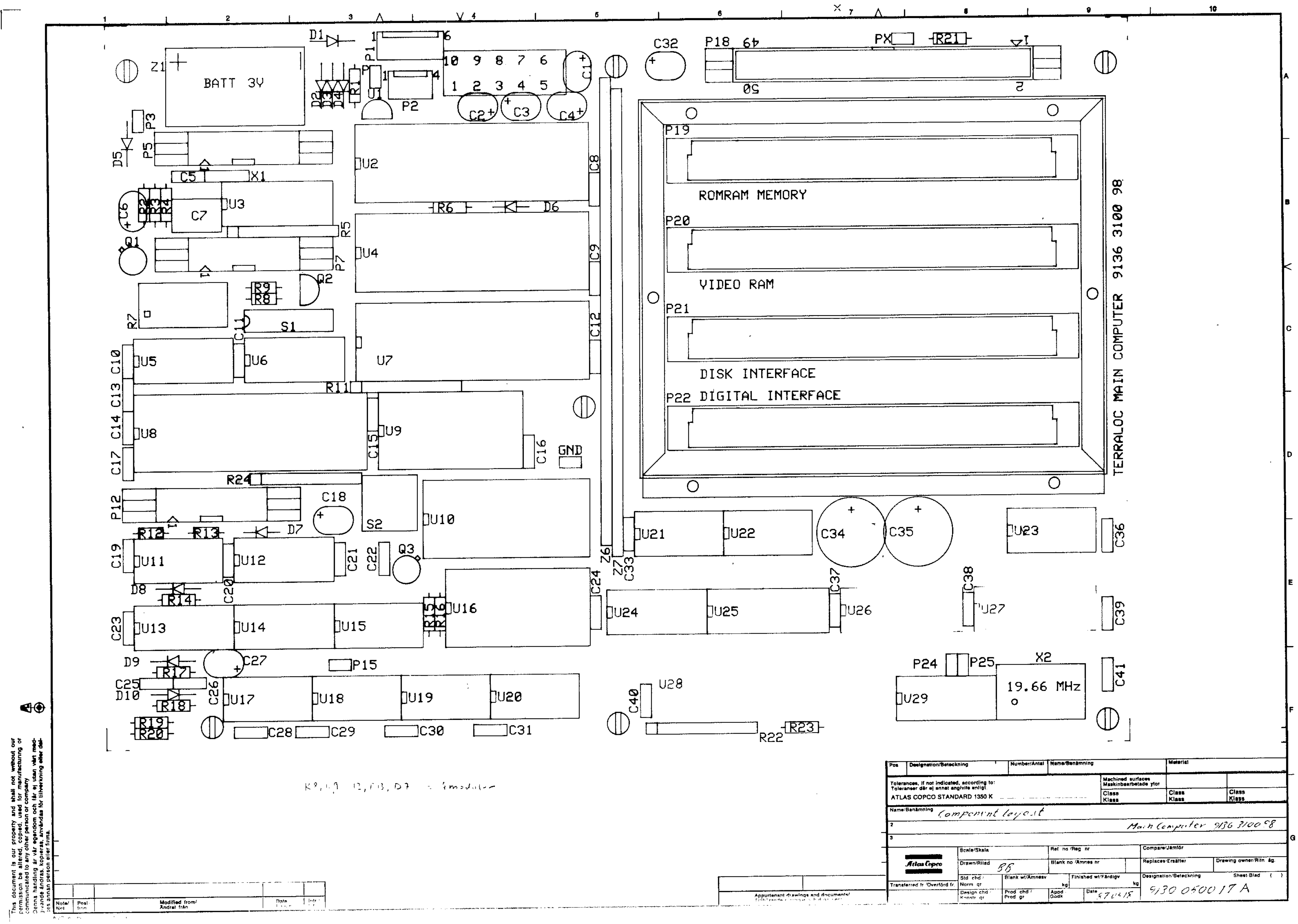
Drawn Ritad GYLS

Jämför TERRALOC

Ersätter 9130 0100 04

Date 82 06 04

9130 0102 23 B



TERRALOC MAIN COMPUTER 9136 3100 98
ROMRAM MEMORY
VIDEO RAM
DISK INTERFACE
DIGITAL INTERFACE
P19
P20
P21
P22
P18
BATT 3V
19.66 MHz
X2
GND
Component layout
Main Computer 9136 3100 98
9130 0500 17 A
ATLAS COPCO STANDARD 1350 K
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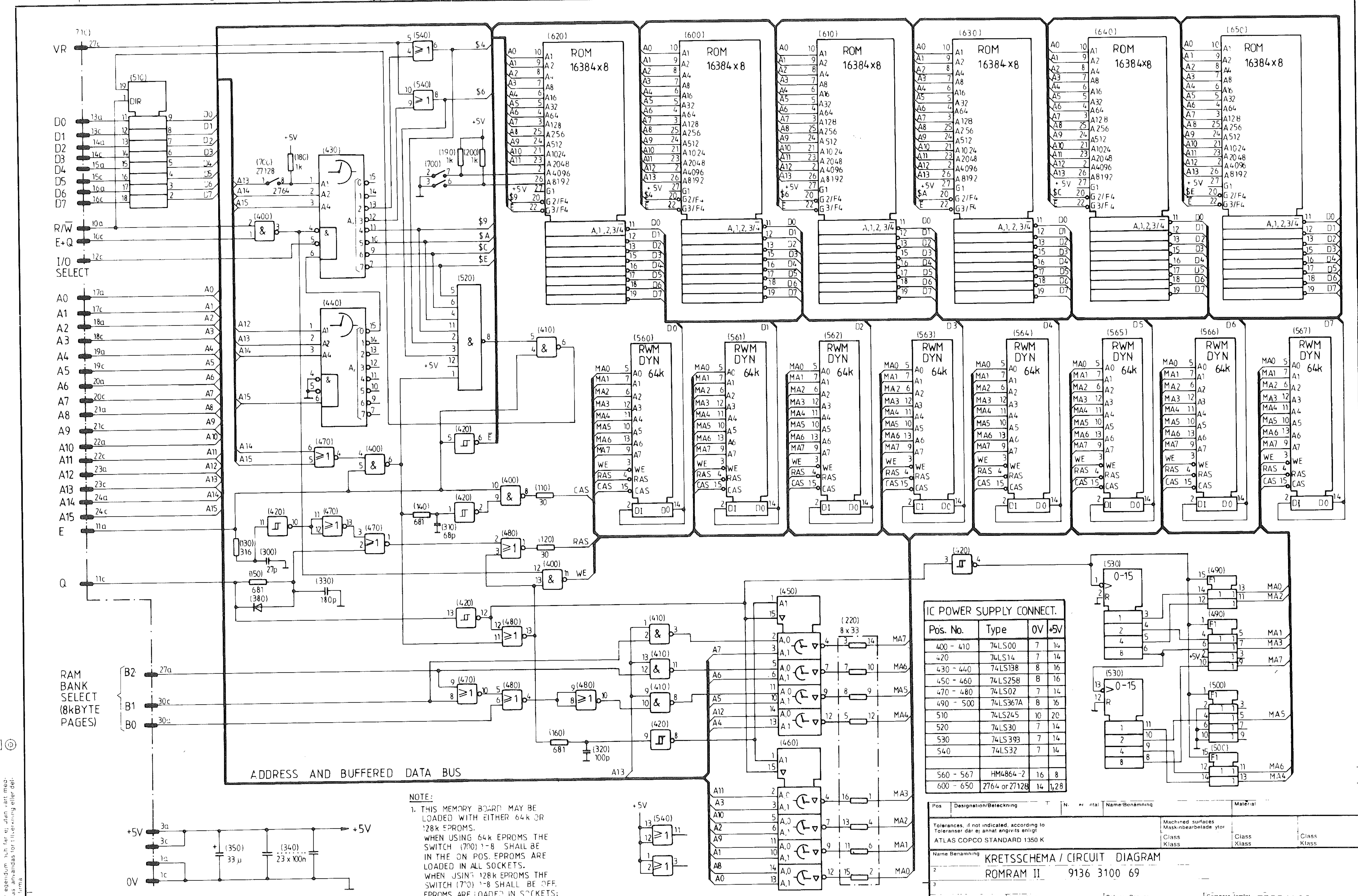


IC POWER SUPPLY CONNECT.			
Pos. No.	Type	0V	+5V
400 - 410	74LS00	7	14
420	74LS14	7	14
430 - 440	74LS138	8	16
450 - 460	74LS258	8	16
470 - 480	74LS02	7	14
490 - 500	74LS367A	8	16
510	74LS245	10	20
520	74LS30	7	14
530	74LS393	7	14
540	74LS32	7	14
560 - 567	HM4864-2	16	8
600 - 650	2764 or 27128	14	1,28

NOTE:

1. THIS MEMORY BOARD MAY BE LOADED WITH EITHER 64k OR 128k EPROMS. WHEN USING 64k EPROMS THE SWITCH (700) 1-8 SHALL BE IN THE ON POS. EPROMS ARE LOADED IN ALL SOCKETS. WHEN USING 128k EPROMS THE SWITCH (700) 1-8 SHALL BE OFF. EPROMS ARE LOADED IN SOCKETS: 610, 630 AND 650
2. WHEN USING 64k EPROMS SEVERAL TEXT SETS MAY BE STORED IN SOCKET 620 AND SELECTED WITH SWITCH (700) 2-7 AND (700) 3 - 6.

Pos | Designation/Beteckning | N. er ntal | Name/Benämning | Material

Tolerances, if not indicated, according to
Toleranser där ej annat angivits enligt
ATLAS COPCO STANDARD 1350 K

Machined surfaces / Maskinbearbetade ytor — Class / Klass — Class / Klass — Class / Klass

Name Benämning: KRETSSCHEMA / CIRCUIT DIAGRAM
ROMRAM II 9136 3100 69

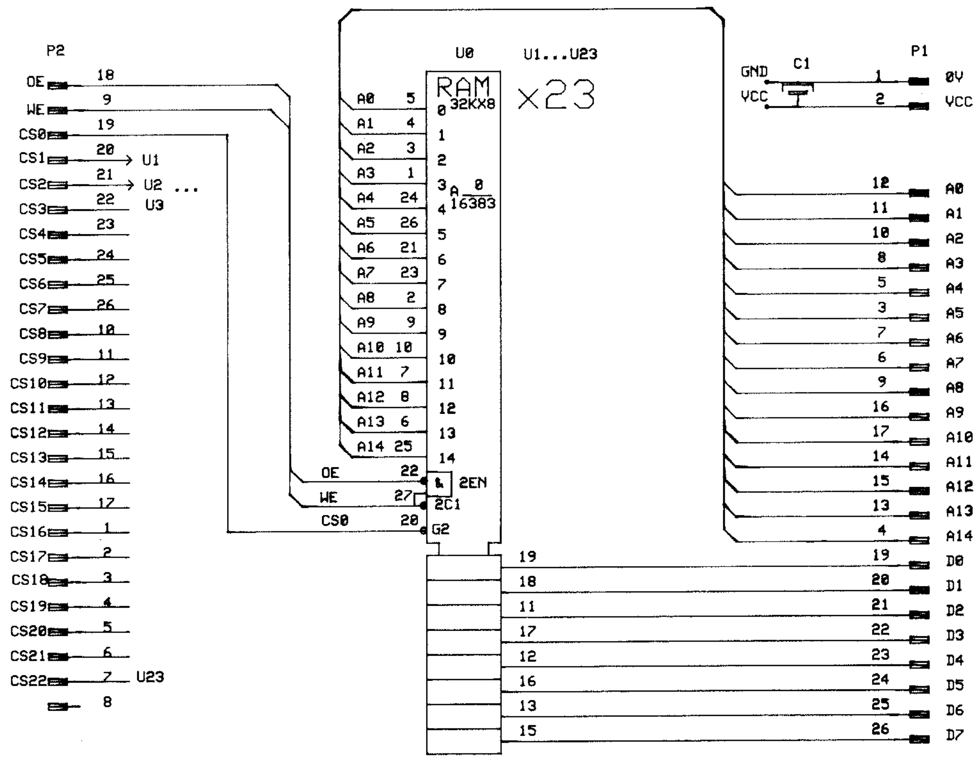
Atlas Copco

Scale Skala
Drawn Ritad: GYLS
Ref no Reg nr
Blank no Ämnes nr
Compare Jämför: TERRALOC
Replaces Ersätter
Drawing owner
Std chd Norm gr
Blank wt Ämnesv kg
Finished wt Färdigv kg
Designation Beteckning
Sheet Blad
Transferred fr Överförd fr
Design chd Konstr gr
Prod chd Prod gr
Appd Godk
Date 83 1128
9130 0101 00 A

Appurtenant drawings and documents/
Tillhörande ritningar och dokument

Note Not | Pos | Modified from Ändrat från | Date Datum | Intr Inf

TERRALOC
RAM DISK



Pos	Designation/Beteckning	Number/Antal	Name/Benämning	Material

Tolerances, if not indicated, according to: / Toleranser där ej annat angivits enligt:
ATLAS COPCO STANDARD 1350 K

Machined surfaces / Maskinbearbetade ytor — Class/Klass — Class/Klass — Class/Klass

Name/Benämning: Circuit diagram RAM disk

2: Terraloc 9136 3CC 94

3

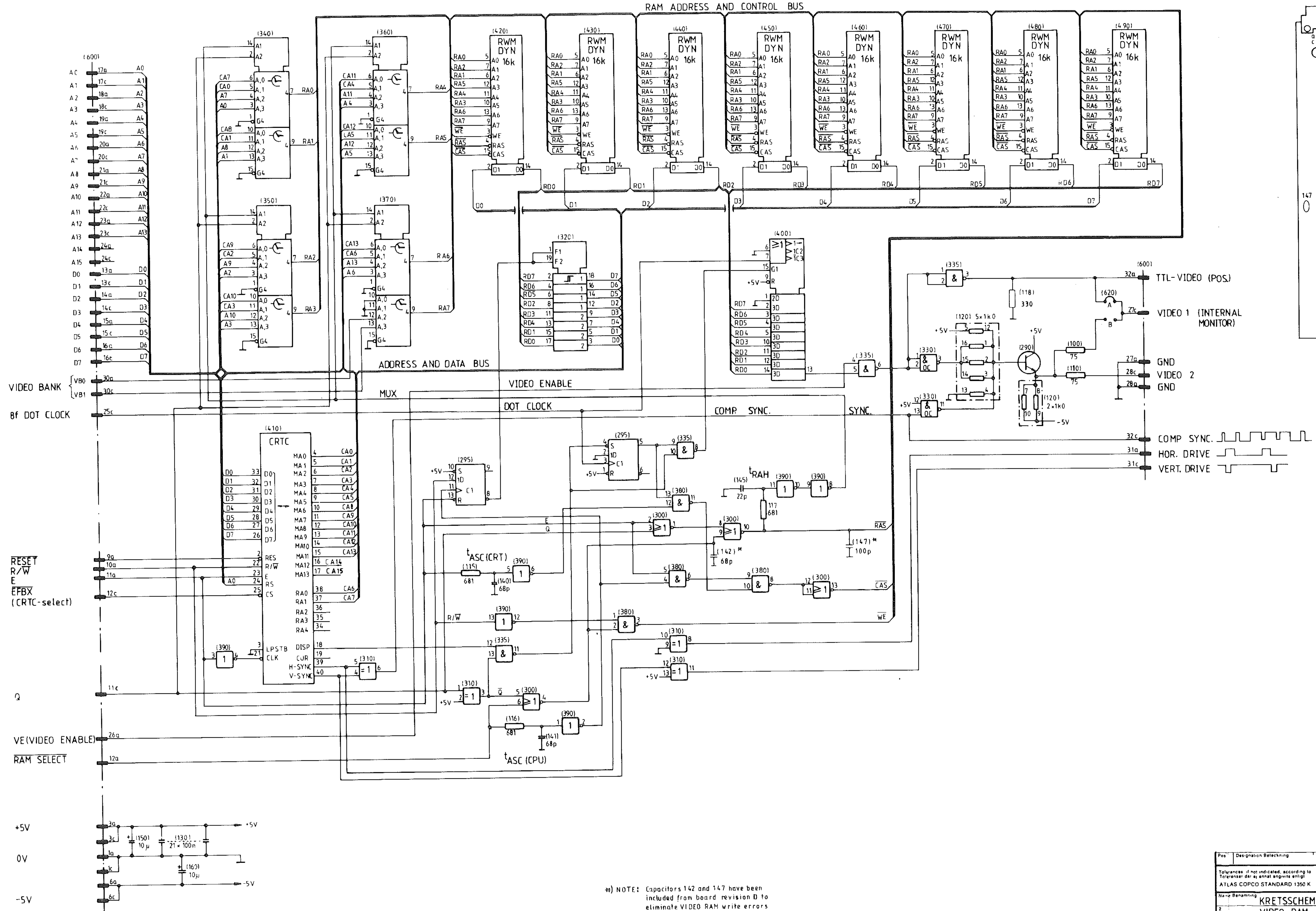
Atlas Copco

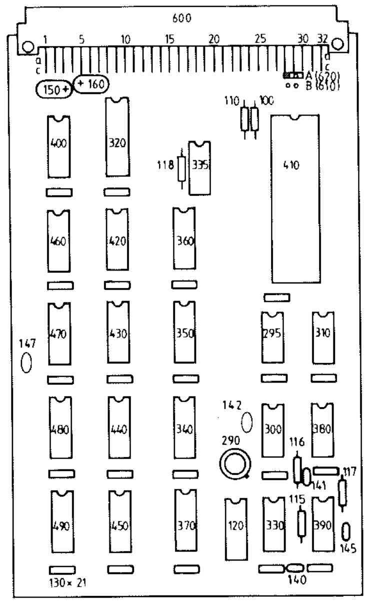
Scale/Skala	Ref. no./Reg. nr	Compare/Jämför	
Drawn/Ritad: H.T	Blank no./Ämnes nr	Replaces/Ersätter	Drawing owner/Ritn. äg.
Std chd./Norm gr.	Blank wt/Ämnesv. kg	Finished wt/Färdigv. kg	Designation/Beteckning — Sheet/Blad ( )
Design chd/Konstr. gr	Prod. chd./Prod. gr	Appd/Godk — Date	9136 ... 10 A

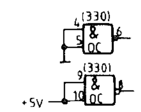
Transferred fr. Överförd fr.

Note/Not	Posi-tion	Modified from/Ändrad från	Date/Datum	Intr./Int

Appurtenant drawings and documents/ Tillhörande ritningar och dokument







IC POWER SUPPLY CONNECTIONS			
Pos. No.	Type	0V	+5V
295	74LS74	7	14
300	74LS02	7	14
310	74LS86	7	14
320	74LS244	10	20
330	74LS03	7	14
335, 380	74LS00	7	14
340-370	74LS153	8	16
390	74LS04	7	14
400	74LS166	8	16
410	HD46505S-1	1	20
420-490	2118-4	16	8

*) NOTE: Capacitors 142 and 147 have been included from board revision D to eliminate VIDEO RAM write errors when the digital interface board is included in the system. Earlier boards may or may not be hardware modified depending on delivery date

Tolerances if not indicated, according to / Toleranser där ej annat angivits enligt
ATLAS COPCO STANDARD 1350 K

Name Benämning: KRETSSCHEMA/CIRCUIT DIAGRAM
VIDEO RAM 9136 3100 42

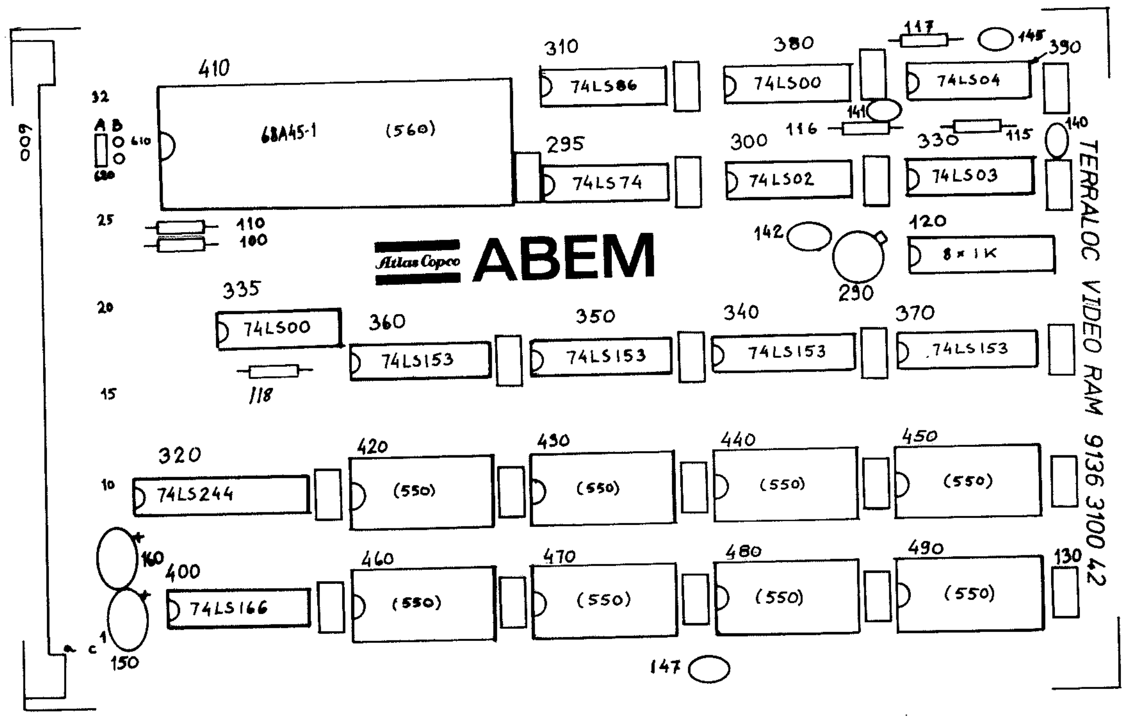
Atlas Copco

Drawn Ritad: GYLS

Compare Jämför: TERRALOC

Date: 82 09 17

9130 0100 02 D



Pos	Designation/Beteckning	Number/Antal	Name/Benämning	Material

Tolerances, if not indicated, according to / Toleranser där ej annat angivits enligt ATLAS COPCO STANDARD 1350 K

Name/Benämning: MONTERINGSRITNING & KOMP. TRYCKORIGINAL

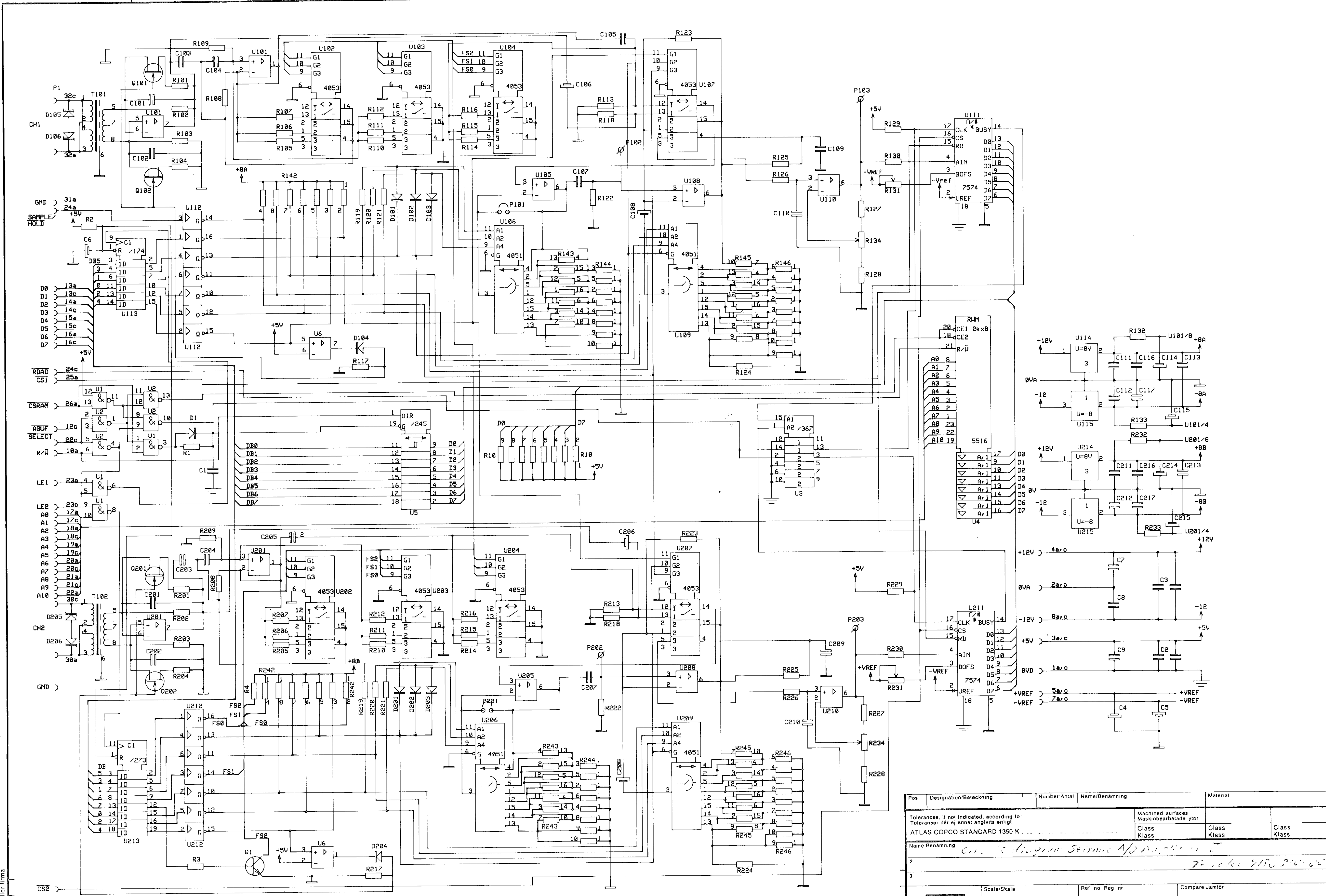
VIDEO RAM 9136 3100 42

Scale/Skala 2:1

TERRALOC

9130 0500 02 E

Date 820915



Pos	Designation/Beteckning	Number/Antal	Name/Benämning	Material

Tolerances, if not indicated, according to:
Toleranser där ej annat angivits enligt:
ATLAS COPCO STANDARD 1350 K

Machined surfaces
Maskinbearbetade ytor

Class Klass | Class Klass | Class Klass

Name Benämning

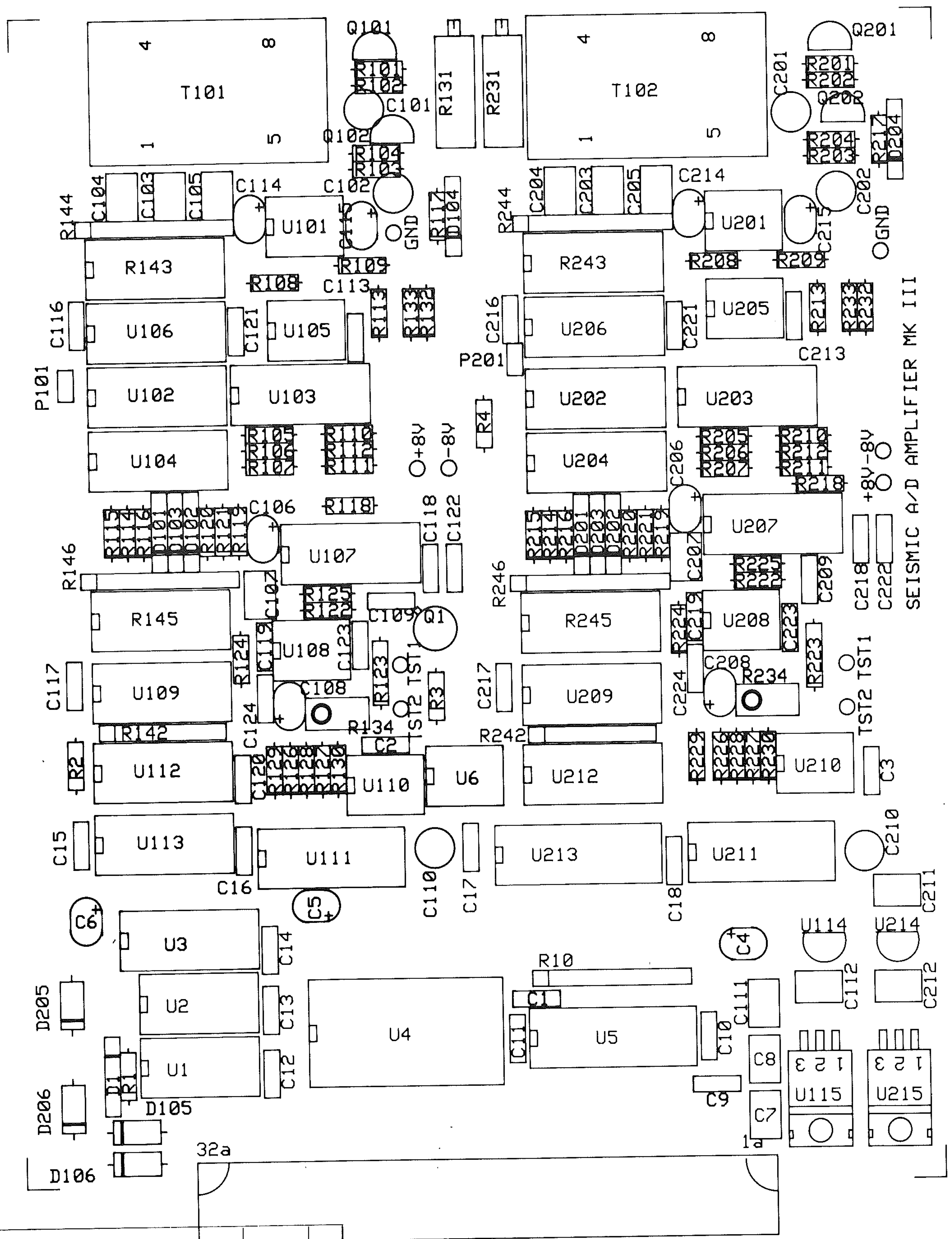
Atlas Copco

Scale/Skala | Ref no Reg nr | Compare Jämför
Drawn/Ritad 4T | Blank no Ämnes nr | Replaces Ersätter | Drawing owner Ritn ag
Std chd / Norm gr | Blank wt/Ämnesv. kg | Finished wt Färdigv kg | Designation Beteckning | Sheet Blad ( )
Transferred fr /Överförd fr.
Design chd Konstr gr | Prod. chd / Prod. gr. | Appd Godk | Date 87-05-05

Appurtenant drawings and documents/
Tillhörande ritningar och dokument

Note/ Not | Posi- tion | Modified from: Ändrat från | Date Datum | Intr./ Inf.

A 2752a augusti 82 Barklunds, Sthlm



Note/Not	Position	Modified from/Ändrat från	Date/Datum	Intr./Inf.

A 2752e augusti 82 Barklunds, Sthlm.

Appurtenant drawings and documents/ Tillhörande ritningar och dokument

Pos.	Designation/Beteckning	Number/Antal	Name/Benämning	Material

Tolerances, if not indicated, according to: / Toleranser där ej annat angivits enligt: ATLAS COPCO STANDARD 1350 K

Machined surfaces / Maskinbearbetade ytor — Class/Klass | Class/Klass | Class/Klass

Name/Benämning: Monteringsritning

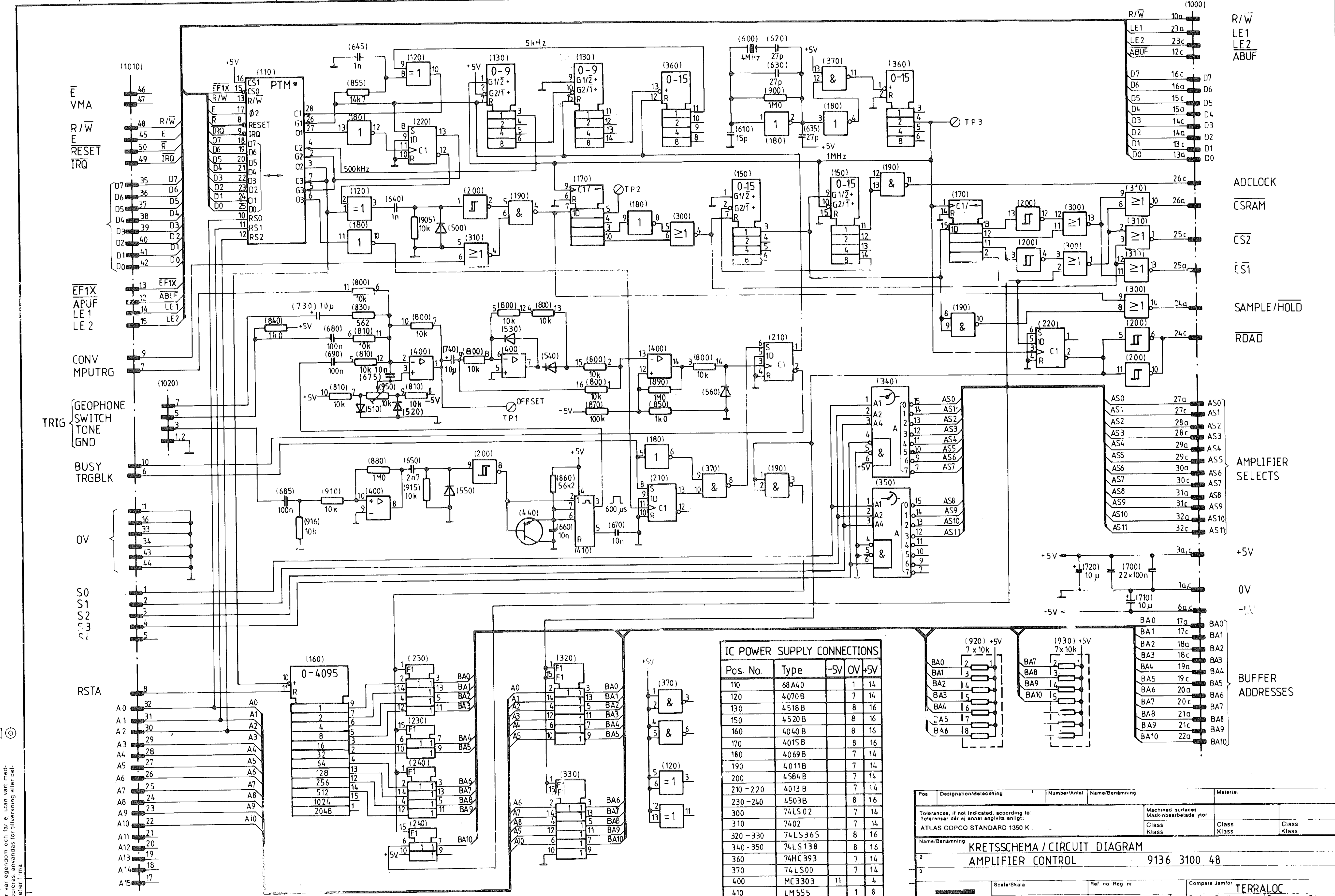
2 Seismic A/D Amp 9136 310100

3

Atlas Copco

Scale/Skala 1,8:1	Ref. no./Reg. nr	Compare/Jämför
Drawn/Ritad BB	Blank no./Ämnes nr	Replaces/Ersätter — Drawing owner/Ritn. äg.
Std. chd./Norm. gr. — Blank wt/Ämnesv. kg — Finished wt/Färdigv. kg		Designation/Beteckning — Sheet/Blad ( )
Design chd./Konstr. gr. — Prod. chd./Prod. gr. — Appd./Godk.	Date 87-04-23	9130 0500 15 B

Transferred fr./Överförd fr.



IC POWER SUPPLY CONNECTIONS				
Pos. No.	Type	-5V	0V	+5V
110	68A40		1	14
120	4070B		7	14
130	4518B		8	16
150	4520B		8	16
160	4040B		8	16
170	4015B		8	16
180	4069B		7	14
190	4011B		7	14
200	4584B		7	14
210 - 220	4013B		7	14
230 - 240	4503B		8	16
300	74LS02		7	14
310	7402		7	14
320 - 330	74LS365		8	16
340 - 350	74LS138		8	16
360	74HC393		7	14
370	74LS00		7	14
400	MC3303	11		4
410	LM555		1	8

Appurtenant drawings and documents/
Tillhörande ritningar och dokument

Note/Not	Position	Modified from/Ändrat från	Date/Datum	
C	Pos 675 740 tillk.		850508	
B	Fr.o.m. uppl. 303		831004	

Pos	Designation/Beteckning	Number/Antal	Name/Benämning	Material

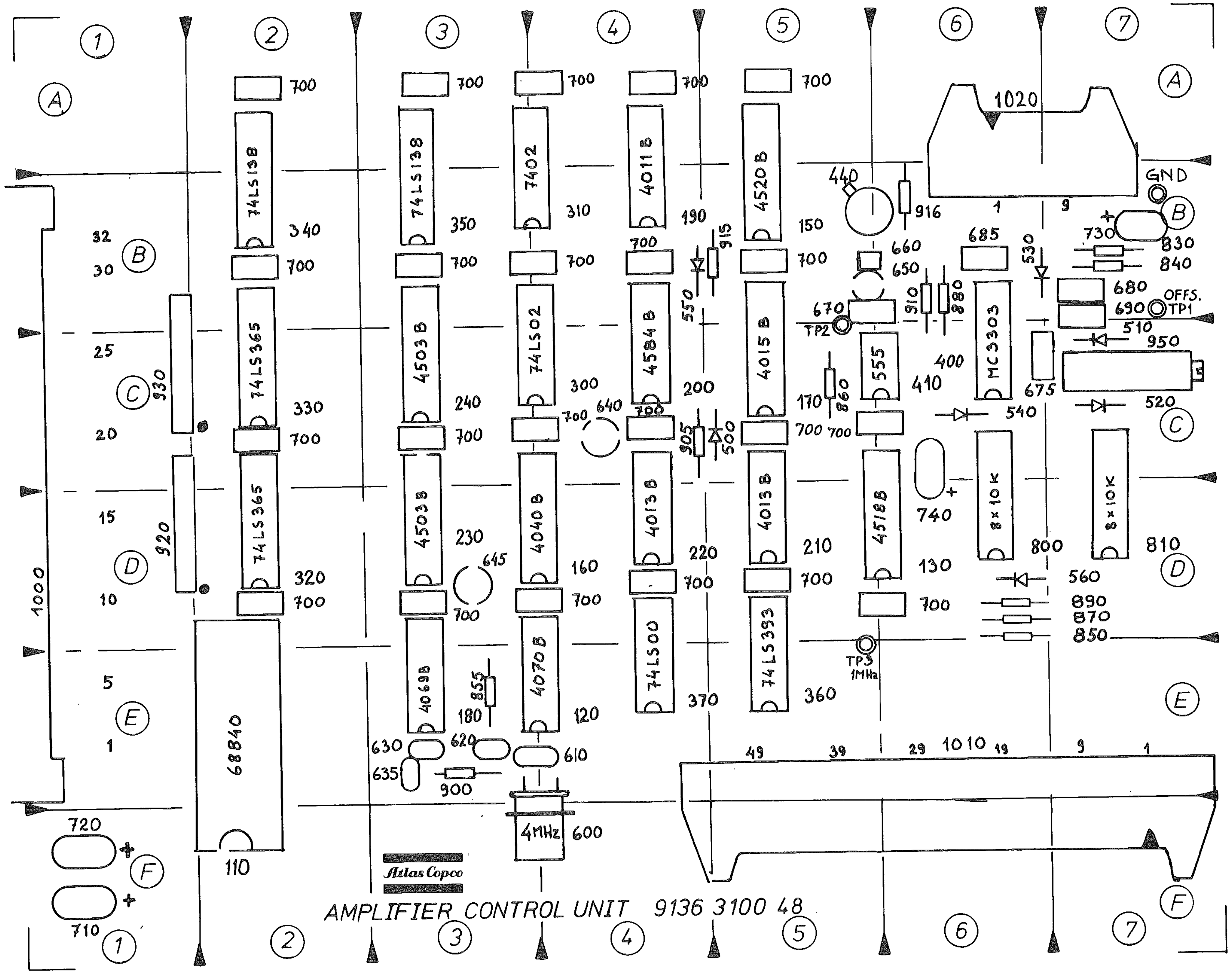
Tolerances, if not indicated, according to:
Toleranser där ej annat angivits enligt:
ATLAS COPCO STANDARD 1350 K

Machined surfaces / Maskinbearbetade ytor — Class / Klass | Class / Klass | Class / Klass

Name/Benämning
KRETSSCHEMA / CIRCUIT DIAGRAM
AMPLIFIER CONTROL 9136 3100 48

Atlas Copco

Scale/Skala:
Ref. no /Reg. nr:
Compare Jamför: TERRALOC
Drawn/Ritad: GYLS
Blank no /Ämnes nr:
Replaces Ersätter:
Drawing owner Ritn. ag:
Transferred fr. Överförd fr:
Std. chd / Norm. gr:
Blank wt/Ämnesv.: kg
Finished wt Färdigv.: kg
Design chd / Konstr. gr:
Prod. chd./Prod. gr.:
Appd / Godk:
Date: 82 05 04
Designation Beteckning: 9130 0100 08 C
Sheet Blad



Kontaktstift Pos.1100
Monteras vid TP1, TP2
TP3, GND.

Pos	Designation/Beteckning	Number/Antal	Name/Benämning	Material

Tolerances, if not indicated, according to: / Toleranser där ej annat angivits enligt: ATLAS COPCO STANDARD 1350 K

Machined surfaces / Maskinbearbetade ytor — Class / Klass

Name/Benämning: MONTERINGSRITNING & KOMP. TRYCKORIGINAL

AMPLIFIER CONTROL 9136 3100 48

Scale/Skala: 2:1

Compare Jämför: TERRALOC

Drawn/Ritad: BB

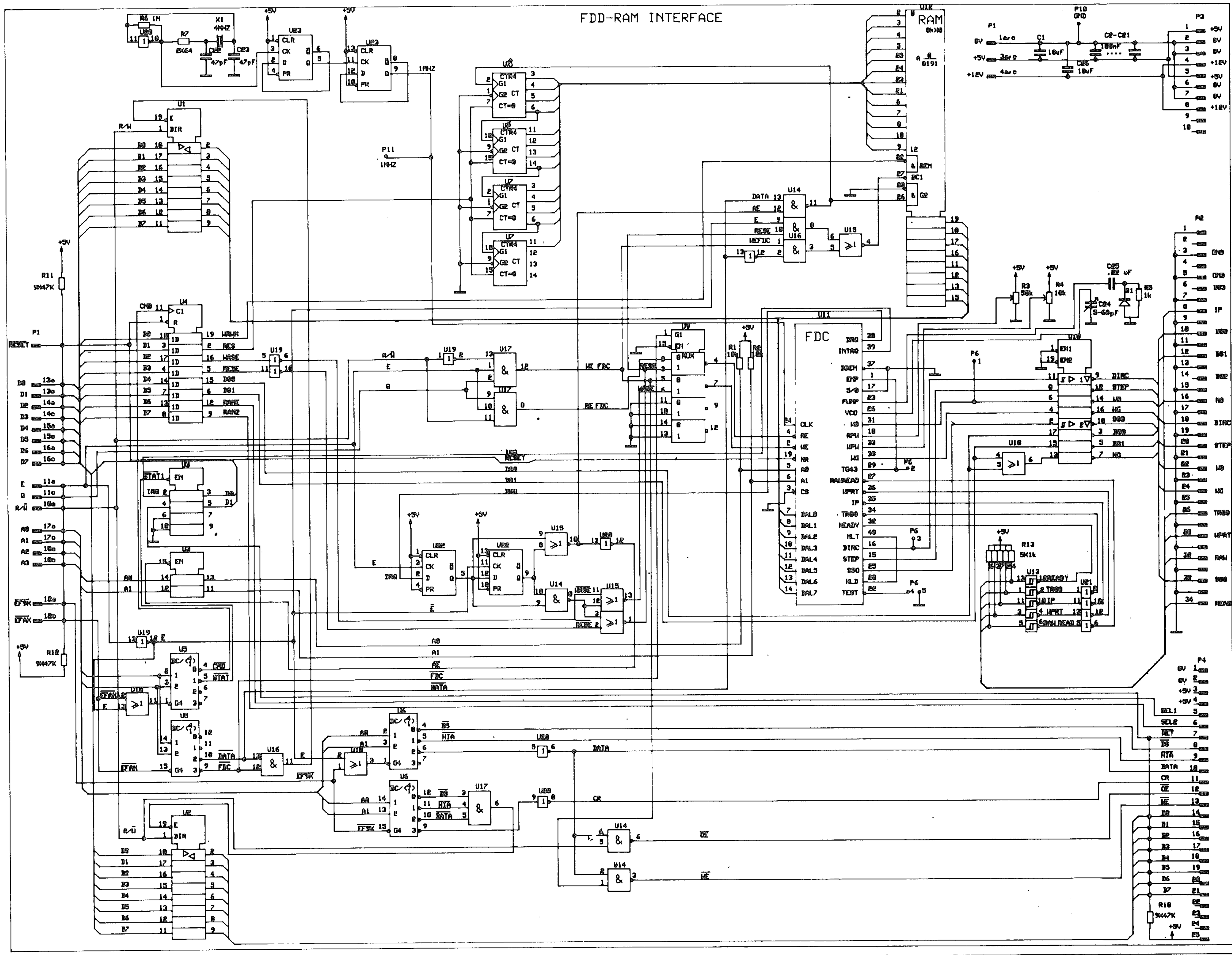
Appd/Godk — Date: 820722

Designation/Beteckning: 9130 0500 08 E

Appurtenant drawings and documents / Tillhörande ritningar och dokument

Note/Not	Position	Modified from/Ändrat från	Date/Datum	Intr./Inf.

A 2752a maj 79 Barklunds, Sthlm.



Tolerances, if not indicated, according to:
Toleranser där ej annat angivits enligt:
ATLAS COPCO STANDARD 1350 K

Machined surfaces / Maskinbearbetade ytor — Class / Klass

Name/Benämning: *Circuit diagram Disk Interface*

Terraloc 9136 3100 92

Atlas Copco

Scale/Skala	Ref. no./Reg. nr	Compare/Jämför
Drawn/Ritad: *HT*	Blank no./Ämnes nr	Replaces/Ersätter
Std. chd./Norm. gr.	Blank wt/Ämnesv. kg	Finished wt/Färdigv. kg
Design chd./Konstr. gr.	Prod. chd./Prod. gr.	Appd./Godk.
Date: *870527HT*		

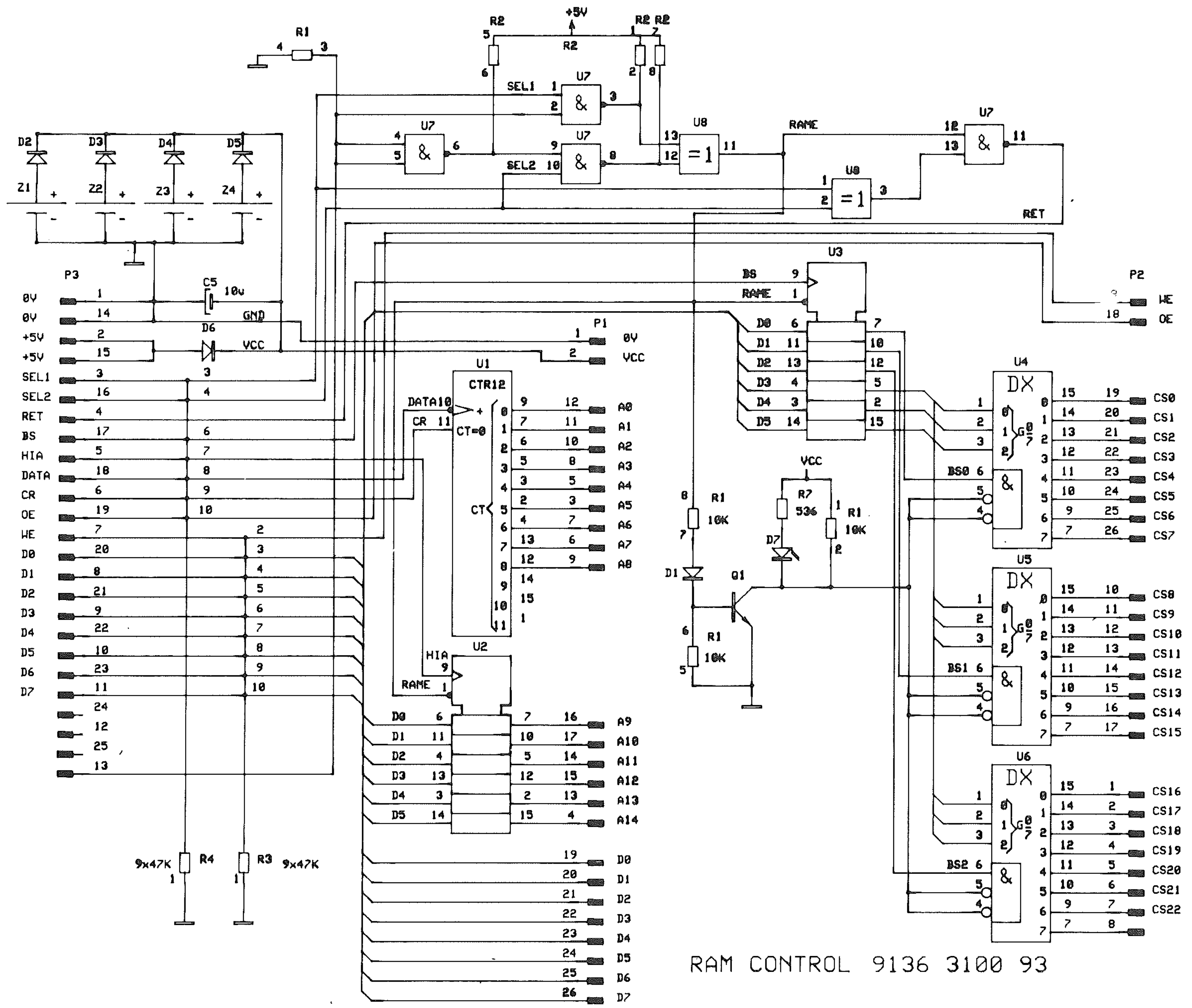
Designation/Beteckning: 9130 0102 00 *A*

Appurtenant drawings and documents/ Tillhörande ritningar och dokument

Note/Not — Position — Modified from/Ändrat från — Date/Datum — Intr./Inf.

A 2752a augusti 82 Barklunds, Sthlm.

TERRALOC
RAM DISK CONTROLLER



RAM CONTROL 9136 3100 93

Pos.	Designation/Beteckning	Number/Antal	Name/Benämning	Material

Tolerances, if not indicated, according to: / Toleranser där ej annat angivits enligt: ATLAS COPCO STANDARD 1350 K

Machined surfaces / Maskinbearbetade ytor — Class / Klass — Class / Klass — Class / Klass

Name/Benämning: Circuit Diagram Ram Control — Terraloc

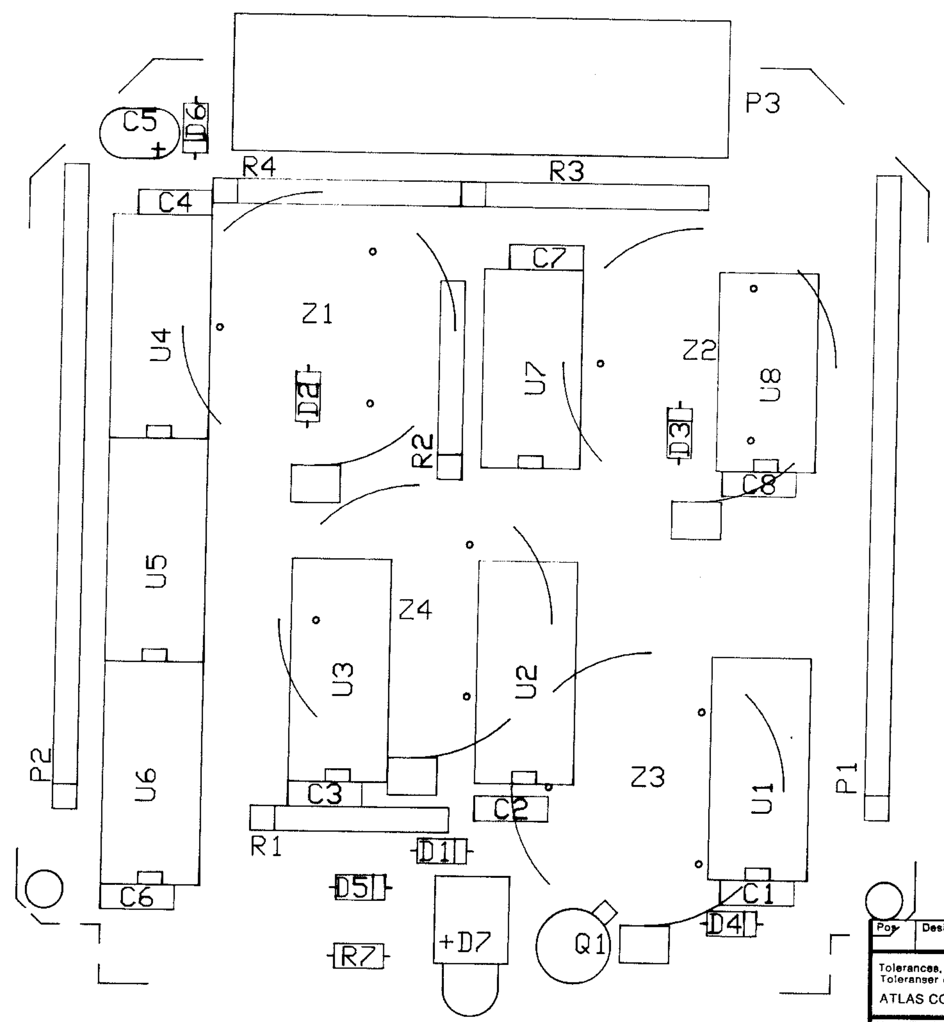
Atlas Copco

Scale/Skala	Ref. no./Reg. nr	Compare/Jämför	
Drawn/Ritad H.T.	Blank no./Ämnes nr	Replaces/Ersätter	Drawing owner/Ritn. äg.
Std. chd./Norm. gr.	Blank wt/Ämnesv. kg	Finished wt/Färdigv. kg	Designation/Beteckning — Sheet/Blad ( )
Design chd./Konstr. gr.	Prod. chd./Prod. gr.	Appd./Godk.	Date 87-10-30 — 9130 0102 09 A

Transferred fr./Överförd fr.

Appurtenant drawings and documents / Tillhörande ritningar och dokument

Note/Not	Posi-tion	Modified from/Ändrat från	Date/Datum	Intr./Inf.



Pos	Designation/Beteckning	Number/Antal	Name/Benämning	Material

Tolerances, if not indicated, according to: / Toleranser där ej annat angivits enligt: ATLAS COPCO STANDARD 1350 K

Machined surfaces / Maskinbearbetade ytor — Class/Klass | Class/Klass | Class/Klass

Name/Benämning: Component Layout RAM Control

2: Terralog 9136310095

3: PCB 9136870176

Scale/Skala	Ref. no./Reg. nr	Compare/Jämför	
Drawn/Ritad H.T.	Blank no./Ämnes nr	Replaces/Ersätter	Drawing owner/Ritn. äg.
Std chd / Norm gr	Blank wt/Ämnesv. kg	Finished wt/Färdigv. kg	Designation/Beteckning — Sheet/Blad ( )
Design chd / Konstr gr	Prod chd / Prod gr	Appd / Godk — Date 87-09-15	9130 050013 A

Atlas Copco

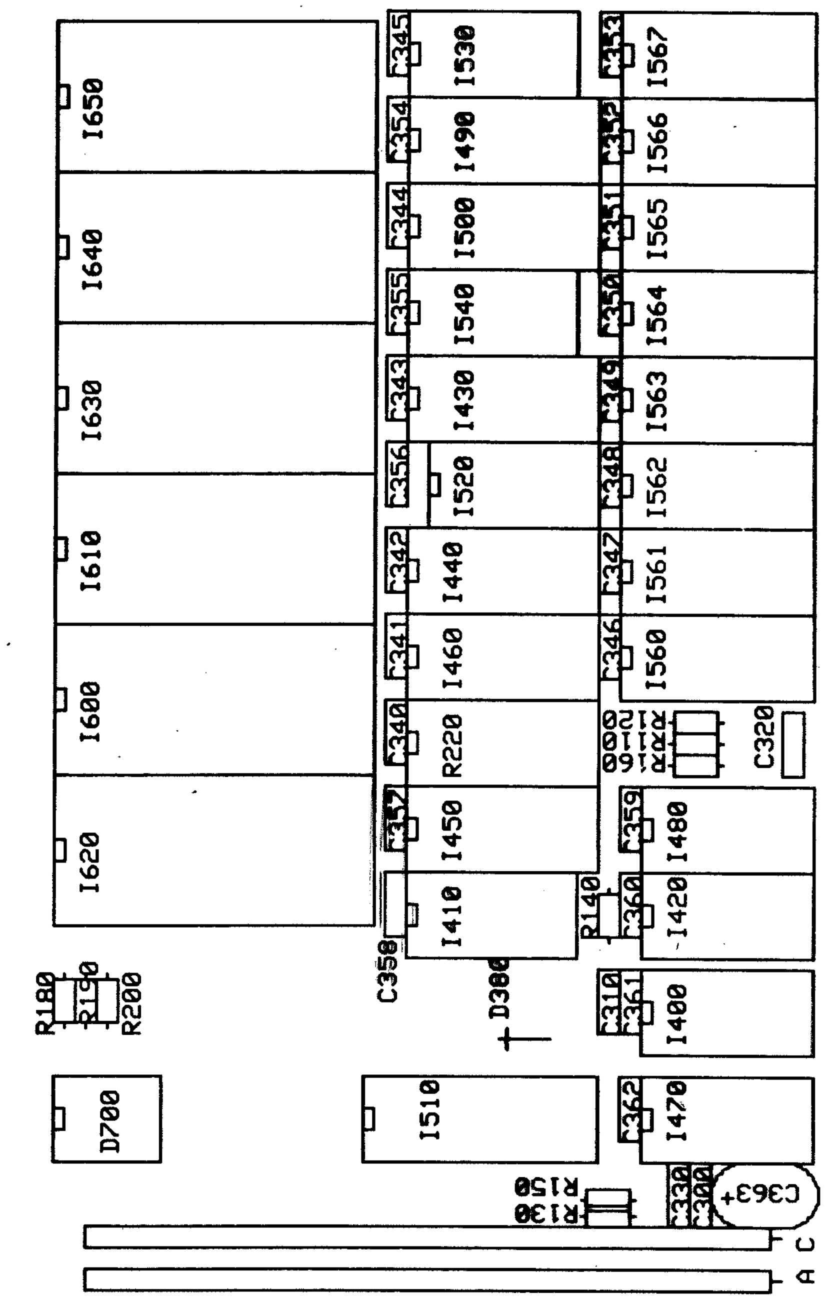
Transferred fr / Överförd fr.

Note/Not	Posi-tion	Modified from/Ändrad från	Date/Datum	Intr./Inf

Appurtenant drawings and documents/ Tillhörande ritningar och dokument

Barklunds, Sthlm

Note	Modified from/Ändrad från	Date	Intr.	Note	Modified from/Ändrad från	Date	Intr.



Tolerances, if not indicated, according to: Toleranser där ej annat angivits enligt: ATLAS COPCO STANDARD 1350 K	Machined surfaces Maskinbearbetade ytor		
	Class Klass	Class Klass	Class Klass

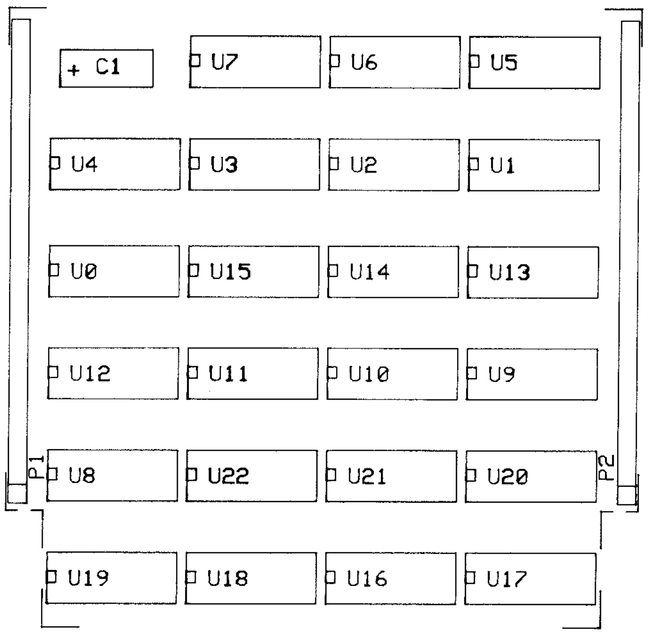
Name/Benämning *Component Layout ROMRAM 2* *Terraloc*

2 *9136 3100 69*

3

	Scale/Skala		Ref. no./Reg. nr		Compare/Jämför	
	Drawn/Ritad *S.W.*		Blank no./Ämnes nr		Replaces/Ersätter	Drawing owner/Ritn. äg.
Transferred fr./Överförd fr.	Std. chd./ Norm. gr.	Blank wt/Ämnesv. kg	Finished wt/Färdigv. kg		Designation/Beteckning	Sheet/Blad ( )
	Design chd./ Konstr. gr.	Prod. chd./ Prod. gr.	Appd./ Godk.	Date *87-11-03*	9130 0500 10 A	

A 2764a augusti 82 Barklunds, Sthlm.



Pos	Designation/Beteckning	Number/Antal	Name/Benämning	Material

Tolerances, if not indicated, according to: / Toleranser där ej annat angivits enligt: ATLAS COPCO STANDARD 1350 K

Machined surfaces / Maskinbearbetade ytor — Class/Klass — Class/Klass — Class/Klass

Name/Benämning: Component layout RAM Board — Tirreloc

2: 9136 3100 94

3

Atlas Copco

Scale/Skala — Ref. no./Reg. nr — Compare/Jämför

Drawn/Ritad: H.T. — Blank no./Ämnes nr — Replaces/Ersätter — Drawing owner/Ritn. äg.

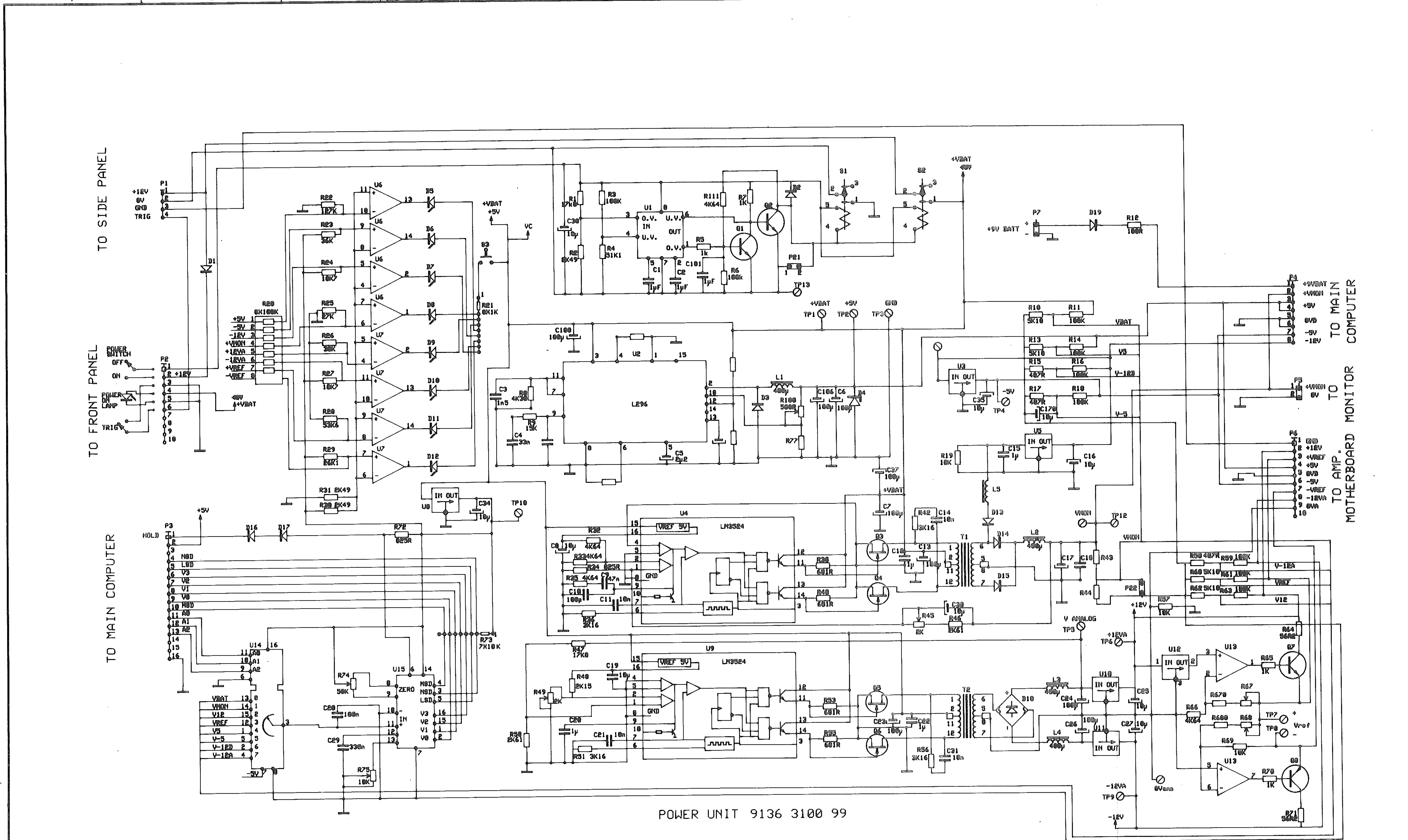
Std. chd / Norm gr — Blank wt/Ämnesv. kg — Finished wt/Färdigv. kg — Designation/Beteckning — Sheet/Blad ( )

Transferred fr. Överförd fr. — Design chd / Konstr. gr — Prod. chd / Prod. gr — Appd / Godk — Date: 871103

9130 0500 14 A

Note/Not	Position	Modified from/Ändrad från	Date/Datum	Intr/Inf

Appurtenant drawings and documents/ Tillhörande ritningar och dokument



Note/Not	Position	Modified from/Ändrat från	Date/Datum	Intr./Inf.

A 2752a augusti 82 Barklunds, Sthlm.

Appurtenant drawings and documents/Tillhörande ritningar och dokument

Pos. | Designation/Beteckning | Number/Antal | Name/Benämning | Material

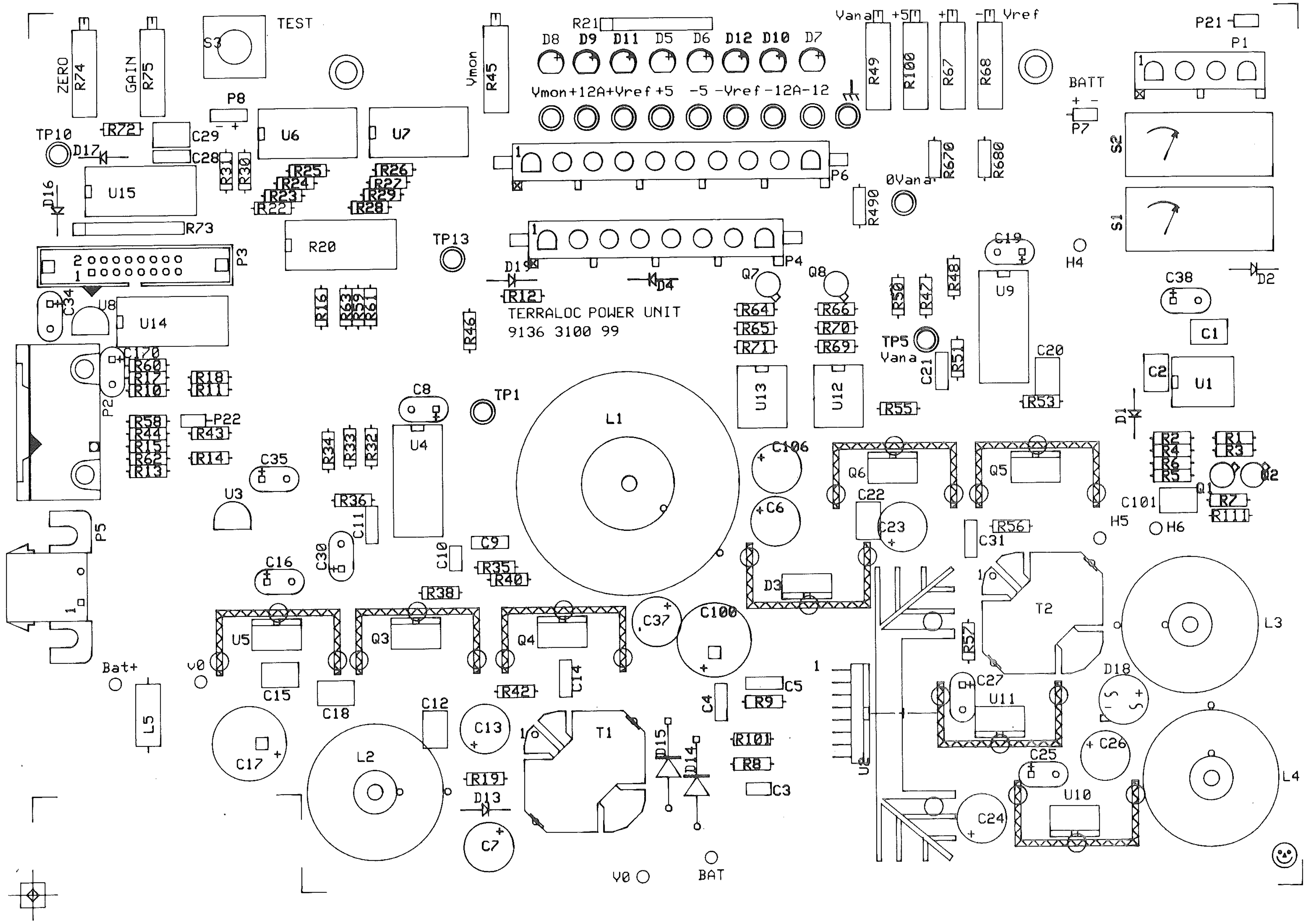
Tolerances, if not indicated, according to: Toleranser där ej annat angivits enligt: ATLAS COPCO STANDARD 1350 K

Machined surfaces / Maskinbearbetade ytor — Class/Klass

Name/Benämning: Circuit diagram Power Supply — Terraloc — 9136 3100 99

Atlas Copco

Scale/Skala: 1:0.65 (10,-5.5)
Drawn/Ritad: HT
Date: 871130
Designation/Beteckning: 9130 0102 11 D



Pos	Designation/Beteckning	Number/Antal	Name/Benämning	Material

Tolerances, if not indicated, according to:
Toleranser där ej annat angivits enligt:
ATLAS COPCO STANDARD 1350 K

Machined surfaces / Maskinbearbetade ytor		
Class / Klass	Class / Klass	Class / Klass

Name/Benämning: Component layout Power Supply — Terraloc

2 — 9136 3100 99

3

Atlas Copco

Scale/Skala	Ref no./Reg nr	Compare/Jämför	
Drawn/Ritad: HT.	Blank no./Ämnes nr	Replaces Ersätter	Drawing owner/Ritn ägare
Std. chd./Norm gr.	Blank wt/Ämnesv. kg	Finished wt/Färdigv. kg	Designation/Beteckning — Sheet Blad ( )
Design chd./Konstr. gr.	Prod. chd./Prod. gr.	Appd Godk. — Date 871103	9130 0500 16

Transferred fr./Overförd fr.

Appurtenant drawings and documents/
Tillhörande ritningar och dokument

Note/ Not	Posi- tion	Modified from/ Ändrat från	Date/ Datum	Intr./ Inf.

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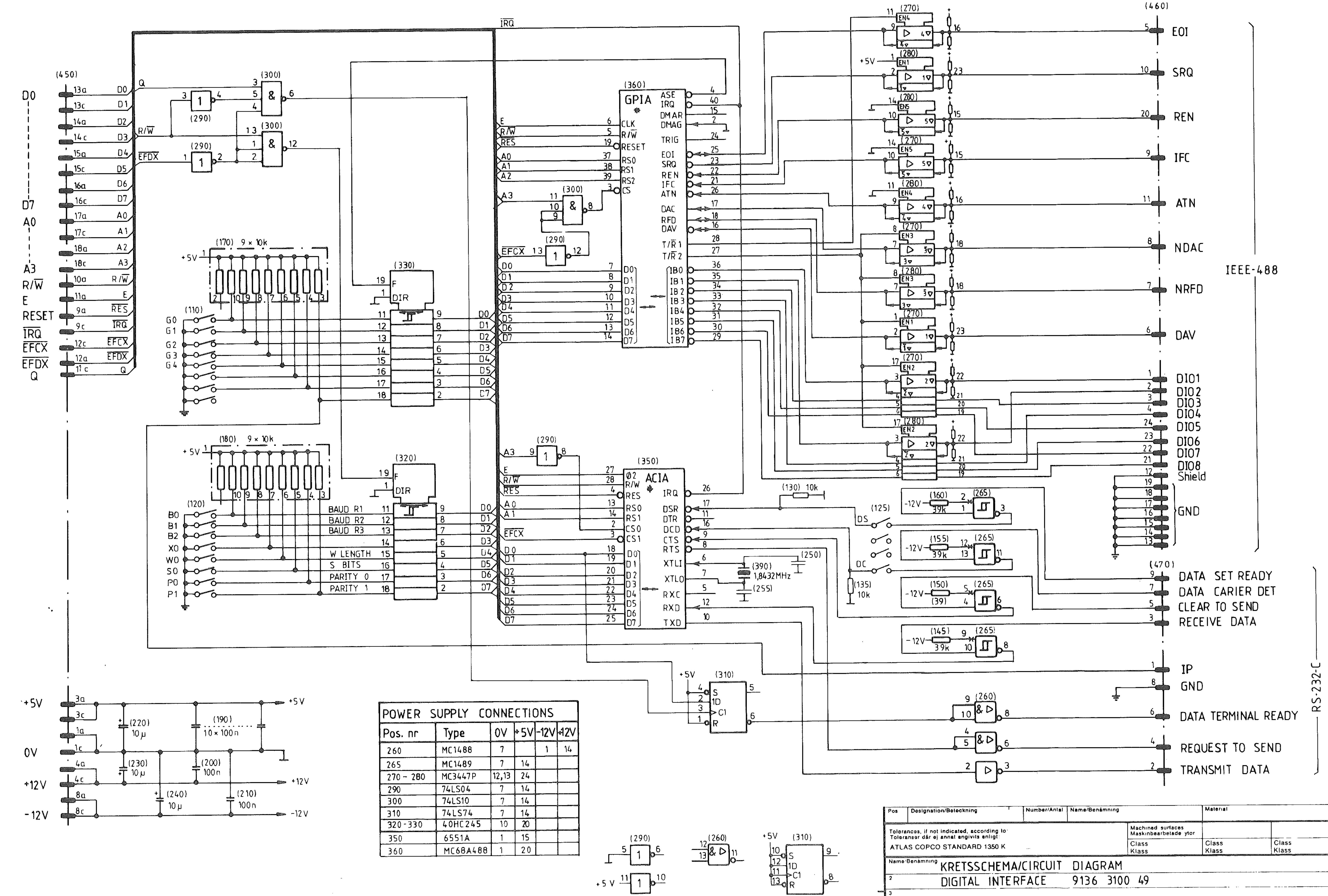


POWER SUPPLY CONNECTIONS					
Pos. nr	Type	0V	+5V	-12V	+12V
260	MC1488	7		1	14
265	MC1489	7	14		
270 - 280	MC3447P	12,13	24		
290	74LS04	7	14		
300	74LS10	7	14		
310	74LS74	7	14		
320 - 330	40HC245	10	20		
350	6551A	1	15		
360	MC68A488	1	20		

Pos	Designation/Beteckning	Number/Antal	Name/Benämning	Material

Tolerances, if not indicated, according to: / Toleranser där ej annat angivits enligt: ATLAS COPCO STANDARD 1350 K

Machined surfaces / Maskinbearbetade ytor — Class Klass | Class Klass | Class Klass

Name/Benämning: KRETSSCHEMA/CIRCUIT DIAGRAM

2 DIGITAL INTERFACE 9136 3100 49

3

Atlas Copco

Scale/Skala | Ref no/Reg nr | Compare/Jamför TERRALOC

Drawn/Ritad GYLS | Blank no/Ämnes nr | Replaces/Ersätter | Drawing owner/Ritn ag

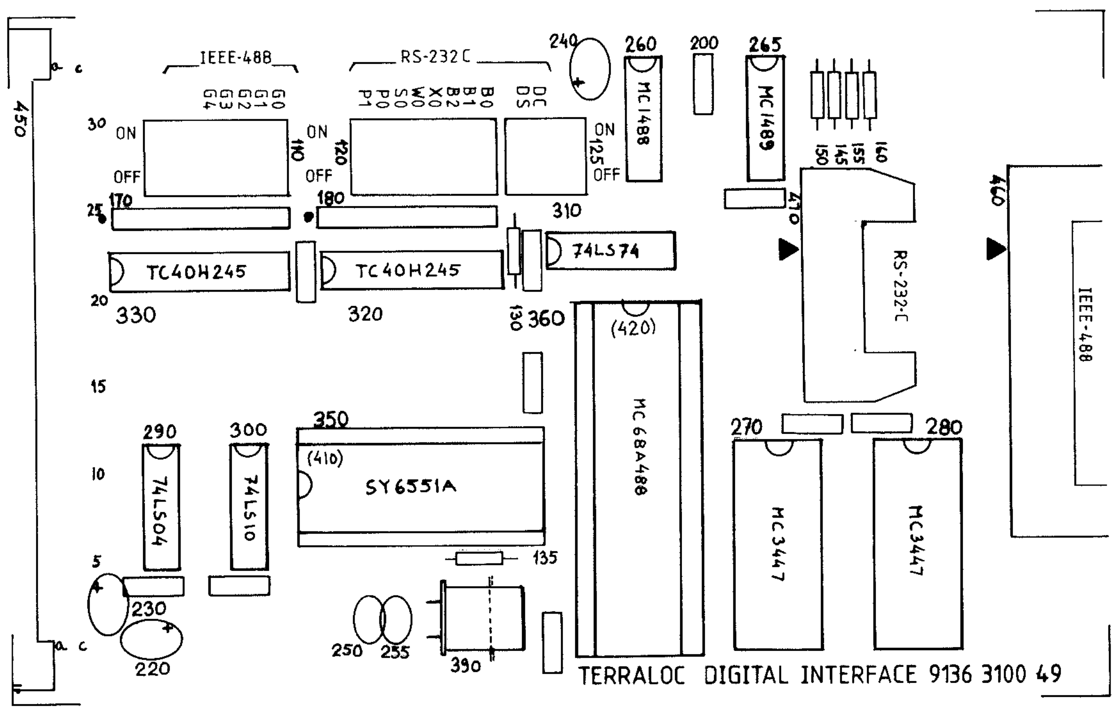
Std chd/Norm gr | Blank wt/Ämnesv kg | Finished wt/Färdigv kg | Designation/Beteckning | Sheet/Blad

Transferred fr/Överförd fr | Design chd/Konstr gr | Prod chd/Prod gr | Appd/Godk | Date 82 10 19

9130 0100 52 B

B	Fr.o.m. uppl. 303	831004	
Note/Not	Posi-tion	Modified from/Ändrat från	Date/Datum	Intr./Inf

Appurtenant drawings and documents/Tillhörande ritningar och dokument



MONTERINGSANVISNINGAR:

1. DIP-SWITCHARNA 110, 120 OCH 125 VÄNDS SÅ ATT "ON" RESP. "OFF" PÅ SWITCHEN STÄMMER MED TEXTEN PÅ KORTET.
2. KRETSARNA 350 OCH 360 MONTERAS PÅ IC-HÅLLARE (410 RESP. 420).
3. KRISTALLEN 390 FÄSTS MED FÖRTENT BLANKTRÅD SOM LÖDS I KORTET.
4. ▭ -SYMBOLEN AVSER KONDENSATORERNA 190-210.

Pos	Designation/Beteckning	Number/Antal	Name/Benämning	Material

Tolerances, if not indicated, according to / Toleranser där ej annat angivits enligt: ATLAS COPCO STANDARD 1350 K

Name/Benämning: MONTERINGSRITNING & KOMP. TRYCKORIGINAL

DIGITAL INTERFACE 9136 3100 49

TERRALOC

Atlas Copco

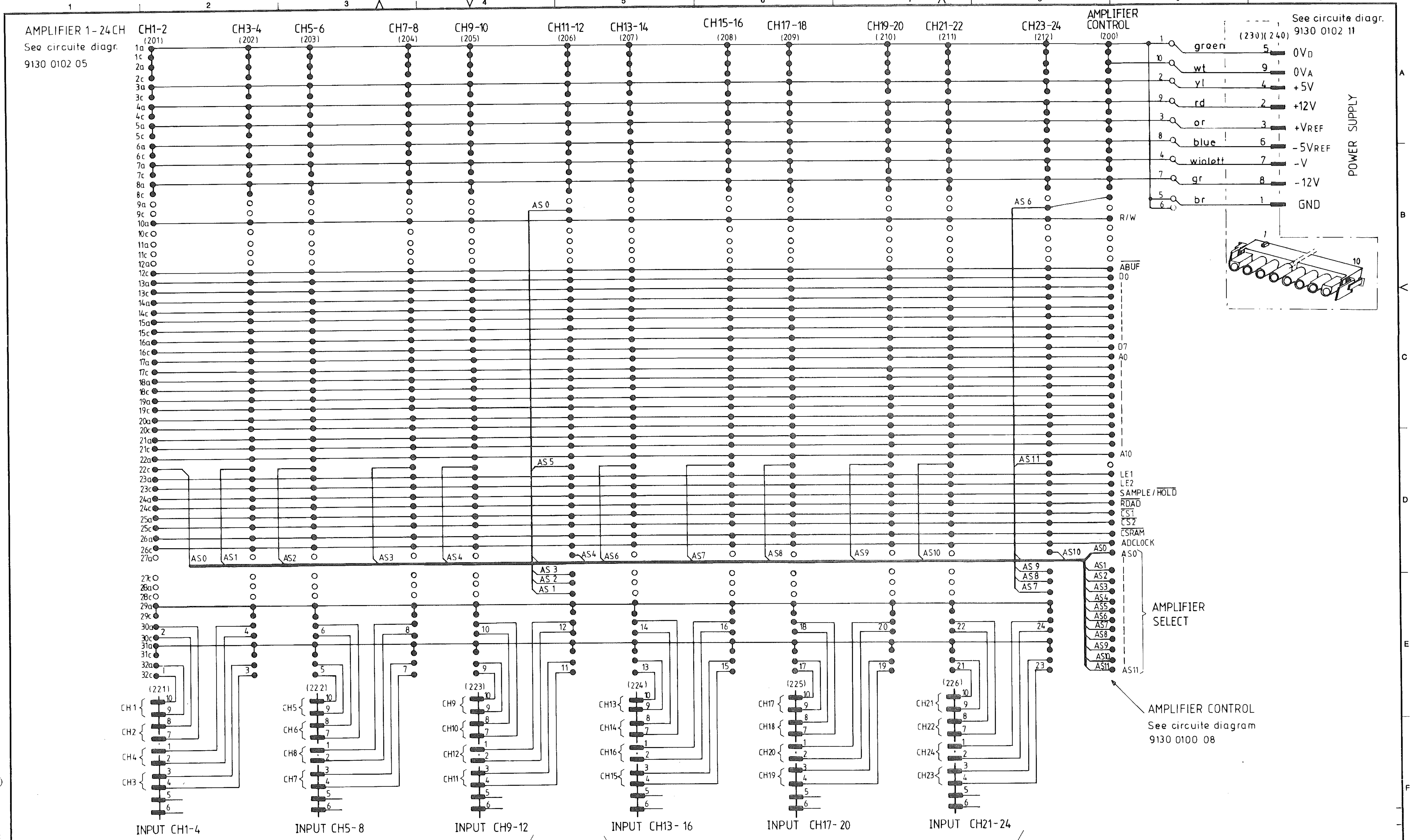
Scale/Skala: 2:1

Drawn/Ritad: BB

Appd/Godk: BB

Date/Datum: 82 11 29

9130 0500 09 A



See circuit diagram 9130 0100 15 CH1-12

9130 0100 15 CH13-24

Pos	Designation/Beteckning	Number/Antal	Name/Benämning	Material

Tolerances, if not indicated, according to
Toleranser där ej annat angivits enligt
ATLAS COPCO STANDARD 1350 K

Machined surfaces / Maskinbearbetade ytor — Class / Klass

Name/Benämning: KRETSSCHEMA/CIRCUIT DIAGRAM
AMPLIFIER MOTHERBOARD
TERRALOC Mark III

Atlas Copco

Drawn/Ritad: GYLS

Appd/Godk: BG — Date: 82 05 10

9130 0100 05C

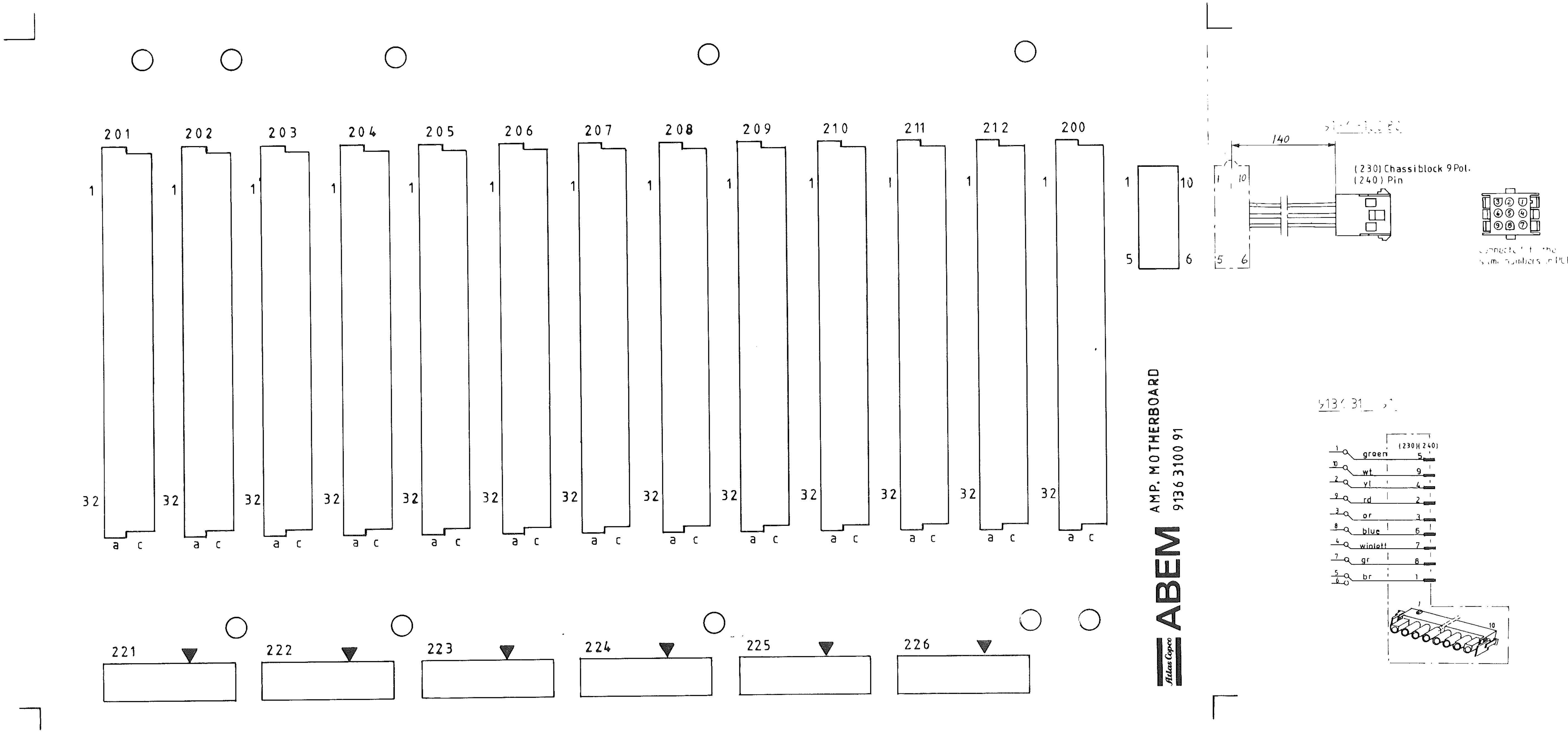
9130 0102 14

9136 3100 91

Appurtenant drawings and documents
Tillhörande ritningar och dokument

Note / Not	Posi- / tion	Modified from / Ändrat från	Date / Datum	Int

A 2752a maj 79 Barklunds, Sthlm



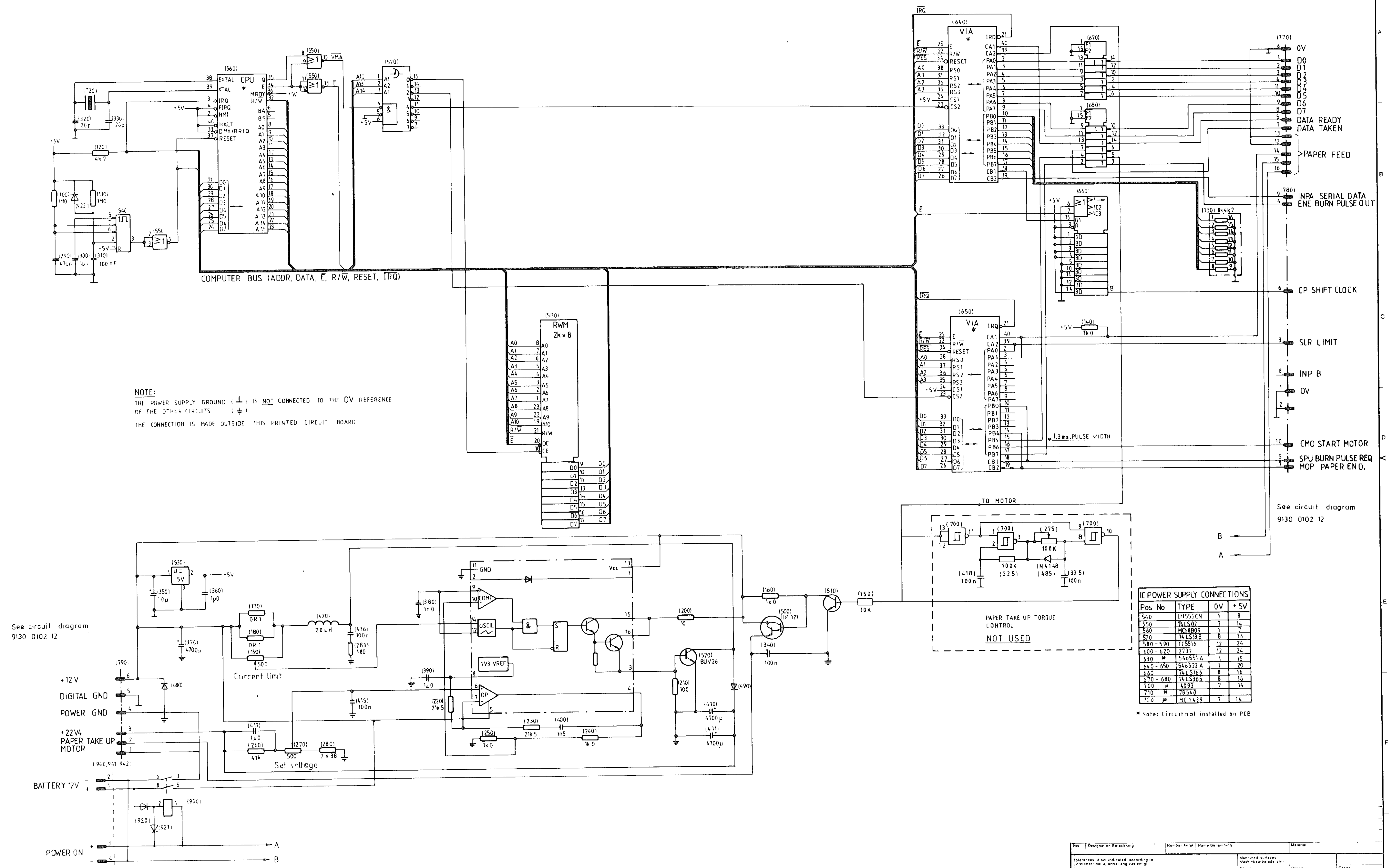
Pos	Designation Beteckning	Number Antal	Name Benämning	Material

Tolerances if not indicated according to
Toleranser där ej annat angivits enligt
ATLAS COPCO STANDARD 1350 K

Machined surfaces
Mask.bearbetade ytor
Class Klass | Class Klass | Class Klass

KOMPONENTTRYCKRITNG
AMPLIFIER MOTHERBOARD (9136 3100 45)
9136 3100 91 Mk3 , 9136 3100 80 MARK II
2:1
TERRALOC
B.B.
820618
9130 0500 05 C

B Pos. 230, 240 och 9136310080 Tillk. 840831



IC POWER SUPPLY CONNECTIONS			
Pos No	TYPE	0V	+ 5V
540	LM555CN	1	8
550	74LS02	7	14
560	MC68B09	1	7
570	74 LS138	8	16
580 - 590	TC5516	12	24
600 - 620	2732	12	24
630 *	S46551 A	1	15
640 - 650	S46522 A	1	20
660	74LS166	8	16
670 - 680	74LS365	8	16
700 *	4093	7	14
710 *	78540		
720 *	MC1489	7	14

* Note: Circuit not installed on PCB

9136 3100 97

Appurtenant drawings and documents
Tillhörande ritningar och dokument

Pos	Designation Beteckning	Number Antal	Name Benämning	Material

Tolerances if not indicated according to
Toleranser där ej annat angivits enligt
ATLAS COPCO STANDARD 1350 K

Machined surfaces
Maskinbearbetade ytor
Class Klass | Class Klass | Class Klass

Name Benämning
KRETSSCHEMA/CIRCUIT DIAGRAM
PRINTER CONTROL

Atlas Copco

Drawn Ritad GYLS

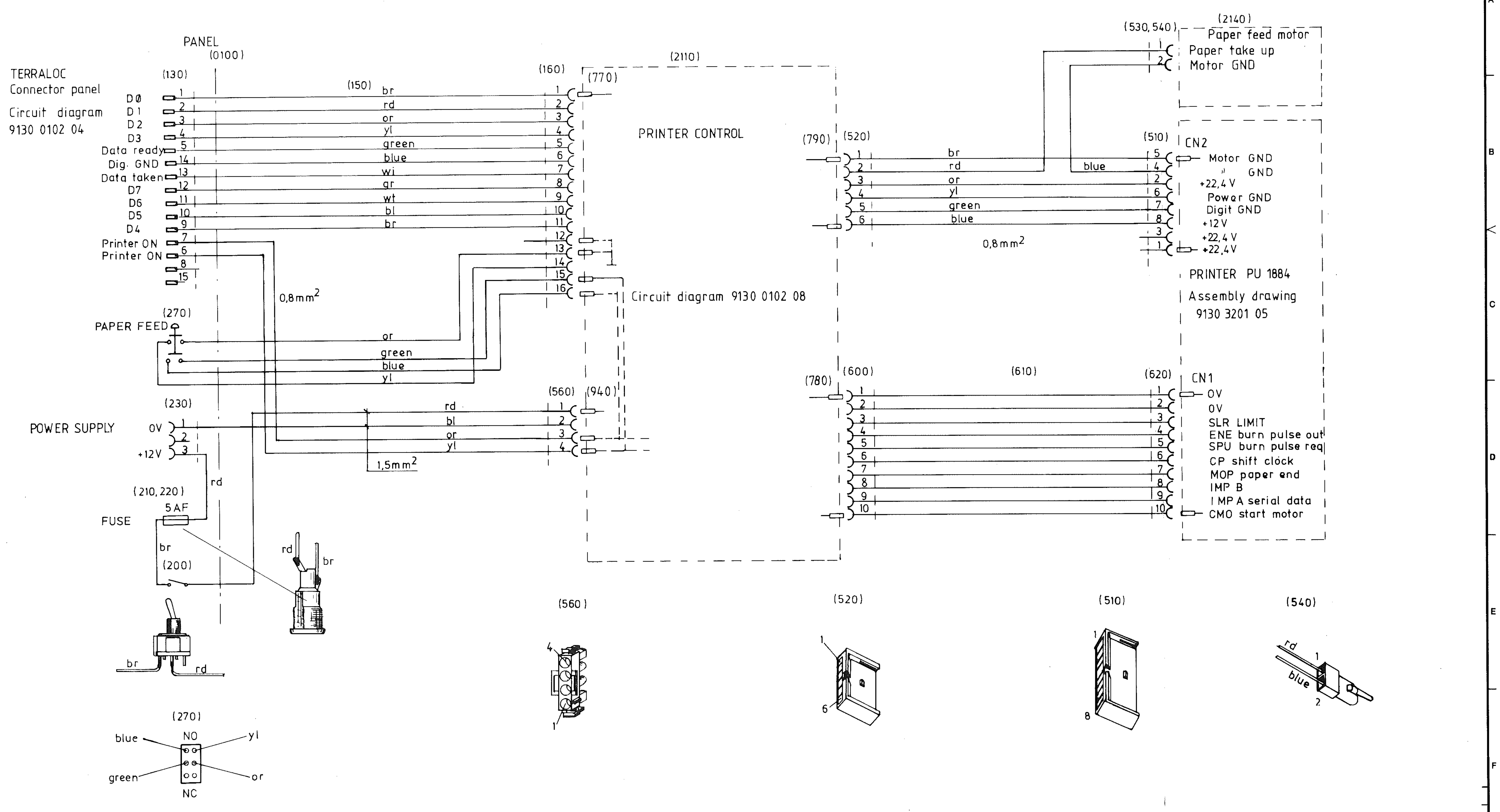
9130 0100 07

Sheet Blad

Transferred to Överförd

29

82 06 15 9130 0102 08 B



Note/Not	Position	Modified from/Ändrat från	Date/Datum	Intr./Int.

A 2752a augusti 82 Barklunds, Sthlm.

9133 0016 40

Appurtenant drawings and documents/Tillhörande ritningar och dokument

Pos	Designation/Beteckning	Number/Antal	Name/Benämning	Material

Tolerances, if not indicated, according to: / Toleranser där ej annat angivits enligt:
ATLAS COPCO STANDARD 1350 K

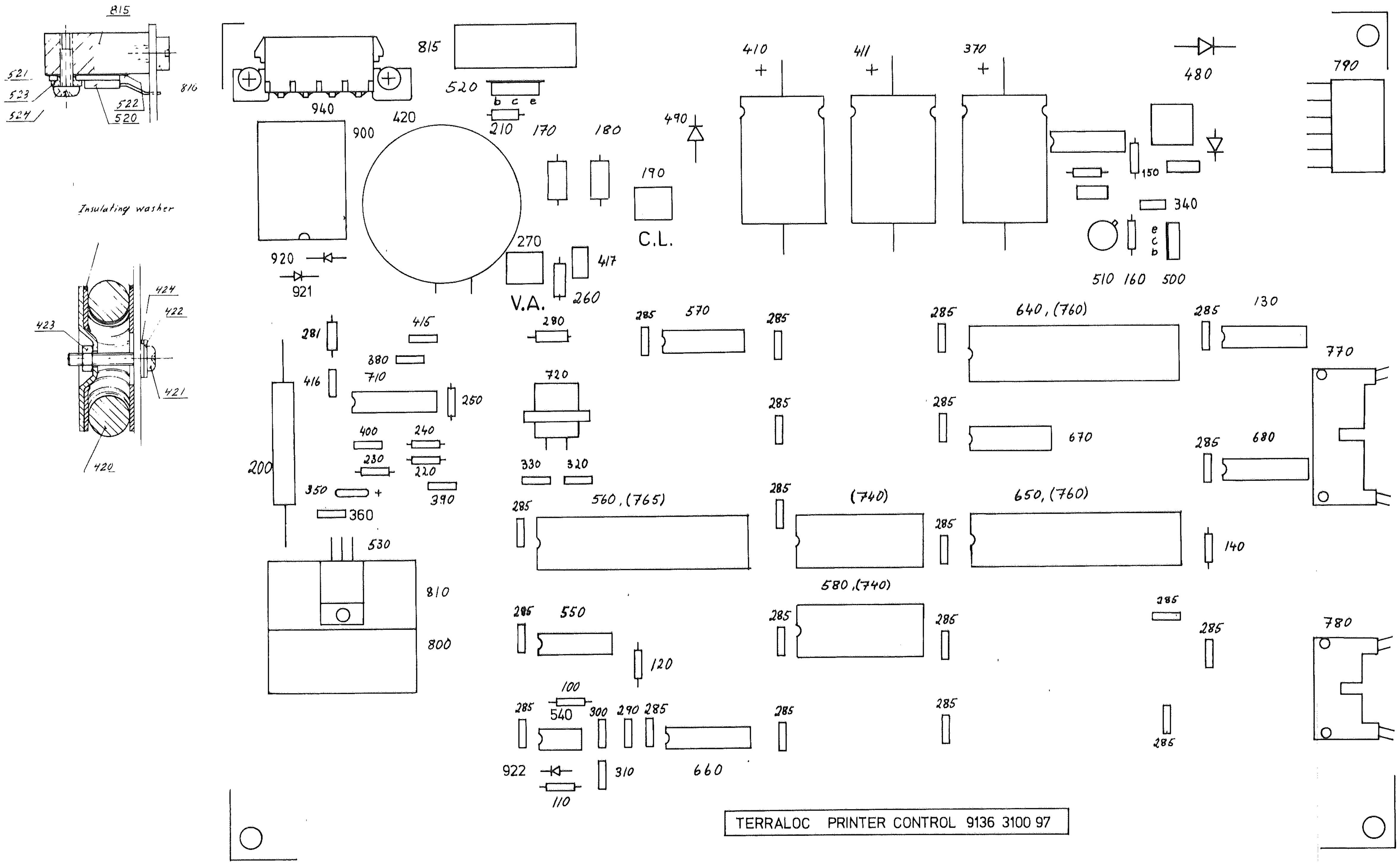
Machined surfaces / Maskinbearbetade ytor — Class/Klass — Class/Klass — Class/Klass

Name/Benämning
PRINTER HARNESS
2 Circuit diagram
3 TERRALOC Mark III

Atlas Copco

Scale/Skala — Ref. no./Reg. nr — Compare/Jämför
Drawn/Ritad — Blank no./Ämnes nr — Replaces/Ersätter — Drawing owner/Ritn. äg.
Transferred fr./Överförd fr. — Std. chd./Norm. gr. — Blank wt/Ämnesv. kg — Finished wt/Färdigv. kg — Designation/Beteckning — Sheet/Blad ( )
Design chd./Konstr. gr. — Prod. chd./Prod. gr. — Appd./Godk. — Date

9130 0102 12 A



Pos	Designation/Beteckning	Number/Antal	Name/Benämning	Material

Tolerances, if not indicated, according to: / Toleranser där ej annat angivits enligt:
ATLAS COPCO STANDARD 1350 K

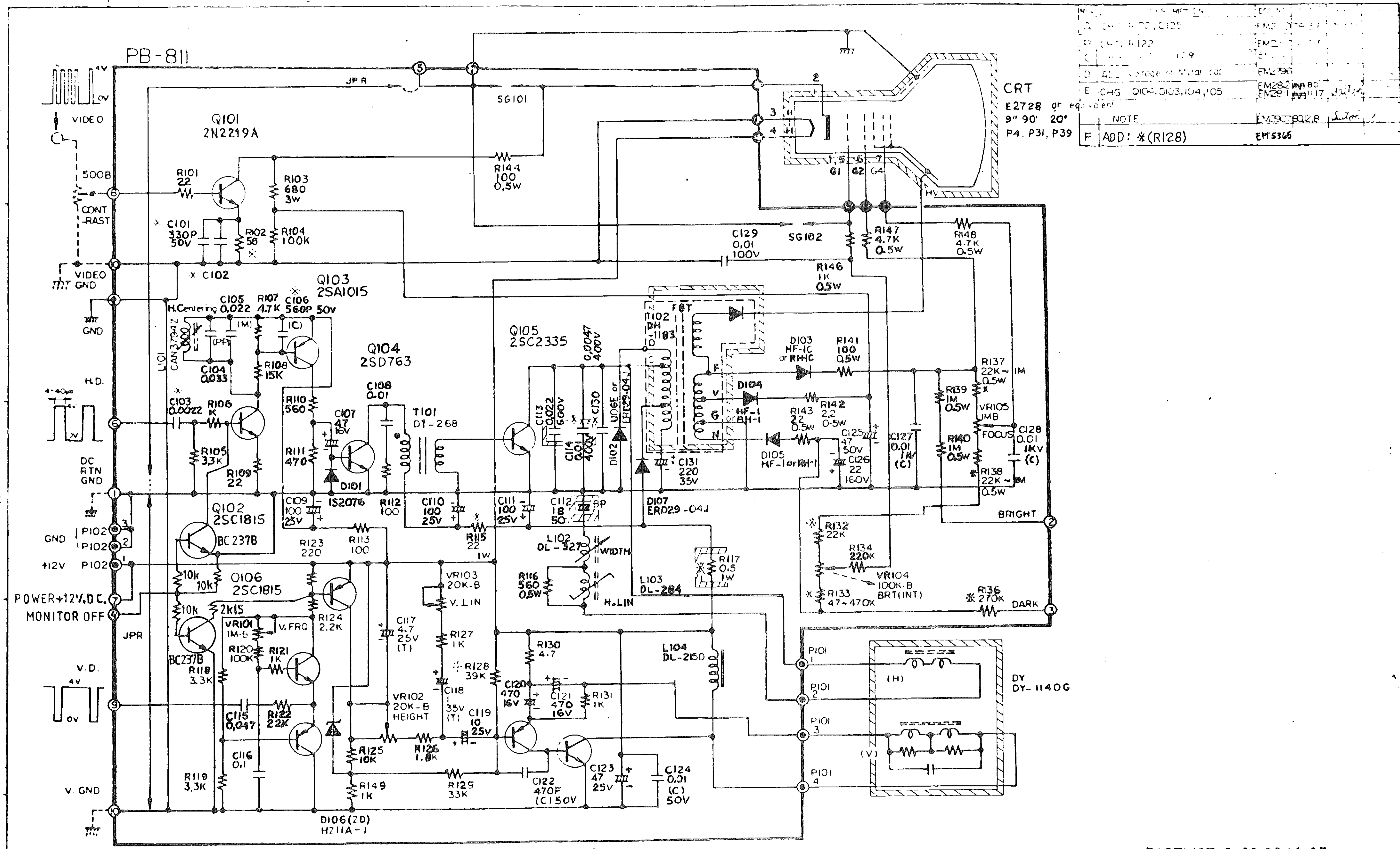
Machined surfaces / Maskinbearbetade ytor — Class / Klass — Class / Klass — Class / Klass

Name Benämning: COMPONENT LAYOUT PRINTER CONTROL
KOMPONENT TRYCKRITNING — Terraloc 9136 310097

Atlas Copco

Scale Skala: 2 : 1
Drawn Ritad: RG
Ref no Reg nr
Blank no Ämnes nr
Compare Jämför
Replaces Ersätter: 9130 0500 07
Drawing owner Ritn. ägare
Std chd Norm gr
Blank wt Ämnesv kg
Finished wt Färdigv kg
Designation Beteckning
Sheet Blad
Translated fr. Översatt fr.
Design chd Konstr gr
Prod chd Prod gr
Appd Godk
Date 830113
9130 0500 38 B

Appurtenant drawings and documents / Tillhörande ritningar och dokument



PARTLIST 9133 0016 07

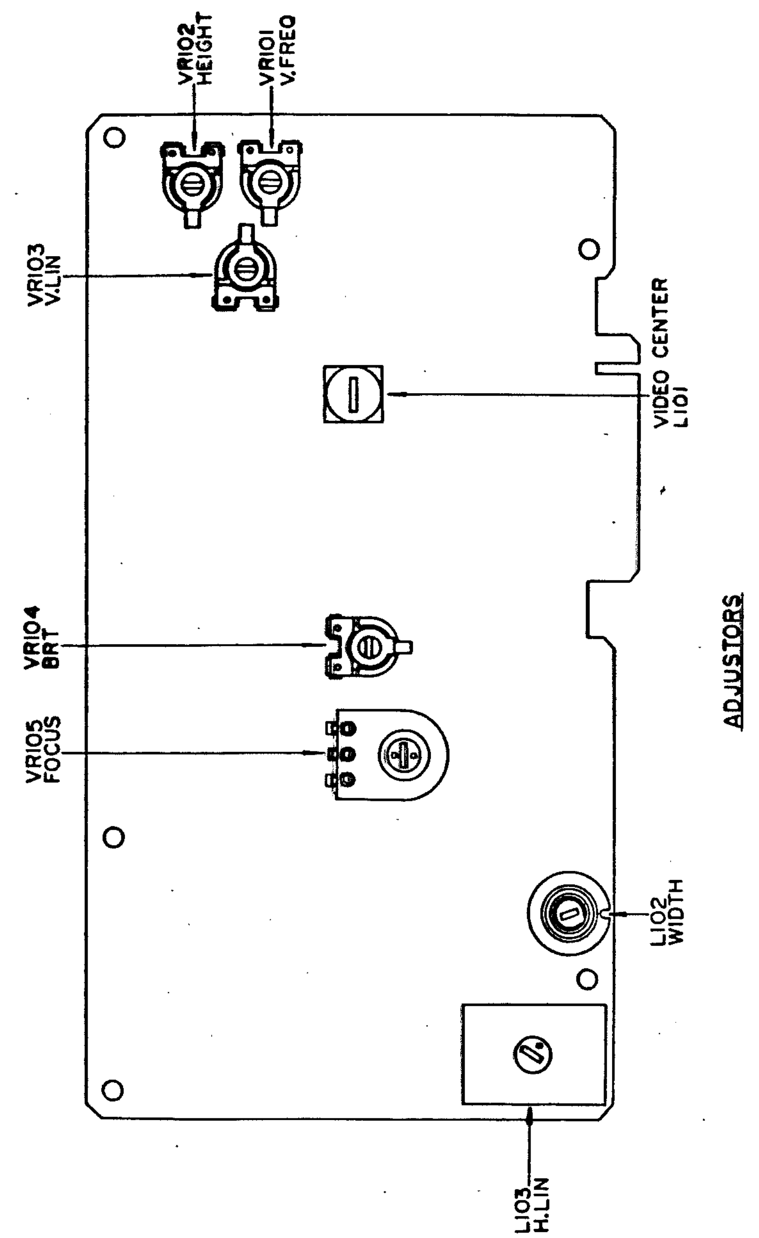
NOTES
- ○ INTERFACE CONNECTOR
- ⦿ PIN CONNECTOR
- ◈ 1 PIN
- ● DIRECT
- ⊗ ADJUSTED

CAPACITORS UNLESS OTHERWISE NOTED ARE 100V

COMPONENTS ENCLOSED WITH ▨ MARK ARE CRITICAL FOR X-RADIATION SAFETY. WHEN REPLACING ANY OF THESE COMPONENTS, REPLACE WITH IDENTICAL ONES.

J. Hattori '79.1.22	QDM - 9VD CIRCUIT DIAGRAM	3Q CHUOMUSEN C.C LTD
K. Ikesoda '79.1.22		9130010149 B
K. Kawasaki '79.1.23	A3	(3C834-201)G

Note	Modified from/Ändrad från	Date	Intr.	Note	Modified from/Ändrad från	Date	Intr.



Tolerances, if not indicated, according to: Toleranser där ej annat angivits enligt: ATLAS COPCO STANDARD 1350 K	Machined surfaces Maskinbearbetade ytor Class Klass	Class Klass	Class Klass

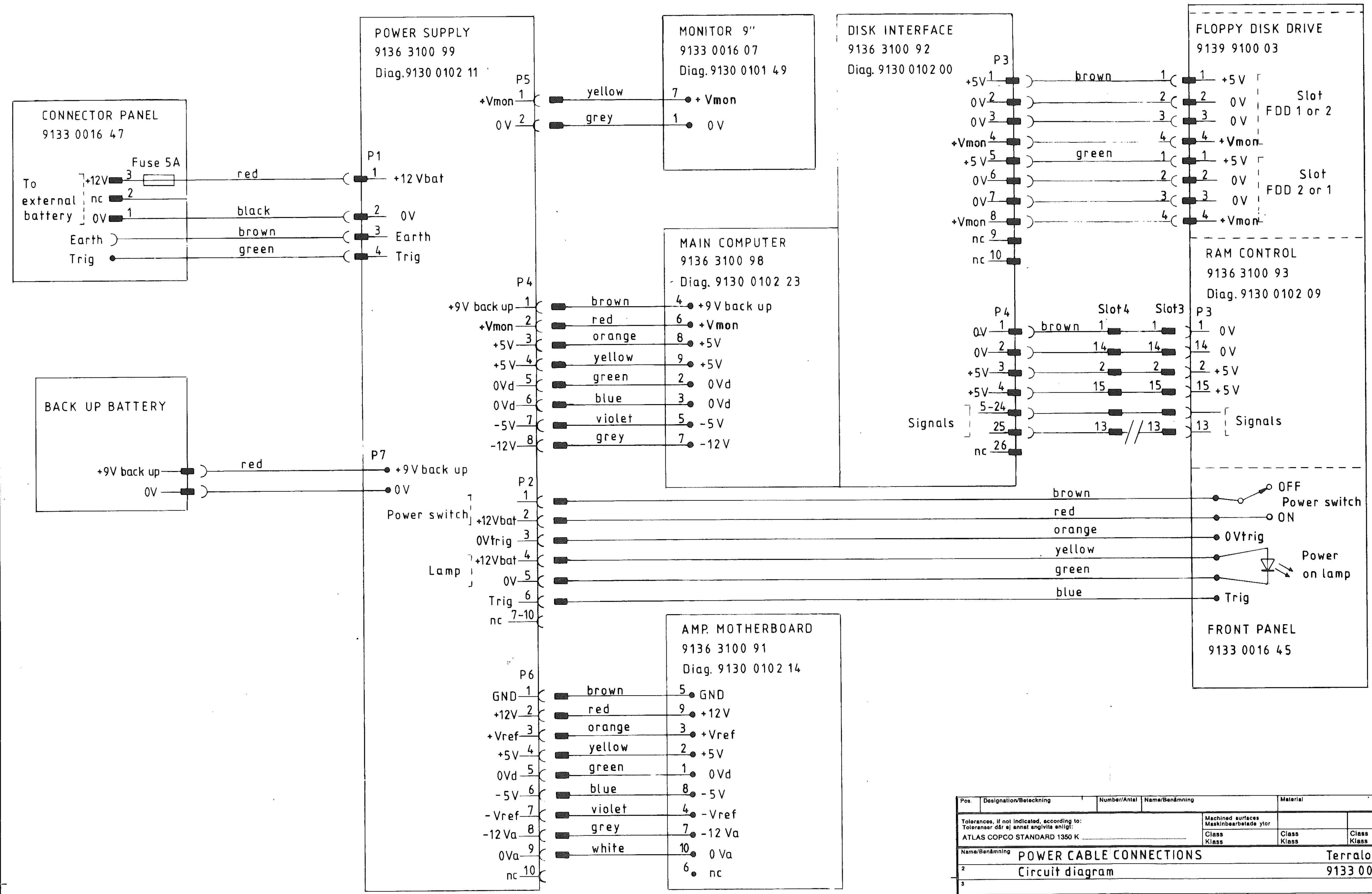
Name/Benämning MONITOR ADJUSTORS — TERRALOC

2 — 9133 0016 07

3

Atlas Copco	Scale/Skala		Ref. no./Reg. nr		Compare/Jämför	
	Drawn/Ritad SW		Blank no./Ämnes nr		Replaces/Ersätter	Drawing owner/Ritn. äg.
Transferred fr./Överförd fr.	Std. chd./Norm. gr.	Blank wt/Ämnesv. kg	Finished wt/Färdigv. kg		Designation/Beteckning	Sheet/Blad ( )
	Design chd./Konstr. gr.	Prod. chd./Prod. gr.	Appd./Godk.	Date 871119	9130 0500 44 A	

A 2754a augusti 82 Barklunds, Sthlm.

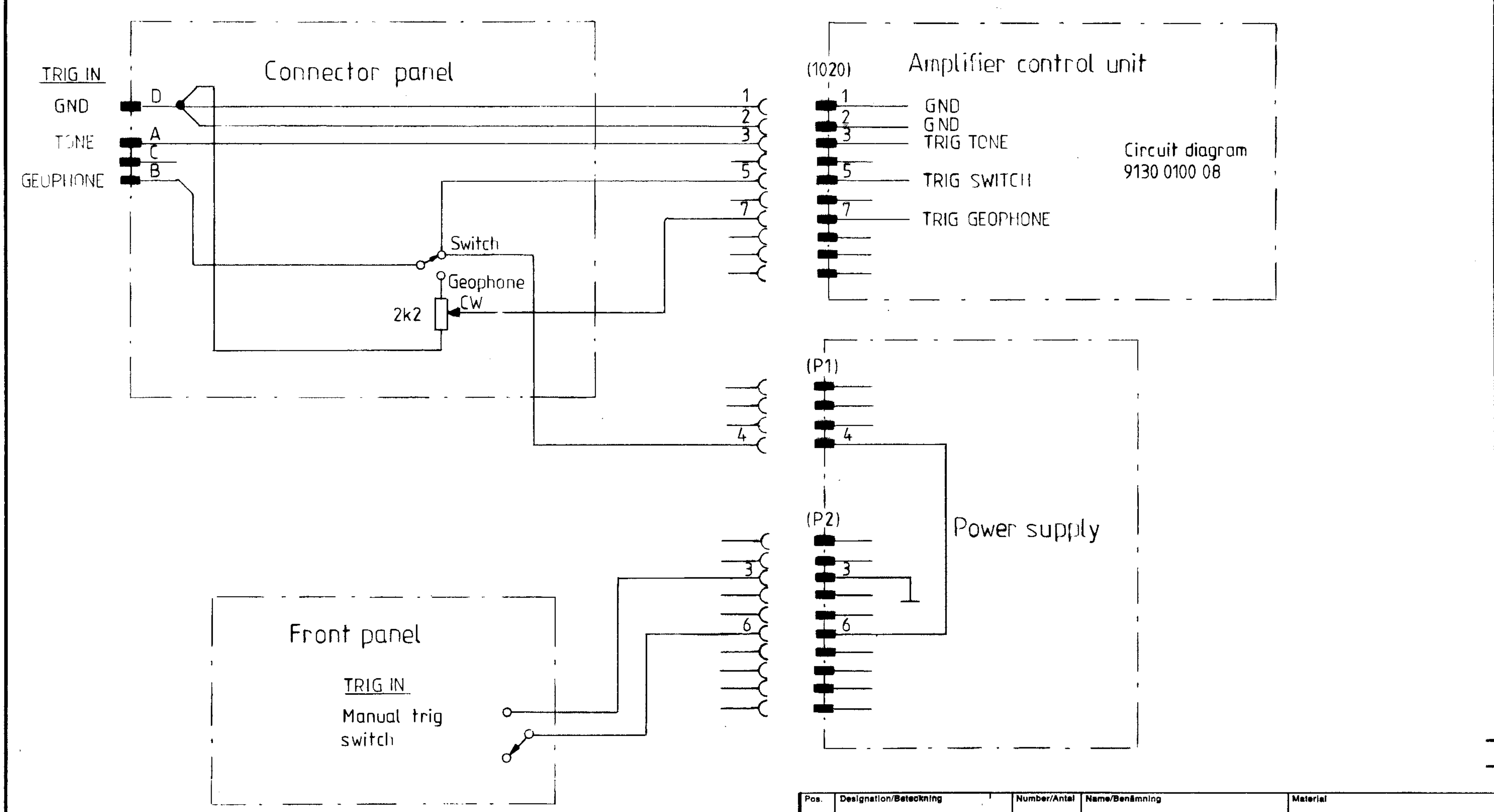


Name/Benämning	POWER CABLE CONNECTIONS — Terraloc
2	Circuit diagram — 9133 0014 06
Drawn/Ritad	SW
Date	871126
Designation/Beteckning	9130 0102 26 A

Tolerances, if not indicated, according to: / Toleranser där ej annat angivits enligt: ATLAS COPCO STANDARD 1350 K

Atlas Copco

A 2752a augusti 82 Barklunds, Sthlm.



Pos.	Designation/Beteckning	Number/Antal	Name/Benämning	Material

Tolerances, if not indicated, according to: / Toleranser där ej annat angivits enligt: ATLAS COPCO STANDARD 1350 K

Machined surfaces / Maskinbearbetade ytor — Class/Klass — Class/Klass — Class/Klass

Name/Benämning: TERRALOC TRIG SYSTEM

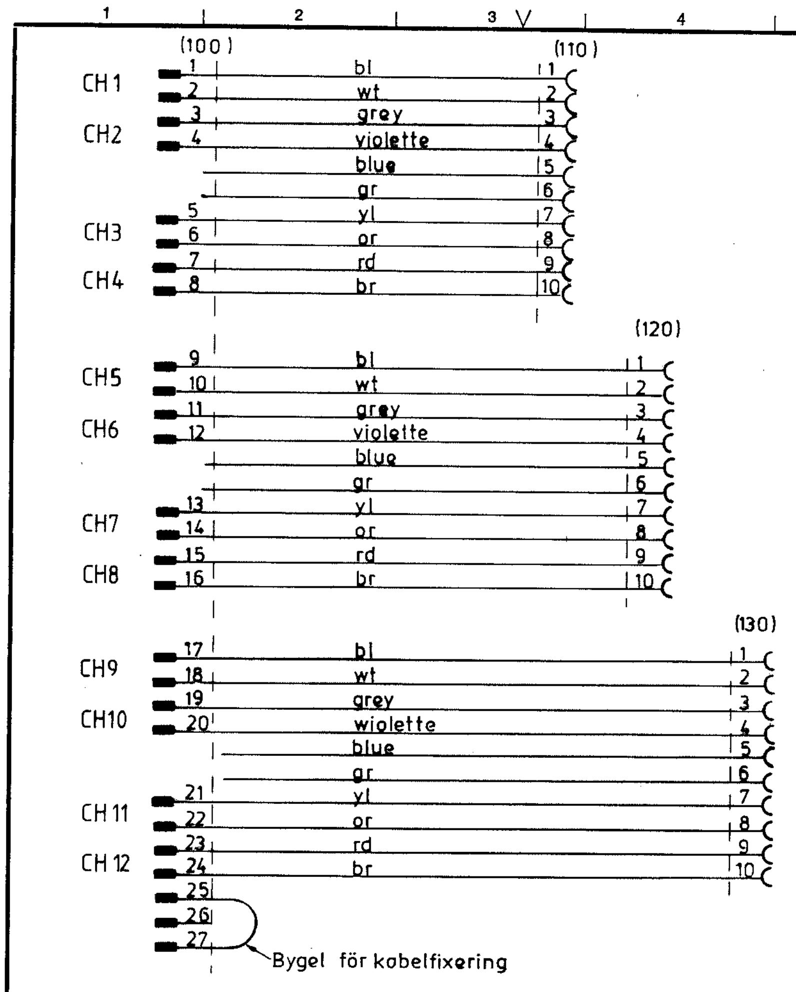
Atlas Copco

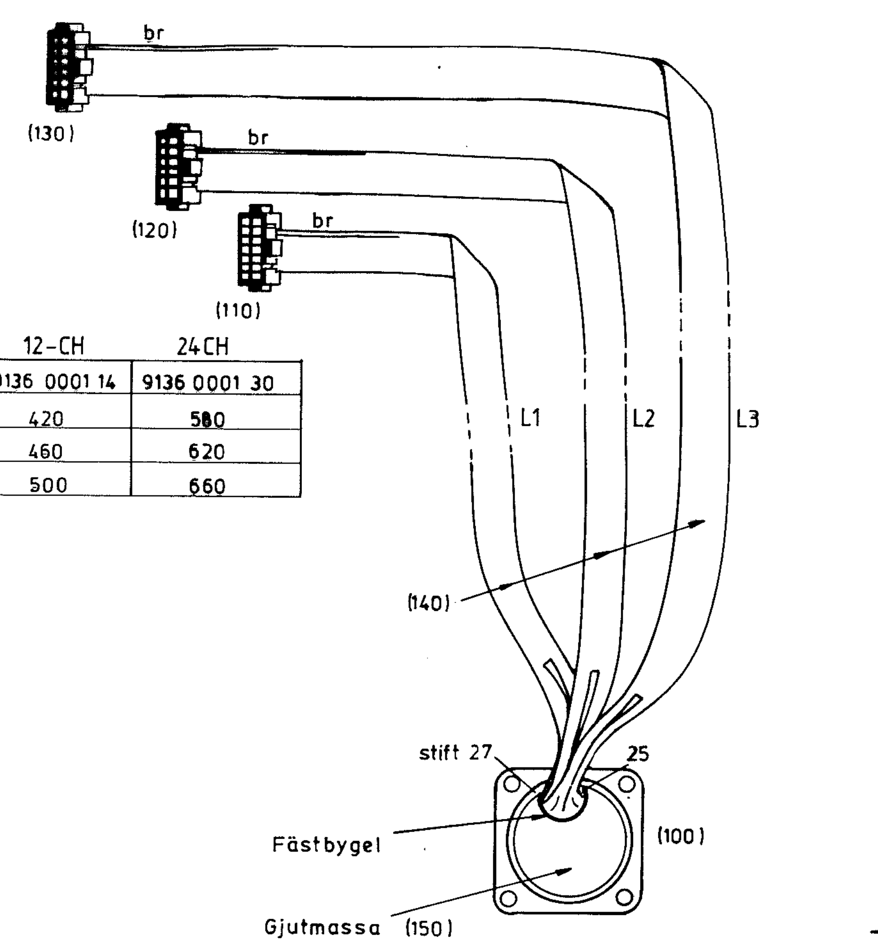
Scale/Skala	Ref. no./Reg. nr	Compare/Jämför
Drawn/Ritad S.W.	Blank no./Ämnes nr	Replaces/Ersätter
Std. chd./Norm. gr.	Blank wt/Ämnesv. kg	Finished wt/Färdigv. kg
Design chd./Konstr. gr	Prod. chd./Prod. gr	Appd./Godk.
Date 871112	Designation/Beteckning 9130 0102 32 A	Sheet/Blad ( )

Transferred fr./Överförd fr.

Note/Not	Posi-tion	Modified from/Ändrad från	Date/Datum	Intr./Inf.

Appurtenant drawings and documents/ Tillhörande ritningar och dokument





mått	12-CH 9136 0001 14	24CH 9136 0001 30
L1	420	580
L2	460	620
L3	500	660

Pos.	Designation/Beteckning	Number/Antal	Name/Benämning	Material

Tolerances. If not indicated, according to: / Toleranser där ej annat angivits enligt: ATLAS COPCO STANDARD 1350 K

Machined surfaces / Maskinbearbetade ytor — Class/Klass — Class/Klass — Class/Klass

Name/Benämning: KRETSSCHEMA

2 Signal cable 12 — 9136 0001 14

3 Signal cable 24 — 9136 0001 30

Atlas Copco

Scale/Skala | Ref. no./Reg. nr | Compare/Jämför

Drawn/Ritad | Blank no./Ämnes nr | Replaces/Ersätter | Drawing owner/Ritn. äg.

Transferred fr./Överförd fr. | Std. chd./Norm. gr. | Blank wt/Ämnesv. kg | Finished wt/Färdigv. kg | Designation/Beteckning | Sheet/Blad ( )

Design chd./Konstr. gr. | Prod. chd./Prod. gr. | Appd./Godk. | Date 870424

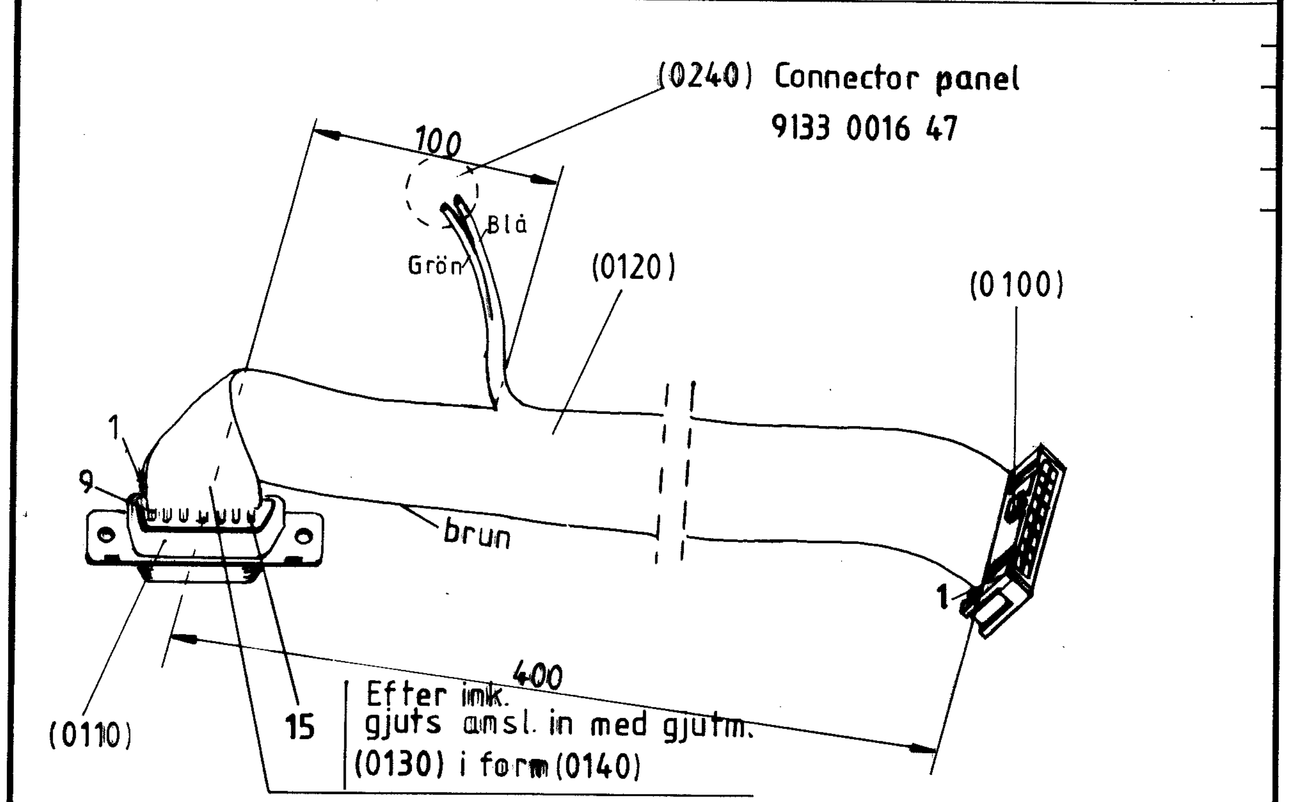
9130 0100 15 B

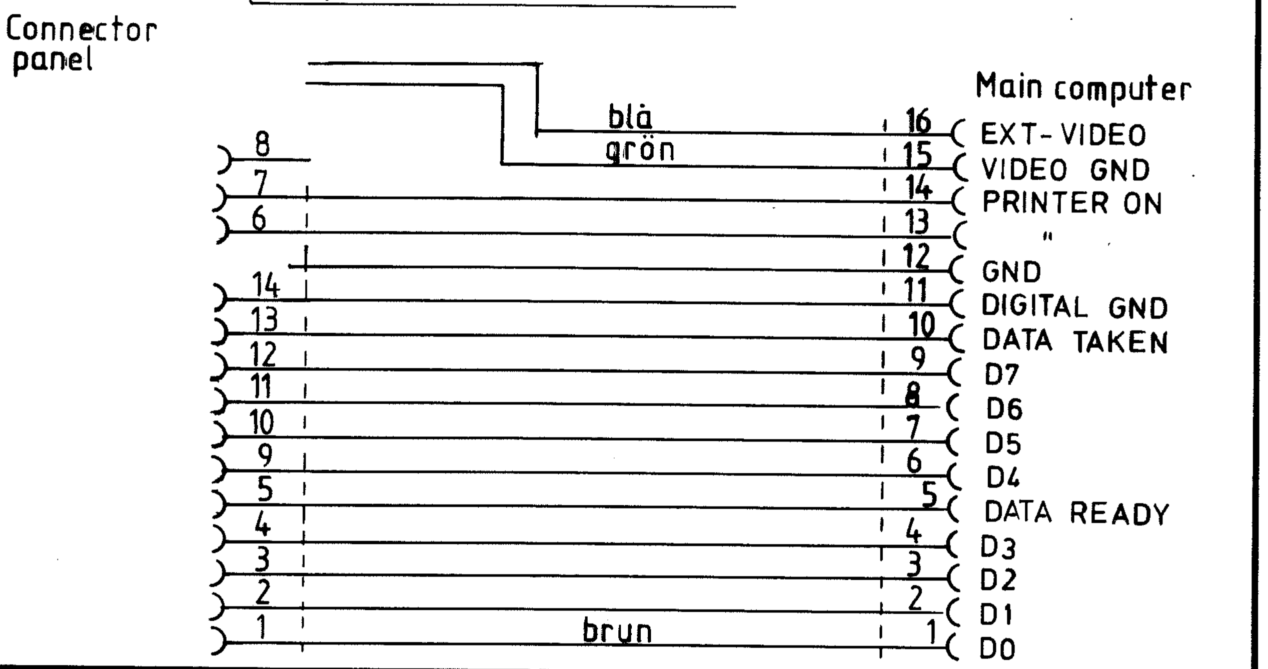
Note/Not	Posi-tion	Modified from/Ändrad från	Date/Datum	Intr./Inf.

Appurtenant drawings and documents/ Tillhörande ritningar och dokument

A 27/13 december 78 Barklunds, Sthlm

Note	Modified from/Ändrad från	Date	Intr.	Note	Modified from/Ändrad från	Date	Intr.





Tolerances, if not indicated, according to:
Toleranser där ej annat angivits enligt:
ATLAS COPCO STANDARD 1350 K

Machined surfaces / Maskinbearbetade ytor		
Class / Klass	Class / Klass	Class / Klass

Name/Benämning: DIGITAL I/O CABLE 9136 0001 61

2

3

Atlas Copco

Scale/Skala		Ref. no./Reg. nr		Compare/Jämför	
Drawn/Ritad		Blank no./Ämnes nr		Replaces/Ersätter	Drawing owner/Ritn. äg.
Std. chd./ Norm. gr.	Blank wt/Ämnesv. kg	Finished wt/Färdigv. kg		Designation/Beteckning	Sheet/Blad ( )
Design chd./ Konstr. gr.	Prod. chd./ Prod. gr.	Appd./ Godk.	Date 870114	9130 0102 19 A	

Transferred fr./Överförd fr.

A 2754a augusti 82 Barklunds, Sthlm.

(110)	(120)	(100)
1	br	1
2	rd	2
3	or	3
4	yl	4
5	gr	5
6	blue	6
7	violette	7
8	grey	8
9	wt	9
10	bl	10
11	br	11
12	rd	12
13	or	24
14	yl	23
15	gr	22
16	blue	21
17	violette	20
18	grey	19
19	wt.	18
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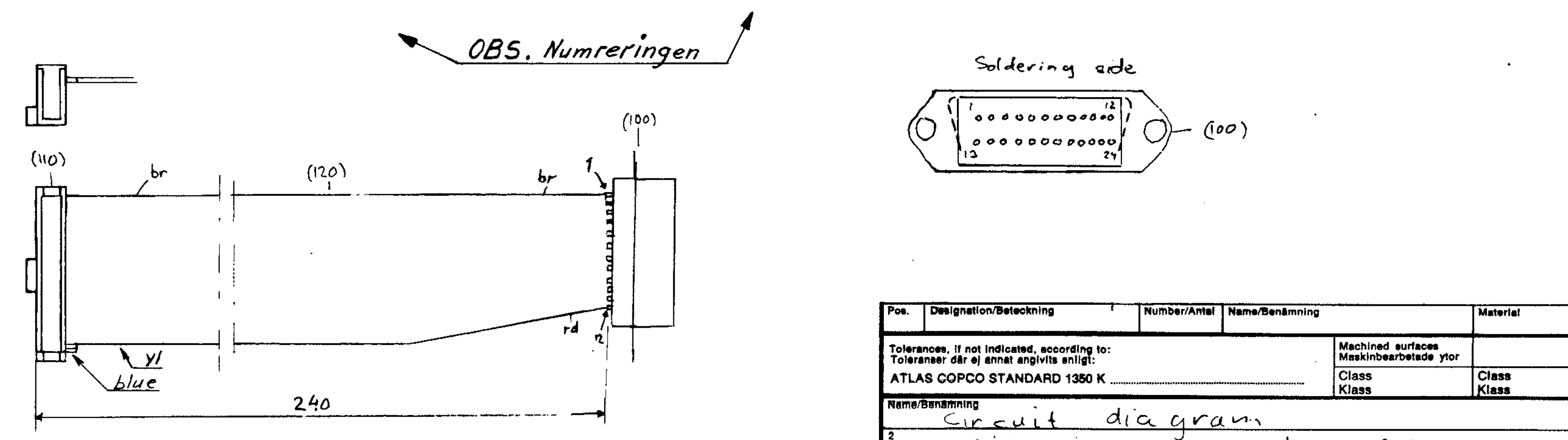
26	blue	x

OBS. Numreringen



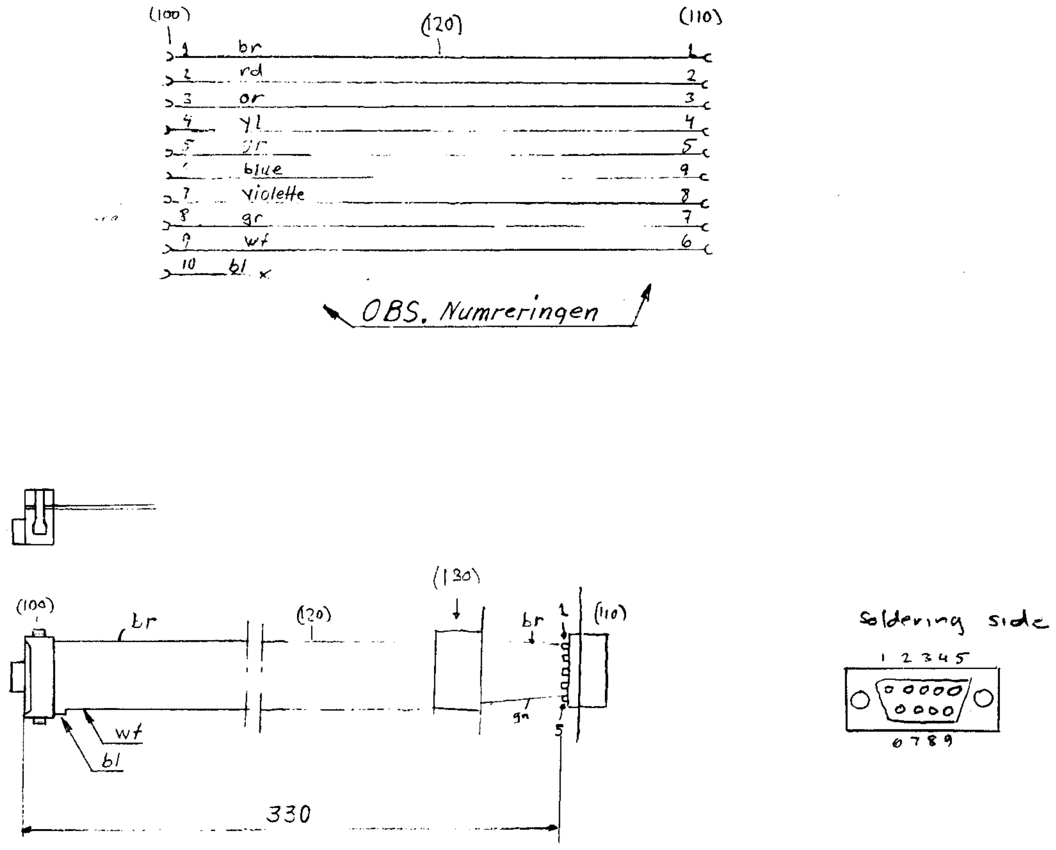
Pos.	Designation/Beteckning	Number/Antal	Name/Benämning	Material
Tolerances, if not indicated, according to: Toleranser där ej annat angivits enligt: ATLAS COPCO STANDARD 1350 K			Machined surfaces Maskinbearbetade ytor	
			Class Klass	Class Klass / Class Klass

Name/Benämning
Circuit diagram
2 GPIB internal cable 9136 000131
3 Terraloc

Atlas Copco	Scale/Skala	Ref. no./Reg. nr	Compare/Jämför	
	Drawn/Ritad	Blank no./Ämnes nr	Replaces/Ersätter	Drawing owner/Ritn. äg.
Transferred fr./Överförd fr.	Std. chd./ Norm. gr.	Blank wt/Ämnesv. kg	Finished wt/Färdigv. kg	Designation/Beteckning: 9130 0100 58 B — Sheet/Blad (1)
	Design chd./ Konstr. gr.	Prod. chd./ Prod. gr.	Appd./Godk. — Date 821202	

Note/Not	Posi-tion	Modified from/Ändrad från	Date/Datum	Intr./Inf.	Appurtenant drawings and documents/Tillhörande ritningar och dokument
B		kompletterad	830824		

A 2753a augusti 82 Barklunds, Sthlm.



Pos.	Designation/Beteckning	Number/Antal	Name/Benämning	Material

Tolerances, if not indicated, according to: / Toleranser där ej annat angivits enligt: ATLAS COPCO STANDARD 1350 K

Machined surfaces / Maskinbearbetade ytor — Class/Klass — Class/Klass — Class/Klass

Name/Benämning

Circuit diagram

RS 232 C internal cable 9136 0001 32

Terraloc

Atlas Copco

Scale/Skala	Ref. no./Reg. nr	Compare/Jämför
Drawn/Ritad PG	Blank no./Ämnes nr	Replaces/Ersätter
Std. chd./Norm. gr.	Blank wt/Ämnesv. kg	Finished wt/Färdigv. kg
Design chd./Konstr. gr.	Prod. chd./Prod. gr.	Appd./Godk. KL Date 821203

Drawing owner/Ritn. äg.

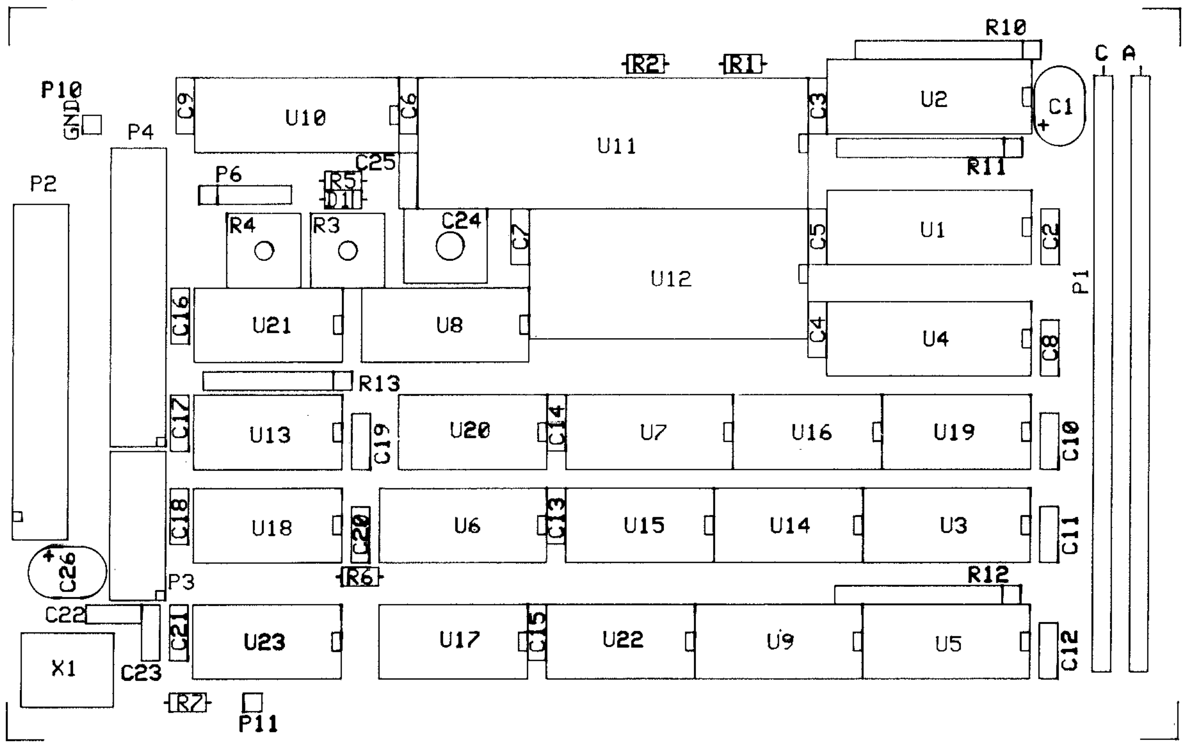
Designation/Beteckning: 9130 0100 59 B — Sheet/Blad ( )

Transferred fr./Överförd fr.

Note/Not	Posi-tion	Modified from/Ändrad från	Date/Datum	Intr./Inf.
E		Kompletteran	830824	

Appurtenant drawings and documents/ Tillhörande ritningar och dokument

A 2753a augusti 82 Barklunds. Sthlm.



Pos.	Designation/Beteckning	Number/Antal	Name/Benämning	Material

Tolerances, if not indicated, according to: / Toleranser där ej annat angivits enligt: ATLAS COPCO STANDARD 1350 K

Machined surfaces / Maskinbearbetade ytor — Class/Klass — Class/Klass — Class/Klass

Name/Benämning: Component layout Disk Interface — Terraloc

9136 3100 92

Atlas Copco

Scale/Skala — Ref. no./Reg. nr — Compare/Jämför

Drawn/Ritad: H.T. — Blank no./Ämnes nr — Replaces/Ersätter — Drawing owner/Ritn. äg.

Std chd./Norm gr. — Blank wt/Ämnesv. kg — Finished wt/Färdigv. kg — Designation/Beteckning — Sheet/Blad ( )

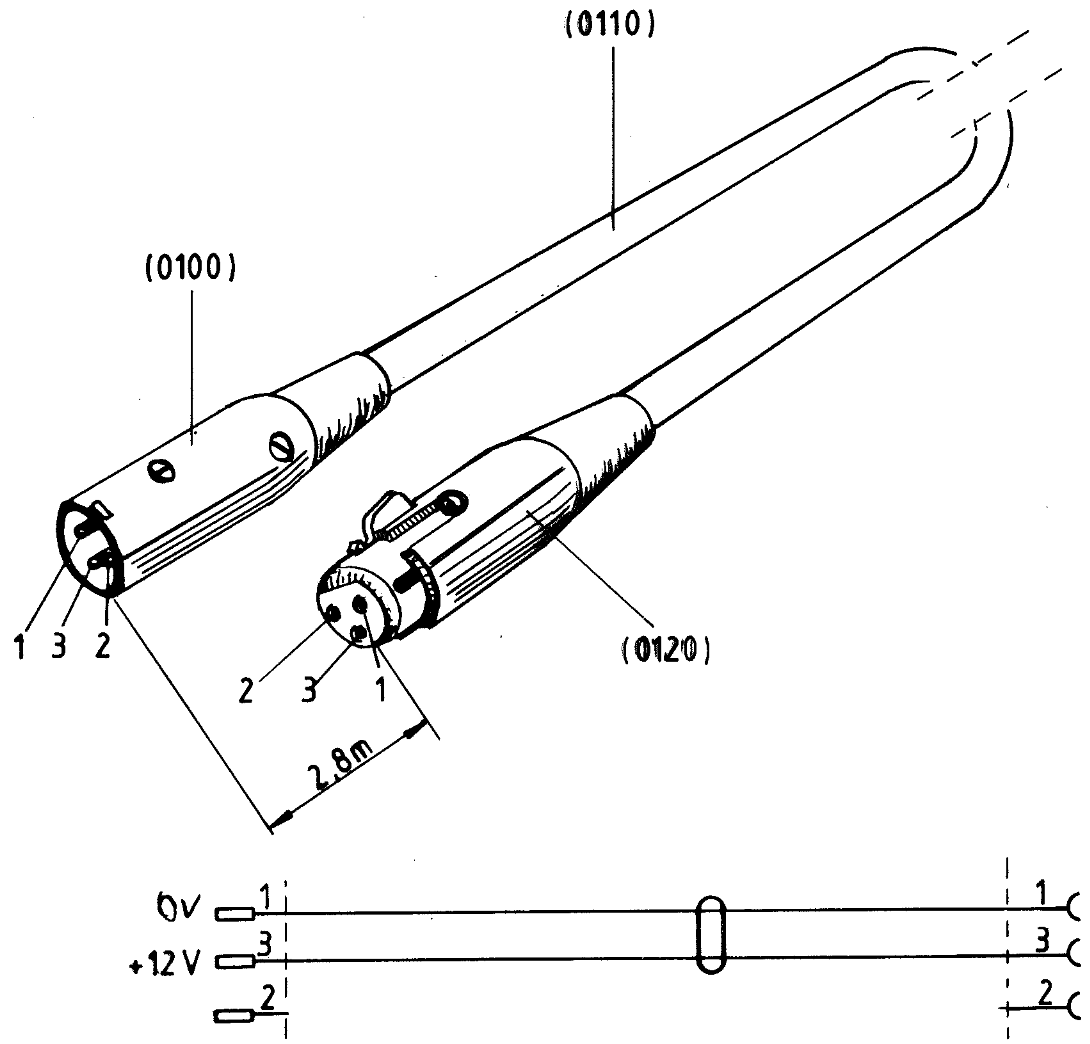
Transferred fr. Overförd fr.

Design chd./Konstr. gr — Prod. chd./Prod. gr. — Appd./Godk. — Date 87.11.03

9130 0500 12 A

Note/Not	Posi-tion	Modified from/Ändrad från	Date/Datum	Intr./Inf.	Appurtenant drawings and documents/Tillhörande ritningar och dokument

Note	Modified from/Ändrad från	Date	Intr.	Note	Modified from/Ändrad från	Date	Intr.



Tolerances, if not indicated, according to:
Toleranser där ej annat angivits enligt:
ATLAS COPCO STANDARD 1350 K

Machined surfaces / Maskinbearbetade ytor		
Class / Klass	Class / Klass	Class / Klass

Name/Benämning: EXT POWER SUPPLY CABLE TER 9136 0001 48

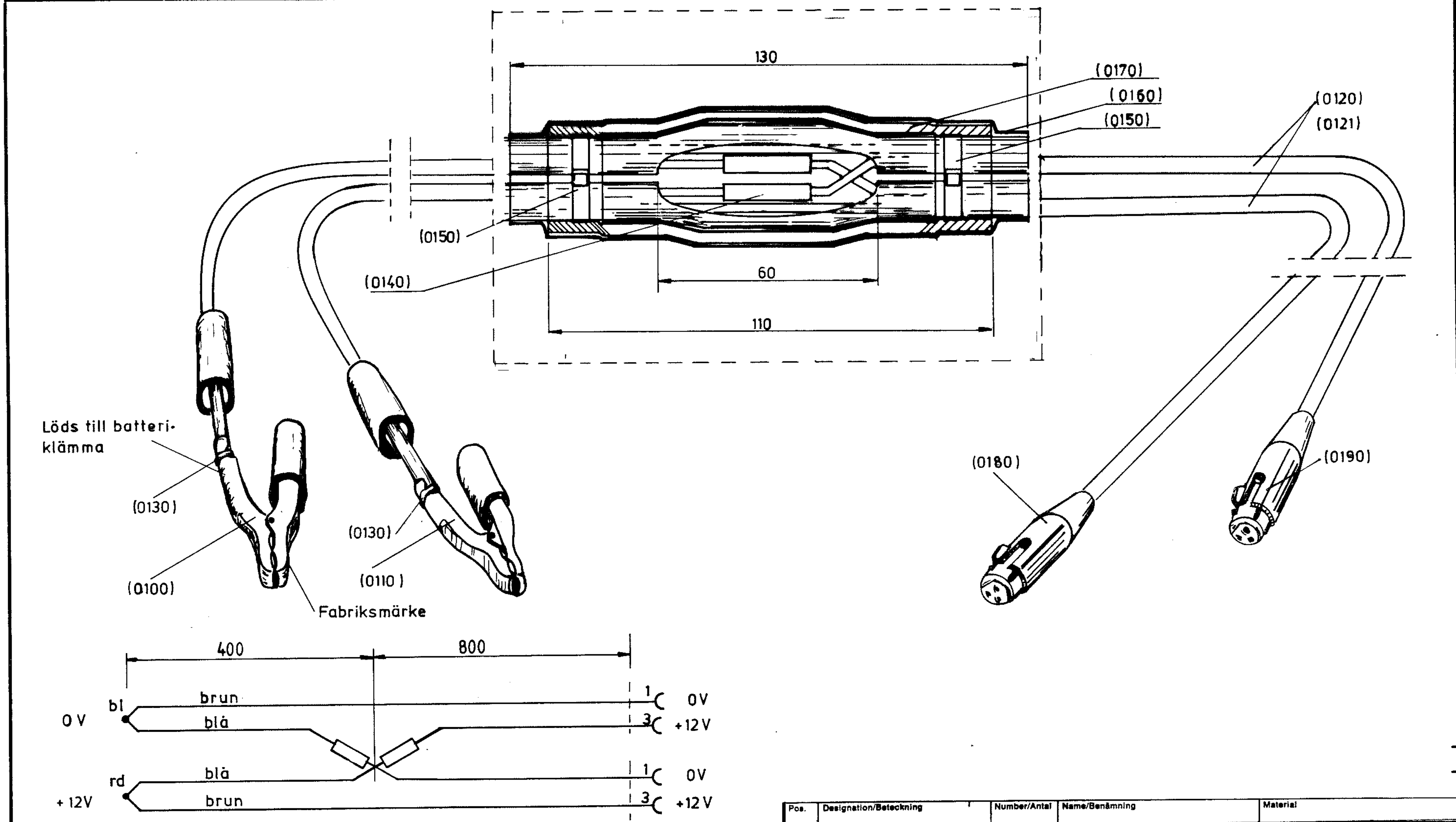
2

3

Atlas Copco

Scale/Skala	Ref. no./Reg. nr	Compare/Jämför
Drawn/Ritad	Blank no./Ämnes nr	Replaces/Ersätter — Drawing owner/Ritn. äg.
Std. chd./Norm. gr. — Blank wt/Ämnesv. kg	Finished wt/Färdigv. kg	Designation/Beteckning — Sheet/Blad ( )
Design chd./Konstr. gr. — Prod. chd./Prod. gr.	Appd./Godk. — Date 9?0108	9130 0102 17 A

Transferred fr./Överförd fr.



Pos.	Designation/Beteckning	Number/Antal	Name/Benämning	Material

Tolerances, if not indicated, according to:
Toleranser där ej annat angivits enligt:
ATLAS COPCO STANDARD 1350 K

Machined surfaces / Maskinbearbetade ytor — Class / Klass — Class / Klass — Class / Klass

Name/Benämning: BATTERY CLIP ADAPTER

2

3 TERRALOC MKIII

Atlas Copco

Scale/Skala	Ref. no./Reg. nr	Compare/Jämför	
Drawn/Ritad	Blank no./Ämnes nr	Replaces/Ersätter	Drawing owner/Ritn. äg.
Std. chd./ Norm. gr.	Blank wt/Ämnesv. kg	Finished wt/Färdigv. kg	Designation/Beteckning — Sheet/Blad ( )
Design chd./ Konstr. gr.	Prod. chd./ Prod. gr.	Appd./ Godk.	Date 970211

Transferred fr./Överförd fr.

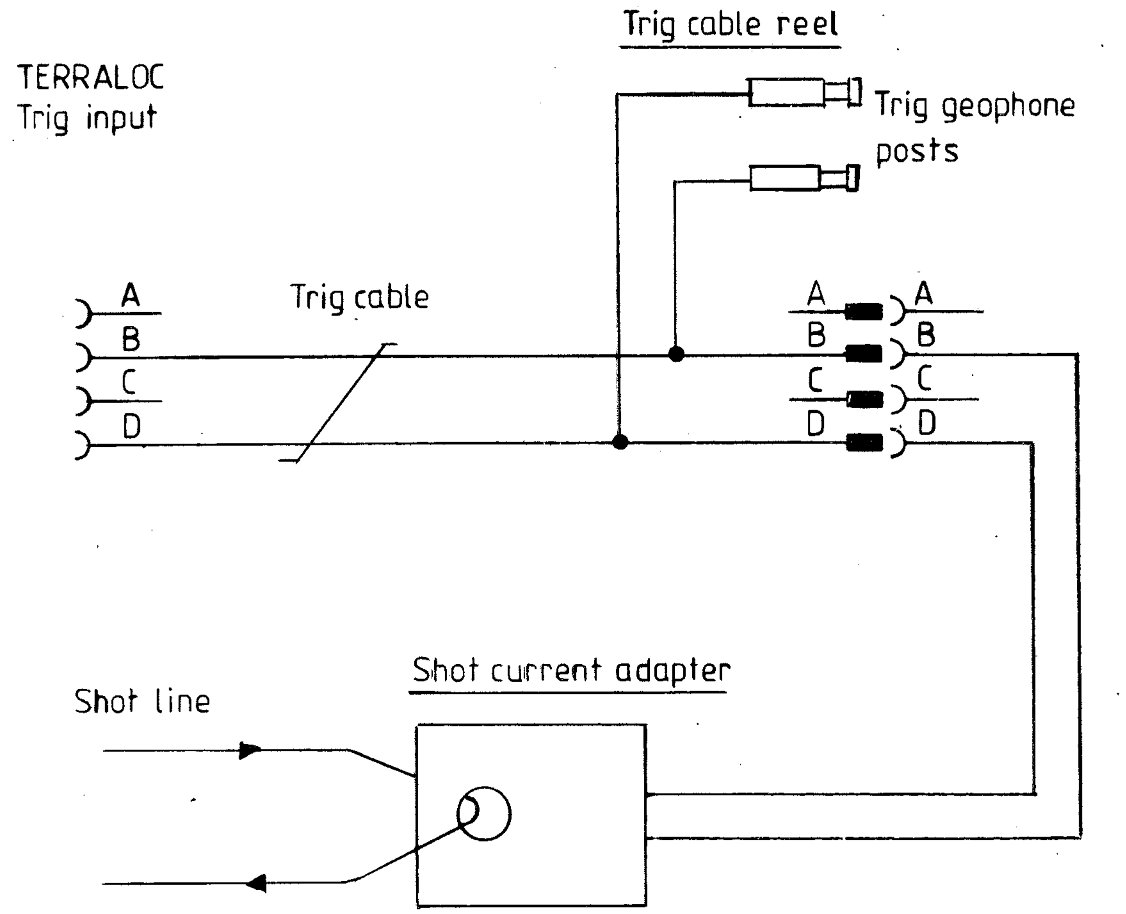
9130 0102 20 A

9136 0001 52

Appurtenant drawings and documents/ Tillhörande ritningar och dokument

Note/ Not	Posi- tion	Modified from/ Ändrad från	Date/ Datum	Intr./ Inf.

Note	Modified from/Ändrad från	Date	Intr.	Note	Modified from/Ändrad från	Date	Intr.



Tolerances, if not indicated, according to:
Toleranser där ej annat angivits enligt:
ATLAS COPCO STANDARD 1350 K

Machined surfaces Maskinbearbetade ytor		
Class Klass	Class Klass	Class Klass

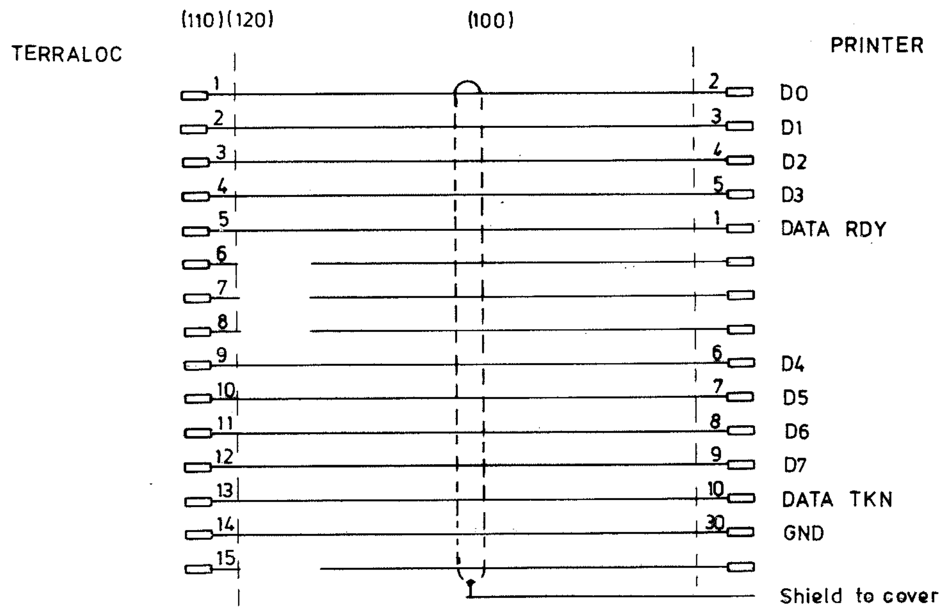
Name/Benämning Trig cable with shot current adapter

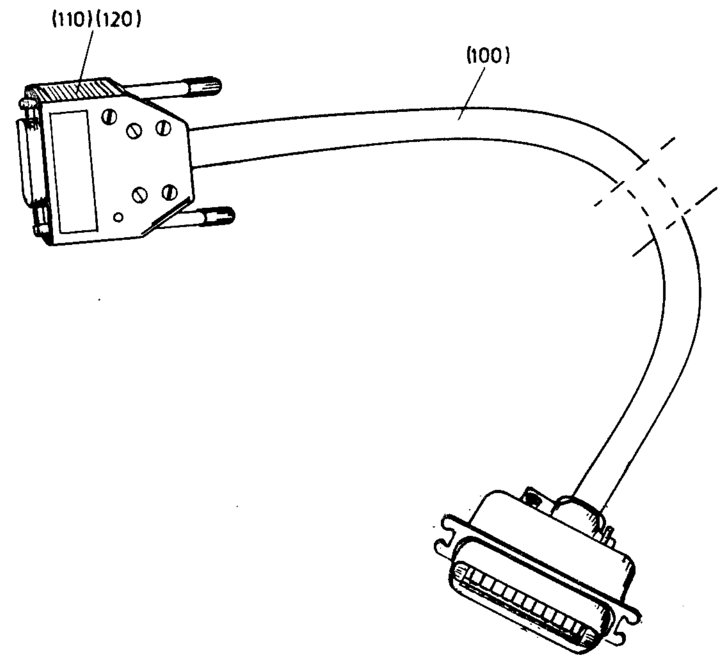
2 Outside trig systems

3

Atlas Copco	Scale/Skala	Ref. no./Reg. nr	Compare/Jämför	
	Drawn/Ritad BB/SW	Blank no./Ämnes nr	Replaces/Ersätter	Drawing owner/Ritn. äg.
Transferred fr./Överförd fr.	Std. chd./ Norm. gr.	Blank wt/Ämnesv. kg	Finished wt/Färdigv. kg	Designation/Beteckning Sheet/Blad ( )
	Design chd./ Konstr. gr.	Prod. chd./ Prod. gr.	Appd./ Godk. Date 871110	9130 0102 31 A

A 2754a augusti 82 Barklunds, Sthlm.





Pos.	Designation/Beteckning	Number/Antal	Name/Benämning	Material

Tolerances, if not indicated, according to:
Toleranser där ej annat angivits enligt:
ATLAS COPCO STANDARD 1350 K

Machined surfaces / Maskinbearbetade ytor — Class/Klass — Class/Klass — Class/Klass

Name/Benämning: OFFICE PRINTER CABLE

2

3 TERRALOC Mark III

Atlas Copco

Scale/Skala — Ref. no./Reg. nr — Compare/Jämför

Drawn/Ritad — Blank no./Ämnes nr — Replaces/Ersätter — Drawing owner/Ritn. äg.

Std. chd./Norm. gr. — Blank wt/Ämnesv. kg — Finished wt/Färdigv. kg — Designation/Beteckning — Sheet/Blad ( )

Transferred fr./Överförd fr. — Design chd./Konstr. gr. — Prod. chd./Prod. gr. — Appd./Godk. — Date 870302

9130 0102 22 A

9136 0001 51

Appurtenant drawings and documents/ Tillhörande ritningar och dokument

Note/ Not	Posi- tion	Modified from/ Ändrad från	Date/ Datum	Intr./ Inf.

A 2753a december 78 Barklunds, Sthlm.