



**TECHNICAL MANUAL
NORD MULTI POWER
SYSTEM EMP 325**



Elektro Mek. Industri A.s
HORTEN - NORWAY



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NORD MULTI POWER
SYSTEM EMP 325**

12/80

C O N T E N T S

	Page.
1. General	1
2. Technical specification	2
3. Technical description	3
3.1 AC-input	3
3.2 Detailed function description of the control panel	3
1. 12V/2A regulator	3
12V marginal control	4
2. 5V Local	4
3. Alarm-reset circuit	5
4. Acoustic alarm	5
5. Time delay circuit	5
6. Over temperature	6
7. Interrupt signals	6
8. AC-input monitoring	7
9. Alarm indication high/low voltage 12V Local	7
10-11-12-13-14-15 Alarmindication from external power supplies.	8
1a. Monitoring 12V Local	8
16-17-18-19-20-21 Monitoring of external power supplies.	9
22-23-24-25 Over temperature external power supplies.	9
26-27 Battery indication	11
4.0 Adjustments	12
4.1 12V Local	12
4.2 12V Local, over voltage	12
4.3 Over temperature	12
4.4 Alarm high input AC-voltage	12
4.5 5V Local	13
5.0 Maintenance	13
Mechanical lay out	14
Component list EP 338/3	20
Lay out PC-board EP 338/3	23
Componentlist EP 339/3	24
Lay out PC-board EP 339/3	28
Drawing no. 01 1 133	29

1. GENERAL.

NORD MULTIPower, SYSTEM EMP 325, is a control unit for monitoring and control of up to 4 pcs. external power supplies.

It is possible to mount three of these directly on the framework to the control unit, while the last one must be mounted separately.

From SYSTEM EMP 325 it is possible, besides the control- and monitoring functions, also to use a 12V.DC. power supply with a maximum load of 2 amps.

The external power supplies' control- and monitoring functions that will be connected to the control panel are:

1. SMPS 1.

5V.DC. for indicating and monitoring.
+/- marginal control of 5V.DC. output.
Powerfail (interrupt).
Remote ON/OFF.
Overtemperature.

2. STAND BY 2.

As for SMPS 1, but in addition;

12V.DC. for indicating and monitoring.
+/- marginal control of 12V.DC. output.
Indication of battery connected.

3. STAND BY 3.

As for STAND BY 2.

4. SMPS 4.

As for SMPS 1.

2. TECHNICAL SPECIFICATION.

AC-input: 196 - 264V.AC. 47 - 63 Hz. single phase.

OUTPUT_PLUG_PL.8

Pin 1(+) and pin 2(-): 12V.DC. max load 2 amps.

Regulation: 2% (line+load).

Current limiting: 3 amps.

Overvoltage: Above 15,4 volts.

Marg.control: +/- 5%

Pin 3 : System GND.

Pin 4 : +5V(externally) for connection of POWER INTERRUPT and MEMORY INHIBIT signals.

Pin 5 : MEMORY INHIBIT.

Pin 6 : POWER INTERRUPT.

Pin 7 : 0V(externally) for connection of POWER INTERRUPT and MEMORY INHIBIT signals.

Pin 8 : SYSTEM EMP-325 remote ON/OFF.

Pin 9 : External interrupt signals.

Pin 10 : System GND.

Pin 11. : External connection of temperature or air flow sensor.

Operating temperature: 0 - 40 °C convection cooled.

0 - 55 °C forced air cooling.

Relative humidity : 2 - 90%, non-condensing.

Dielectric strenght : Line to case, 1250V.AC. rms in one minute.

3. TECHNICAL DESCRIPTION.

ALL REFERANCES IN THIS CHAPTER IS MADE TO
DRAW. NO: 01 1 133 "CONTROL UNIT NORD 500".

3.1 AC-INPUT.

The power supplied to SYSTEM EMP 325 control unit is at full load about 60VA. (The AC-power to external power supplies not taken into consideration).

AC-input is by plug at the framework to the control panel.

All necessary fuses are placed outside the SYSTEM EMP 325.

AC-input to SMPS 1, STAND BY 2 and STAND BY 3 are via plugs on the framework to the control panel.

A timemeter is placed in the control panel and will be running as soon as the current is switched ON. (Internal 5VDC to control- and monitoring functions is ON).

3.2 DETAILED FUNCTION DESCRIPTION OF THE CONTROL PANEL.

1. AC-input on transformer TR1 (type no. 915).
The secondary side is equipped with two separate windings where S2 is for 12VDC/2A and S1 is for internal 5VDC in the control unit.

12V/2A_regulator.

From TR1.S2 the IC-regulator Q40 is supplied with DC-voltage via rectifier D41 and filter-capacitors C8,C9,C10 and C11. The 4 capacitors are connected in parallel.

Across IC-regulator Q40, the diode D43 works as protection if an external voltage should be connected to the output terminals.

Potentiometer P1 "12V LOCAL" is accessible from the front of the control unit, and the output voltage can be adjusted +/- 10% of nominal voltage.

The optocoupler Q37 is connected in the remote ON/OFF loop and is used to make it possible to switch OFF the 12V output externally. When current is floating in Q37's LED, 12V output is ON. When remote OFF is activated, output voltage will drop to about 3 volts.

Q50 is a voltage control circuit monitoring 12V output. If the output voltage raises above 15,4 volts, the thyristor Q41 will be activated by Q50. The overvoltage protection may be adjusted by altering the voltage divider R229, R230.

12V marginal control.

Marginal control, +/- 5% of nominal, is controlled by switch SW11, MARG.SW.12V.LOCAL". SW11 has selfreturn to mid.position.

With SW11 in mid.position, output voltage will be dependant of the series connection of R192, P1,R187,R184 and to GND via Q38.3.

By pushing SW11 upwards, +Marg. is activated. The output voltage is then regulated by R192, P1,R186,R183 and Q38.2 to GND.

By pushing SW11 downwards, -Marg. is activated. The output voltage is then regulated by R192, P1,R188,R185 and Q38.4 to GND.

LED L8 "12V LOCAL ON" indicates 12V ON.

2. 5V LOCAL.

From TR1.S1 the voltage regulator Q39 is supplied with DC-voltage via rectifier D40 and filter capacitors C4,C5,C6 and C7. Across Q39 the diode D42 protects the regulator against input of external voltage.

Output voltage is adjusted by means of potentiometer P3, and is normally factory set to 5,25 volts.

LED L1 "MAINS" is connected to 5V LOCAL and not directly to the mains input voltage. If a fault occurs in the DC-circuit, "MAINS FAILURE" may be indicated even if the AC-input voltage is OK.

Relay contact d1.1 supplies power to all logic functions when relay d1 is activated. Operating voltage to the relay coil is obtained when pin 8 on the output plug PL8 is low.

When relay d1 is activated, relaycontact d1.2 starts the timemeter.

3. ALARM - RESET - CIRCUIT.

If an alarm condition has occurred, the control panel may be reset to normal by means of RESET SWITCH SW12.

Q34 is a oneshot IC-circuit used to automatically reset the control panel when it is switched ON. A small delay allows all control- and monitoring functions to be stabilized before Q34 is activated.

4. ACOUSTIC_ALARM.

All monitoring functions activate both the belonging optical indication and an acoustic alarm by buzzer BZZ at the same time. The buzzer cannot be reset before the fault is removed.

5. TIME_DELAY_CIRCUIT.

Q36 with involving components is used as a timedelay circuit for external fan/temperature control. When a fault in this circuit is detected, the contact "T₁" will cause pin 11 at the output plug PL8 to be low.

Fan/temperature failure will be indicated on the control panel by LED L24 "ALARM FAN".

6. OVER TEMPERATURE.

An over temperature monitoring circuit is built in to the control panel and monitors the internal temperature in the panel. A NTC-resistor "NTC" works as a temperature sensor, and if the temperature raises above preset level, signal is given via op.amp. Q45.4, inverter/buffer Q42.1 to activate LED L22 "OVER.TEMP. CONTROL PANEL LOCAL" on the front of the control panel.

By overtemperature all external power supplies (SMPS 1, STAND BY 2, STAND BY 3 and SMPS 4) are shut OFF via diode D51.

High temperature alarm/shut off is factory set to 70 °C.

7. INTERRUPT SIGNALS (POWER INTERRUPT and MEMORY INHIBIT).

From 7A +5V is supplied via R180 and in a loop through "power failure" connections in each external power supply, via optocoupler Q43 (external interrupt) and Q44 (extern ON/OFF) to op.amp. Q45.1 pin 3. As long as the input on Q45.1 pin 3 is high, the output will be high thus giving a high signal on POWER INTERRUPT and MEMORY INHIBIT via op.amp. Q45.2 and Q45.3.

The two output signals are galvanic separated from the internal electronics by means of optocouplers Q47 and Q46.

The RC-network R206/c23 delays the MEMORY INHIBIT signal in relation to POWER INTERRUPT.

Following functions will result in POWER INTERRUPT and MEMORY INHIBIT.

1. Power failure from one or more of the external connected power supplies.

The series loop through these power supplies will be low and output on Q45.1 will be low.

2. Overtemperature from one or more of the external power supplies.
3. External interruptsignal.

LED in optocoupler Q43 will be deactivated and transistor in Q43 nonconducting, thus breaking the loop.

4. External ON/OFF.

LED in optocoupler Q44 will be deactivated when pin 8 in output plug PL8 is not connected to system GND, and transistor in Q44 non-conducting thus breaking the loop. At the same time LED in Q37 will be deactivated thus switching OFF the 12V/2A output. (re. §1).

8. The AC-input level is measured via transformer, rectifier D46 and filtercapacitor C13. The input signal to op.amp. Q32.1 pin 5 is taken from potentiometer P2 NET, and compared with a referance voltage from Z21.

By too high input voltage LED 123 "ALARM MAINS" will be activated.

Simultaneously will signal to acoustic alarm be given via diode D39.

9. ALARMINDICATION HIGH/LOW VOLTAGE 12V LOCAL.

12V LOCAL is continously monitored by circuit 1A.

Optocoupler Q31 is normally conducting and keeps input on op.amp. Q32.2 pin 3 low. Output of op.amp. Q32.2 pin 1 is low and LED L21 "ALARM 12V LOCAL" is not activated. Too high or too low output voltage on 12V LOCAL will be detected by circuit 1A. LED in optocoupler Q31 will be OFF and transistor non-conducting. Q32.2 pin 3 will then go high via resistors R153, R151. Output from pin 1, Q32.2 will be high and LED L21 "ALARM 12V LOCAL" will be lit via inverter/buffer Q24.

Via diode D35 acoustic alarm is activated.
It is not possible to reset the alarm before
the 12V LOCAL is normal.

10-11-12-13-14-15

Equal circuits for alarm/indicating of high/
low voltage output from the external power
supplies.

The circuits are all working as described
above (9), only numbers on components will
be different.

Additional a switch (SW1/3, SW2/3, SW2/4,
SW3/3, SW3/4 and SW4/3) is connected in
parallel with each optocoupler (Q2, Q4, Q6,
Q8, Q10 and Q26).

These switches must be ON if belonging
external power supply is not connected.

1A. MONITORING OF 12V LOCAL.

Supply voltage to the circuit is taken from
12V LOCAL output (see §1).

Zenerdiode Z17 gives referance voltage to
op.amp. Q30.1 and Q30.2

HIGH VOLTAGE ALARM.

Normally the output from Q30.1 pin 1 is high,
and LED in optocoupler Q31 will be activated.

By too high voltage on 12V LOCAL, pin 1, Q30.1
will be low, thus deactivating LED in Q31.
Transistor in Q31 will be non-conducting and
alarm/indicating circuit will be activated.

Zenerdiode Z18 is used because the output of
op.amp. Q30.1 does not bring the voltage level
complete to zero.

LOW VOLTAGE ALARM.

Normally the output from Q30.2 pin 7 is high
and LED in optocoupler Q31 will be activated.

By too low voltage on 12V LOCAL, pin 7 Q30.2 will be low, thus deactivating LED in Q31. Transistor in Q31 will be non-conducting and alarm/indicating circuit will be activated.

16-17-18-19-20-21.

Equal circuits for monitoring of 5V and 12V from external power supplies. The circuits are all working as described above (1A) only numbers and values of compnents are different.

Additional LEDs are connected across each voltage for indicating power ON at the control panel.

All circuits for monitoring of 5V and 12V are galvanic separated from the internal 5V power supply in the control panel.

22-23-24-25.

OVERTEMPERATURE_EXTERNAL_POWER_SUPPLIES.

Each of the external power supplies are equipped with temperature monitoring devices.

In order to have galvanic separation from the control panel, optocouplers for high temperature signals are used in each external power supply.

OVERTEMPERATURE_SMPS_1.

By overtemperature the transistor in the opto-coupler will be non-conducting. This will cause the transistor Q12 to conduct and LED L10 "OVERTEMP. SMPS 1" will be activated.

If one or more of the external power supplies are not connected to the control panel, the switches belonging to same must be ON. Otherwise will alarm and faultindication be ON in the control panel.

For the different external power supplies following switches must be ON if power supply is not connected:

SMPS 1. SW1/1, SW1/2, SW1/3

STAND BY 2. SW2/1, SW2/2, SW2/3, SW2/4

STAND BY 3. SW3/1, SW3/2, SW3/3, SW3/4.

SMPS 4. SW4/1, SW4/2, SW4/3.

Overtemperature in one of the external power supplies will activate POWER INTERRUPT and MEMORY INHIBIT circuit (7).

MANUALLY SWITCHING ON/OFF OF EXTERNAL POWER SUPPLIES.

Each of the external power supplies can be switched ON/OFF from the control panel. (SMPS 1 = SW2 "22").

MARGINAL CONTROL EXTERNAL POWER SUPPLIES.

Each of the external power supplies' output voltage can be remotely controlled from the control panel:

SMPS 1 = SW1 (22), 5V output.

STAND BY 2 = SW3 (23), 5V output.

STAND BY 2 = SW5 (23), 12V output.

STAND BY 3 = SW6 (24), 5V output.

STAND BY 3 = SW8 (24), 12V output.

SMPS 4 = SW9 (25), 5V output.

REMOTE ON/OFF OF ENTIRE POWER SYSTEM.

If remote ON/OFF switch is connected to the output plug PL8.8, the entire power system inclusive external power supplies can be switched OFF.

Normally, when the power system is ON, PL8.8 shall be connected to system GND. If this connection is broken, POWER INTERRUPT and MEMORY INHIBIT will be activated by means of optocoupler Q44. Simultaneously the signal is inverted in Q42,1 and all the external power supplies are switched OFF via diode D53 and

SMPS 1 via D1.

STAND BY 2 via D2.

STAND BY 3 via D3.

SMPA 4 via D4.

If a failure in 5V LOCAL or in the AC-input to the control panel happens, relay d2 will be deactivated.

Relaycontacts d2.1 - 4 (22-23-24-25) will then switch OFF the external power supplies.

26-27. BATTERY INDICATION.

From external power supplies STAND BY 2 and 3 signal is given via optocoupler Q16 and Q20.

If the batteries are connected, LEDs L14 "BATTERY STAND BY 2" and L18 "BATTERY STAND BY 3" will be activated.

4.0 ADJUSTMENTS.

4.1 12V_LOCAL.

12V LOCAL may be adjusted from the front of the control panel by means of potentiometer P1 (1).

- a. Remove black cap by pressing it upwards.
- b. Measure the output voltage on the output plug PL8.1 and 2.
Adjust to correct value.
- c. Put the black cap back in place.

4.2 12V_LOCAL_OVERVOLTAGE.

The overvoltage is not adjustable by potentiometer. The level of overvoltage shut down is set by fixed resistors in the voltage divider R229, R230 (1).

4.3 OVERTEMPERATURE.

This potentiometer is not accessible from the front of the control panel.

Adjustment is done at the factory.

However, if a change in the adjustment is wanted, the two parts of the control panel will have to be separated.

NTC-resistor (6) is exposed to right temperature and potentiometer P4 is adjusted to LED L22 "OVER TEMPERATURE CONTROL PANEL LOCAL" is activated.

4.4 ALARM_HIGH_INPUT_VOLTAGE_(AC).

This potentiometer is not accessible from the front of the control panel.

If readjustment should be necessary, a variable transformer must be connected between the control panel and AC-input.

Set input voltage to 90% of nominal (196V).

Adjust potentiometer P2 NET (8) so LED L23 "ALARM MAINS" is activated.

4.5 5V_LOCAL.

This potentiometer is not accessible from the front of the control panel.

If a change in the voltage is necessary, adjust P3 (2) to 5,25 volts measured between PL6.21 (+) and PL6.19 (-).

NOTE!!! ADJUSTMENTS DESCRIBED IN §4.2-4.3-4.4 and 4.5 ARE NORMALLY ADJUSTED FROM FACTORY. FURTHER ADJUSTMENTS BY UNAUTHORIZED PERSONELL MUST BE AVOIDED.

5.0 MAINTENANCE.

It is not necessary with any periodically maintenance on the control panel except keeping the unit clean and free from dust.

Since all control/monitoring functions is built in to the front panel, the front panel is built to be easily removed from the frame work.

If a fault should occur in the control/monitoring functions, an effective repair/readjustment should be done towards a special built test panel.

MECHANICAL LAY OUT.

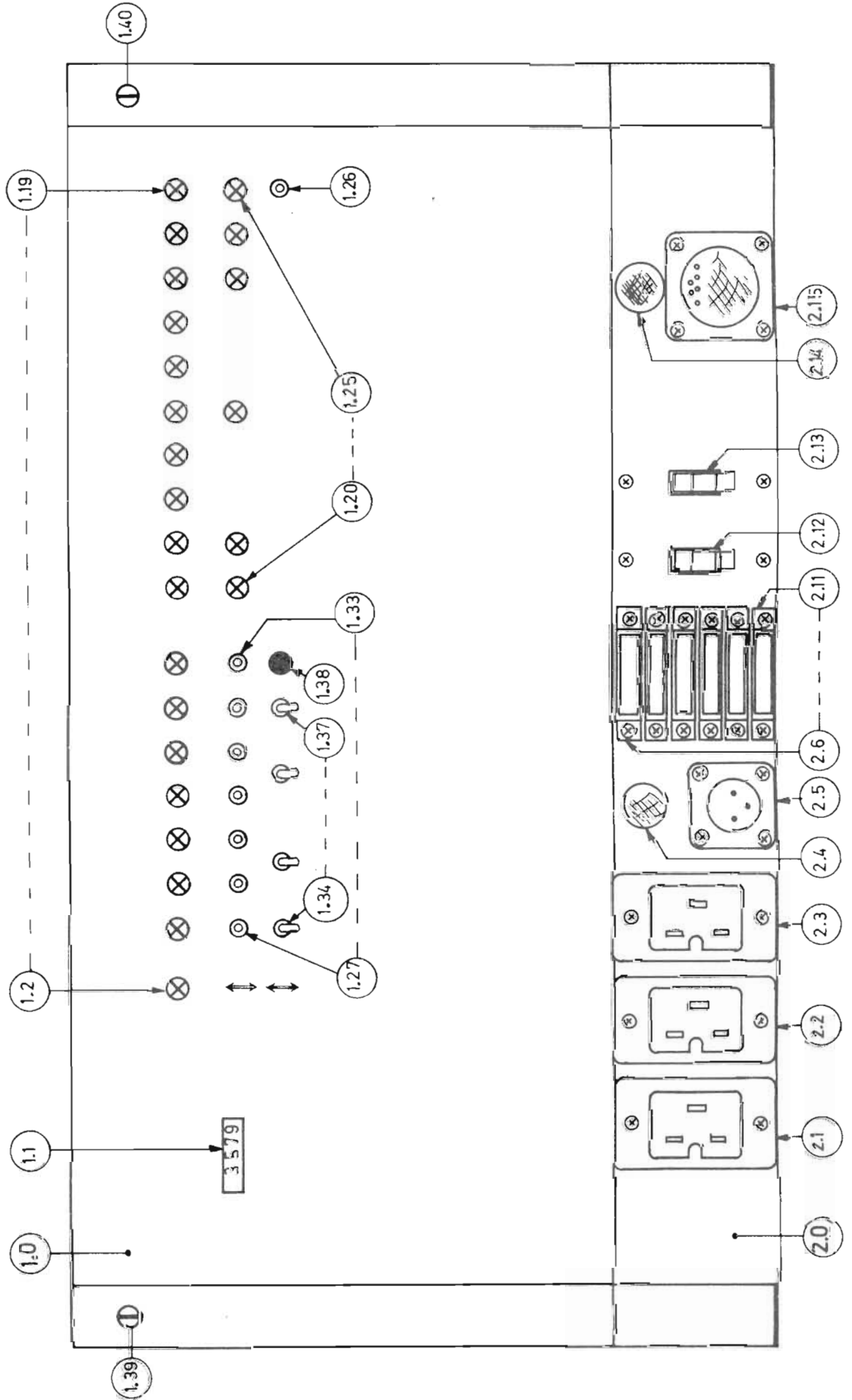
<u>POS.NO.</u>	<u>COMPONENT</u>	<u>TYPE</u>	<u>MAKER</u>
1.0	Frontpanel	No. 482	EMI A/S
1.1	Time meter	311010 220V/50Hz	Paladin
1.2	LED MAINS ON	LD 56 C	Siemens
1.3	" 5V SMPS 1 ON	LD 57 C	"
1.4	" 5V Stand By 2 ON	"	"
1.5	" 12V " " 2 ON	"	"
1.6	" 5V " " 3 ON	"	"
1.7	" 12V " " 3 ON	"	"
1.8	" 5V SMPS 4 ON	"	"
1.9	" 12V LOCAL ON	"	"
1.10	" 5V SMPS 1 ALARM	LD 52 C	"
1.11	" 5V Stand By 2 "	"	"
1.12	" 12V " " 2 "	"	"
1.13	" BATT. " " 2 "	"	"
1.14	" 5V " " 3 "	"	"
1.15	" 12V " " 3 "	"	"
1.16	" BATT. " " 3 "	"	"
1.17	" 5V SMPS 4 "	"	"
1.18	" 12V LOCAL "	"	"
1.19	" MAINS "	"	"

			LD 52 C	Siemens
1.20	LED	SMPS 1 TEMP. FAILURE		
1.21	"	Stand by 2 TEMP. FAILURE	"	"
1.22	"	Stand by 3 TEMP. FAILURE	"	"
1.23	"	SMPS 4 TEMP. FAILURE	"	"
1.24	"	LOCAL TEMP. FAILURE	"	"
1.25	"	FAN FAILURE	"	"
1.26	Alarm	reset switch	7105 CYCQ	C&K
1.27	5V	SMPS 1 Marg. switch	7105 CYCQ	C&K
1.28	5V	Stand By 2 Marg. switch	7105 CYCQ	C&K
1.29	12V	Stand By 2 Marg. switch	7105 CYCQ	C&K
1.30	5V	Stand By 3 Marg. switch	7105 CYCQ	C&K
1.31	12V	Stand By 3 Marg. switch	7105 CYCQ	C&K
1.32	5V	SMPS 4 Marg. switch	7105 CYCQ	C&K
1.33	12V	LOCAL Marg. switch	7105 CYCQ	C&K
1.34	SMPS 1	ON/OFF SWITCH	7101 SYCQ	C&K
1.35	St.By 2	ON/OFF SWITCH	7101 SYCQ	C&K
1.36	St.By 3	ON/OFF SWITCH	7101 SYCQ	C&K
1.37	SMPS 4	ON/OFF SWITCH	7101 SYCQ	C&K
1.38	12V	LOCAL adjust		
1.39)	Lock	screw and lock	Aj3-25	DZUS
1.40)			X-735-180	

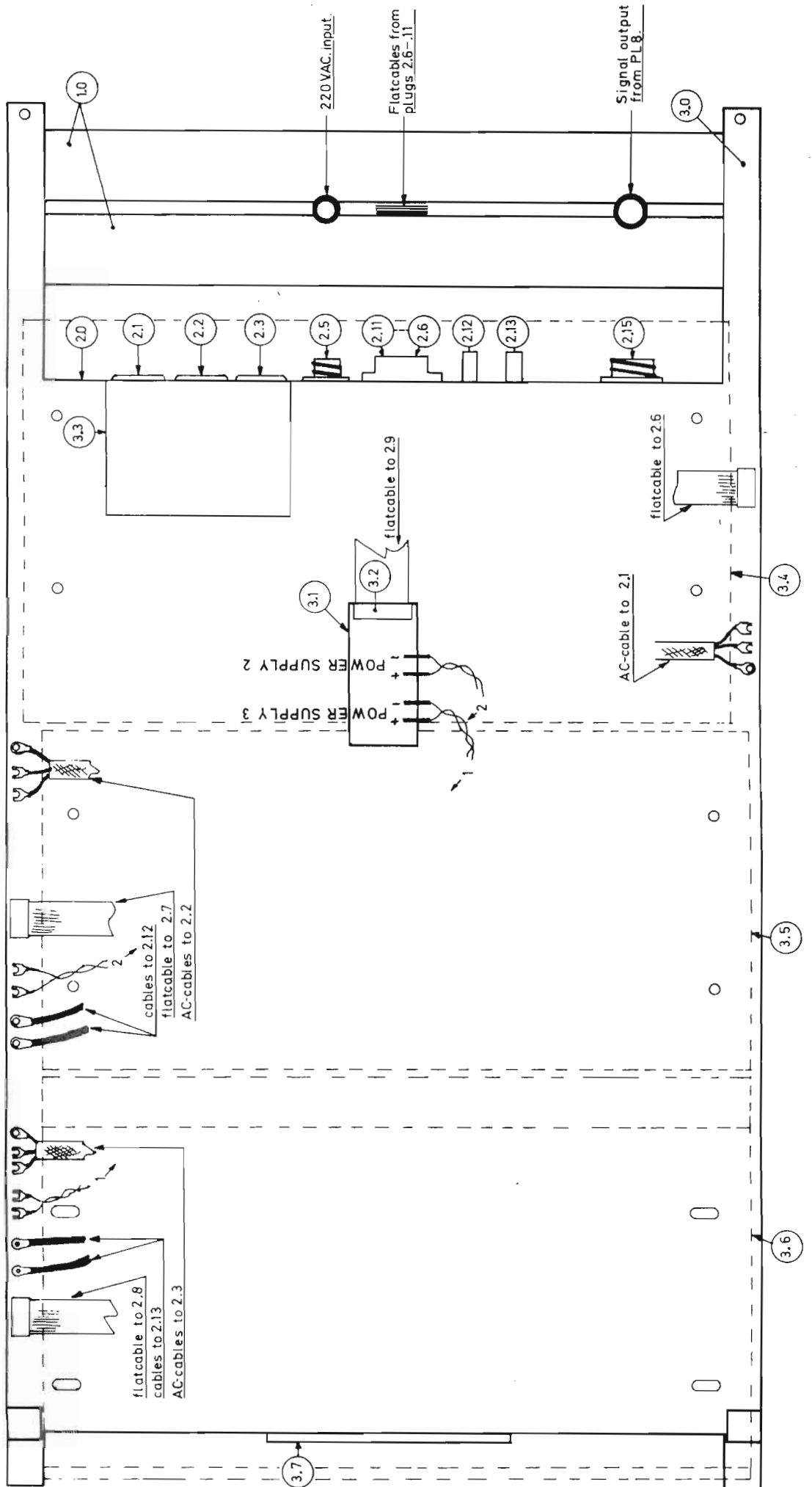
		N 0492	EMI A/S
2.0	Plug panel		
2.1	AC-plug SMPS 1	1621 - 5	Heil
2.2	AC-plug Stand By 2	1621 - 5	"
2.3	AC-plug Stand By 3	1621 - 5	"
2.4	AC-cable to controlpanel	PMH 2x1 $\frac{1}{2}$ mm ² +j	NEK
2.5	AC-plug control panel input	206061-1	A.M.P.
2.6	Aux. plug SMPS 1	609-1616	Ansley
2.7	" " Stand By 2	609-1616	Ansley
2.8	" " Stand By 3	609-1616	Ansley
2.9	Battery voltage from St.By 2 and 3	609-1616	Ansley
2.10)	Aux. plug SMPS 4	609-1616	Ansley
2.11)			
2.12	Stand By 2 ON/OFF switch battery	0320-0101	Marquard
2.13	Stand By 3 ON/OFF switch battery	0320-0101	Marquard
2.14	Cable from aux.output control panel	16x0,5 mm ²	Lütze Silflex
2.15	Plug connection for 2.14	206036-1	A.M.P.

3.0	Frame	N-500	EMI A/S
3.1	PC-board EP-341.2 used as inter connection between St.By 2, St.By 3 and front panel.		EMI A/S
3.2	Plug	609-1612	Ansley
3.3	Cover for AC-contacts	N 0594	EMI A/S
3.4	Power supply SMPS 1		
3.5	Power supply Stand By 2		
3.6	Power supply Stand By 3		
3.7	Earth bar		EMI A/S

FRONT - and PLUGPANEL



Frame seen from bottom side



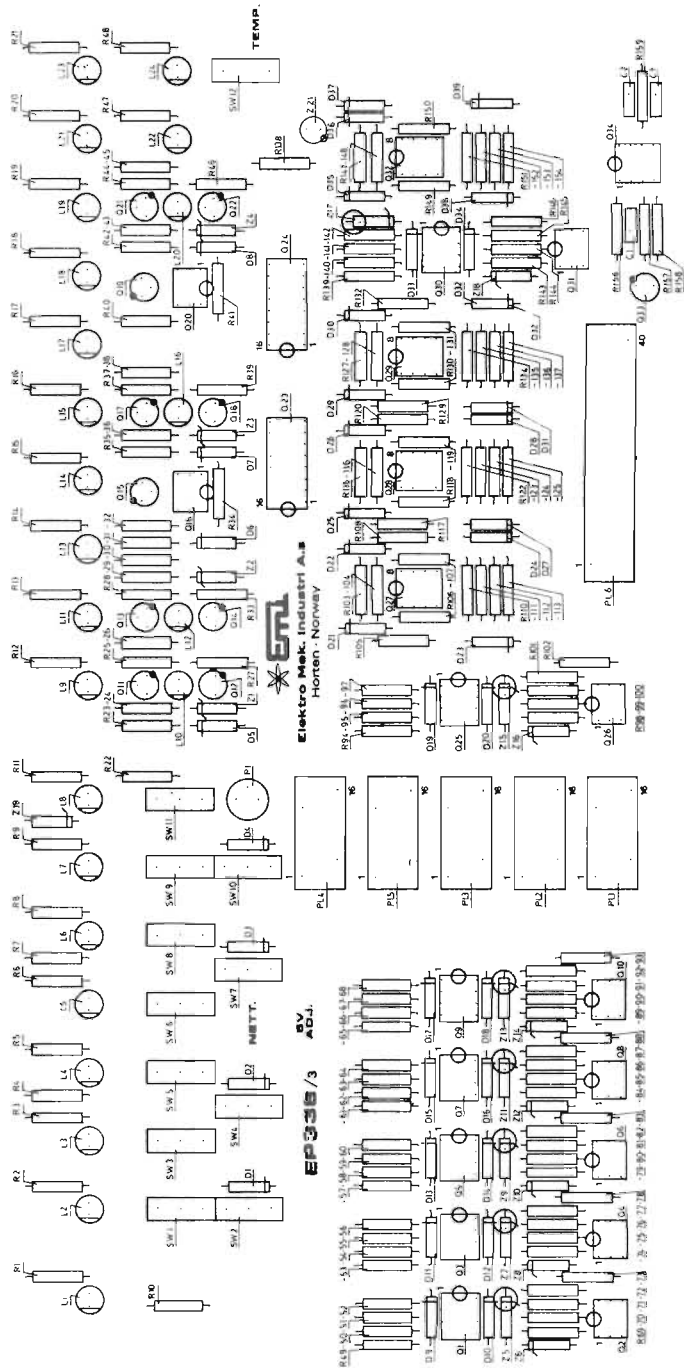
COMPONENTLIST PC-CARD TYPE EP 338/3.

<u>PART.NO.</u>	<u>TYPE</u>	<u>MAKER</u>
<u>Resistors:</u>		
R24,30,36,43,	MR.25 1K5	Phillips
R22,23,26,29,31,32,34,35 38,40,41,42,45	MR.25 1K	"
R103,104,105,108,110,111,112 113,115,116,117,120,122,123 124,125,127,128,129,132,134 135,136,137,147,148,151,152 153,156,157	MR.25 10K	"
R27,33,39,46,82,146,92	MR.25 2K2	"
R52,56,64,71,72,76,77,86,87 97,100,101,138	MR.25 2K7	"
R150	MR.25 47K	"
R60,68,81,91,142,145	MR.25 4K3	"
R57,65,139	MR.25 3K9	"
R58,66,140	MR.25 3K3	"
R50,54,62,80,90,95,144	MR.25 470E	"
R59,67,141	MR.25 680E	"
R70,75,85,99	MR.25 220E	"
R49,53,61,94	MR.25 1K1	"
R51,55,63,96	MR.25 270E	"
R79,89,143	MR.25 1K6	"
R69,74,84,98	MR.25 560E	"
R106,107,118,119,130,131,149	MR.25 22K	"
R73,78,83,88,93,102,154	MR.25 8K2	"
R158	MR.25 100K	"
R159	CR.25 10M	"
R11	MR.30 270E	"
R1,10	MR.30 51E	"
R12,13,14,15,16,17,18,19 20,21,25,28,37,44,47,48	MR.30 100E	"
R2,3,6,9	MR.30 120E	"
R4,5,7,8	MR.30 180E	"

<u>PART.NO.</u>	<u>TYPE</u>	<u>MAKER</u>
<u>Ceramic capacitors:</u>		
C1,2	100 nano F	Siemens
C3	10 nano F	"
<u>Diodes:</u>		
D1,2,3,4,5,6,7,8,9,10,11 12,13,14,15,16,17,18,19 20,21,22,23,24,25,26,27 28,29,30,31,32,33,34,35 36,37,38,39	1N 4148	Phillips
<u>Zenerdiodes:</u>		
Z1,2,3,4	3v9	"
Z6.8.10.12.14.16.18.19	2v7	"
Z9,13,17	1N 4572A	Siemens
Z5,7,11,15,21	ICL 8069	Intersil
<u>Potentiometer:</u>		
P1	T7YA 1K	Sfernice
<u>IC-circuits:</u>		
Q1,3,5,7,9,25,27,28,29,30 32	LM 359	National
Q23,24	ULN 2003A	Texas Instr.
Q34	LM 555 CN	Natinal
<u>Photocouplers:</u>		
Q2,4,6,8,10,16,20,26,31	4N28	Gen. Electric
<u>Transistors:</u>		
Q12,14,15,18,19,22,33	2N 2222 A	Phillips
Q11,13,17,21	2N 2907 A	"

<u>PART.NO.</u>	<u>TYPE</u>	<u>MAKER</u>
<u>LED's:</u>		
L1	LD56C	Siemens
L2,3,4,5,6,7,8	LD57C	"
L9,10,11,12,13,14,15,16,17 18,19,20,21,22,23,24	LD52C	"
<u>Switches:</u>		
SW1,3,5,6,8,9,11,12	7105 SYCQ	C&K
SW2,4,7,10	7101 SYCQ	C&K
<u>Plugs:</u>		
PL1,2,3,4,5 (PC-board)	609 - 1603	Ansley
PL6 (PC-board)	609 - 4003	"
PL1,2,3,4,5 (cable)	609 - 1630	"
PL6 (cable)	609 - 4030	"
<u>Flat_cable:</u>		
5 pcs. á 30 cm. 16 pos.	171 - 16 Blue streak	Ansley
1 pc. á 15 cm. 40 pos.	171 - 40 " " "	"

PRINTED CIRCUIT BOARD TYPE EP 338/3



COMPONENT LIST PC-CARD TYPE EP 339/3.

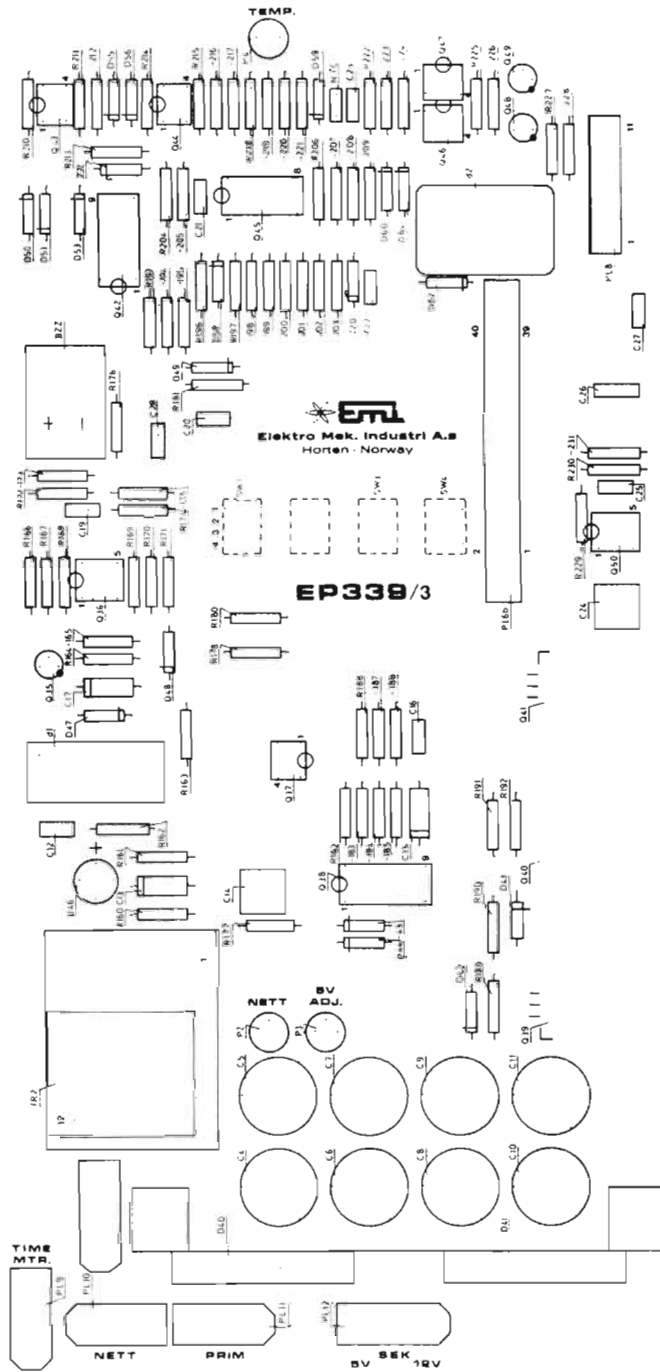
<u>PART NO.</u>	<u>TYPE</u>	<u>MAKER</u>
<u>Resistors:</u>		
R174	CR.25 10M	Phillips
R166,176,177,191,194,195 222	MR.25 1K	"
R160,164,165,167,168,170 171,182,193,197,200,201 203,205,207,208,212,214 215,218,219,220	MR.25 10K	"
R161,173,181,206	MR.25 100K	"
R189,192	MR.25 240E	"
R186,187,188	MR.25 1K3	"
R183	MR.25 270E	"
R184	MR.25 160E	"
R185	MR.25 47E	"
R190	MR.25 510E	"
R172,175,229	MR.25 4K7	"
R230	MR.25 910E	"
R169	MR.25 1K8	"
R217	MR.25 220K	"
R216	MR.25 56K	"
R196	MR.25 3K3	"
R204	MR.25 8K2	"
R178,210,211,213,223,224 227,228	MR.25 220E	"
R163	MR.25 180E	"
R231	MR.25 100E	"
R225,226	MR.25 2K2	"
R198,199,202,209	CR.25 1M	"
R180	MR.25 2K7	"
R162	MR.30 47E	"
NTC-resistor	232264211104, 100K	"

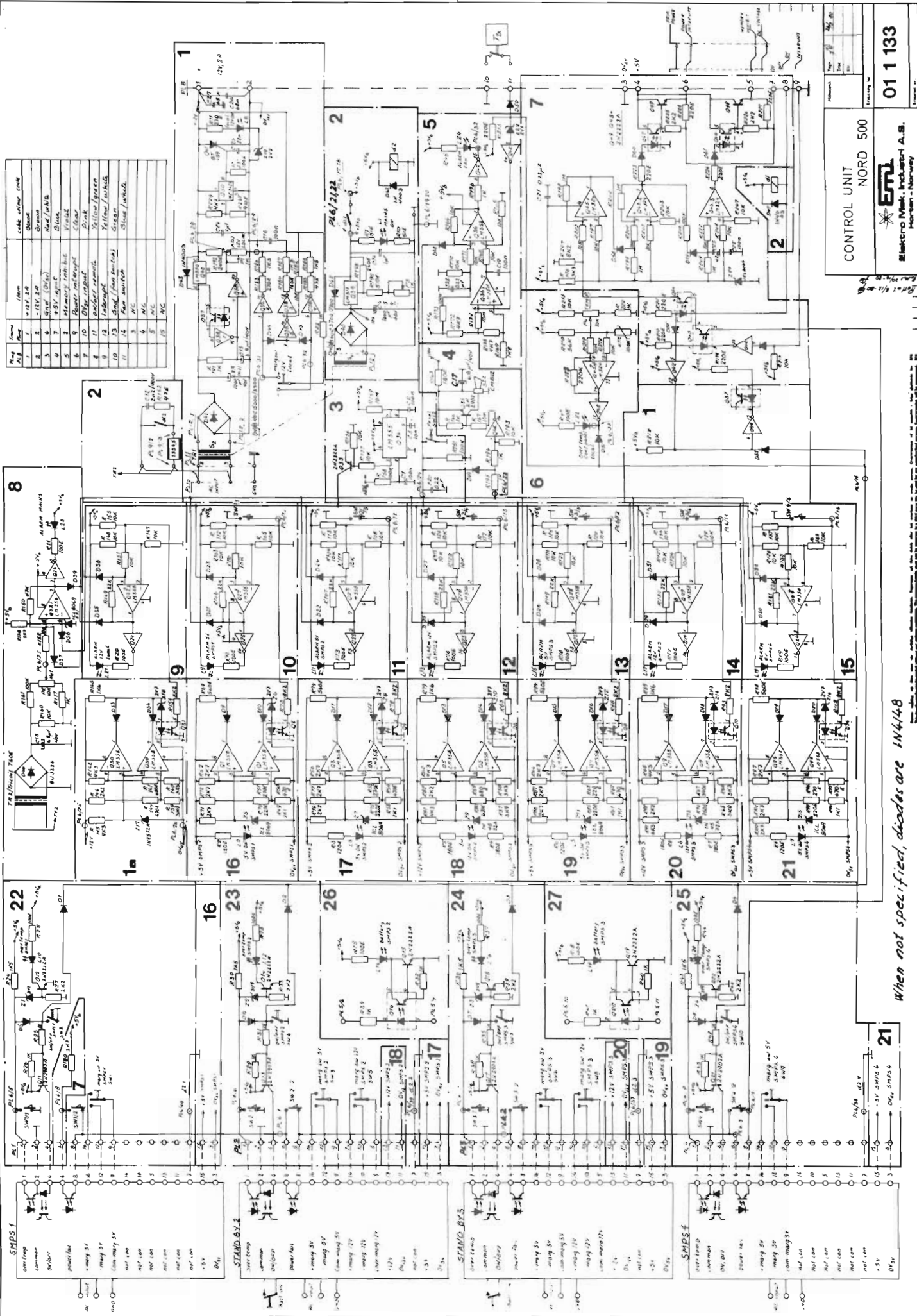
<u>PART NO.</u>	<u>TYPE</u>	<u>MAKER</u>
<u>Electrolytic capacitors:</u>		
C4,5,6,7,8,9,10,11	1000 uF/40V B41293 J7108T	Siemens
C15,17	6,8 uF/40V	Phillips
C13	6,8 uF/63V	"
<u>Ceramic capacitors:</u>		
C25	22 nano F	Siemens
C20,21,28	100 nano F	"
C26,27	68 nano F	"
C14,24	1 uF	"
C12	2n2, 250V	"
C23	47 nano F	"
<u>Diodes:</u>		
D44,45,48,49,50,51,53,55 56,58,59,60,61	1N 4148	Phillips
D42,43,47,62	1N 4003	Toshiba
<u>Rectifier:</u>		
D46	WO 08	Gen.Electric
D40	C2206 B40C3700/2200	Siemens
Bracket for D40	D4	"
D41	E2506 B40C5000/3300	"
Bracket for D41	D5	"
<u>IC-circuits:</u>		
Q39	LM 317	National
Q40	LM 350	"
Q37,43,44,46,47	4N28	Gen.Electric
Q36	LM 358 N	National

<u>PART NO.</u>	<u>TYPE</u>	<u>MAKER</u>
Q45	LM 324 N	National
Q38	ULN 2004 A	Texas Instr.
Q42	ULN 2003 A	" "
Q50	MC 3423 P	" "
 <u>Switches:</u>		
Sw1,2,3,4	76RSB04 "dual in line"	McGraw Hill
 <u>Transistors:</u>		
Q35	2N 2907 A	Phillips
Q48,49	2N 2222 A	"
 <u>Thyristor:</u>		
Q41	BT 139	Phillips
 <u>Zenerdiodes:</u>		
Z20	ICL 8069	Intersil
Z22	2v1	Phillips
 <u>Potentiometers:</u>		
P3	T7YA 1K	Sfernice
P2,4	T7YA 10K	"
 <u>Relay:</u>		
d1	V23037-A0001-A101	Siemens
d2	V23154-N0712-B110	"
Buzzer	CMB 12	Star Mfg. Co
 <u>Transformer:</u>		
TR1	No. 915	EMI A/S
TR2	BV 3224	Eberle

<u>PART NO.</u>	<u>TYPE</u>	<u>MAKER</u>
<u>Plugs:</u>		
PL9,10,11	A 4273 - 3	Molex
PL12	3099 - 4	"
PL6b	609 - 4022	Ansley
PL8	1 - 164713 - 1	A.M.P.
Aluminum cooling rib.	No. 115	EMI A/S

PRINTED CIRCUIT BOARD TYPE EP 339/3





Color	Mean	code
1	Blank	
2	Blank	
3	Red/white	
4	Red	
5	Black	
6	Blue	
7	Green	
8	Yellow	
9	Orange	
10	Purple	
11	White	
12	Black	
13	White	
14	White	
15	White	
16	White	
17	White	
18	White	
19	White	
20	White	
21	White	
22	White	
23	White	
24	White	
25	White	
26	White	
27	White	

When not specified, diodes are IN4148



10



