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INDUSTRIAL CONTROL
RESEARCH CENTER

CONVERSION OF *AZMAYESH*
INDUSTRIAL FACTORIES CO.
HOT CHAMBER
FINAL REPORT

Contract no. 96/038

UNIDO's PROJECT NO. MP/IRA/94/403

March 1997

Industrial Control Research Center, No. 8 Second Floor, First St. Fatemi Sq.

Tehran, Iran, Fax, + 98 21 559120

INDUSTRIAL CONTROL
RESEARCH CENTER

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SYNOPSIS

Under supreme supervision of UNIDO the CFC phase project has been implemented in Iran to phase out 100 % ODS in five major Iranian White Industries.

The project No. MP/IRA/94/403 has been nominated to Islamic Republic of Iran for the Multilateral Fund for the implementation of The Montreal Protocol Financing.

The project was approved by Montreal Protocol Multilateral Fund executive committee. The project was actually started in November 1994, but the implementation of the project has been already started from January 1994, by recommendation of Montreal Protocol and request of Government of Islamic Republic of Iran, the refrigerant R134a was finally approved and selected by UNIDO as an alternative for refrigerant R12.

AZMAYESH Industrial Factories Co. As a leading home appliance manufacturer in Iran was established in 1959, the main activities of AZMAYESH Co., In Marvdasht plant is producing eight models of refrigerators and freezers, as well as washing machine and vacuum cleaner. The older factory in located near Tehran and produces convector heaters and water coolers as well as water heaters.

The total production rate of refrigerators and freezers are estimated to be more than 250,000 units per year at maximum capacity. More than 1200 people are working in Marvdasht plant and 600 production personnel are working in refrigerator production department. Laboratory department is taking care of testing of performance criteria of our refrigerators and freezers, as well as material acceptance tests.

The total annual ODP consumption rate, are estimated 159 MT (33 MT of

CFC-12 and 126 MT of CFC-11), 3 MT of CFC-12 are considered for our service stations. Approximately more than 2,000,000 refrigerator and freezer units have been manufactured by AZMAYESH Co., and are still in service.

This company as one of the largest home appliance manufacturer was formed in 1959, Azmayesh activities are mainly accomplished in two large plants in Tehran and Marvdasht near ancient city of Perspolis. The older plants in Tehran produces a space heater, water cooler, water heaters, while, the larger plant in Marvdasht produces, refrigerator and ref.-freezer, freezer, washing machine, vacuum cleaner and electromotor and water pumps. 2000 personnel are working for Azmayesh at Tehran and Marvdasht plants and a service center in Tehran.The original design of refrigerators are from SILTAL of Italy.

INTRODUCTION

According to UNIDO contract No. 96/038 with Industrial Research Center Co. (ICRC) the existing AZMAYESH Industrial Factories Co. hot chambers facilities in Marvadasht Plant and Tehran After Sale Service Support Facility will be converted and modified to phase out CFC-12 and suitable for R134a refrigerant to perform functionality and performance test of converted refrigerators and complying with ISO standards 7173, 8187, and 5155.

1 This contract has been executed according the requirements of Islamic Republic of Iran indicated in the country programme no UNEP/OZL. PRO/EX COM/10/24 dated 27 May 1993 prepared by UNDP.

2 The CFC phase out project in AZMAYESH Co. enables AZMAYESH to convert the existing production line facilities and existing hot chambers into Non CFC production line, using R134a refrigerant.

3 The converted Hot Chamber Installations will provide more than sixteen data points in the refrigeration circuit this means more information and the ability of analyzing refrigeration system and new refrigerant effect.

4 The reconstructed Hot Chambers will be able to check and test four refrigerator and/or ref.-freezers units at the same time. The same equipment and data processing system, as will be used at Marvdasht plant test room will be installed in this chamber.

5 The immediate effect of this project at AZMAYESH Industrial Factories Co. is to perform all required check and tests, suitable for Refrigerator & Freezers using Ozone Friendly Gases. The existing test facilities in AZMAYESH Co. In Marvdasht and Tehran are not adequate for check

and testing, converted ref. and freezer units, in addition to that the hot rooms are not able to perform Energy Consumption and Optimization .

ICRC Hot Chamber Characteristics

In order to convert AZMAYESH hot rooms facilities in Marvdasht and Tehran, ICRC will provide following services:

- Supply of new equipment.
- Redesign of old equipment
- Delivery of technical drawings and software.
- Installation and commissioning.
- Start-up of the equipment and the technology.
- On-the-job training of the plant personnel.

With respect to ISO standards test requirements, and for the purpose of functionality and performance tests of the new redesigned Refrigerator and Ref.-Freezers using R134a refrigerants. The existing hot rooms in AZMAYESH Co. have been being converted and equipped in such a way to enable AZMAYESH Co. to check and test at least six different models of refrigerators and freezers at ambient temperature 15 to 50 degree centigrade at two hot room chambers in Marvdasht Plant and Tehran facilities. Following services have been provided to the project.

a) Procurement of new test measurement and data processing equipment.
b) Redesign and rebuilding of presently used equipments and installation.
c) Installation, commissioning, trial operation, start-up and on-the-job training

AZMAYESH, MARVDASHT PLANT HOT CHAMBER TECHNICAL SPECIFICATION

As previously mentioned, Azmayesh Co.'s main plant is located in Marvdasht in southern part of Iran and is producing 1000 refrigerator daily, subsequently the hot chamber should is able to cover plant daily test requirement as well as other activities. Therefore, the converted hot chamber should respond to all test requirement and be able to meet ISO standards numbers 7371, 5155, 8187 as set forth in the contract and IJISI, Iranian standards numbers 254, 2482, 2818. The Marvdasht plant hot chamber technical specification are as follows:

- Hot Chamber Dimension 4 mt. by 4.5 mt.
- Refrigerator test ability simultaneously, 4 units
- Ability to perform following operational tests and report:

    1 - Pull down test.
    2 - Continuous run test.
    3 - Cyclic run test.
    4 - Ice Freeze test.
    5 - Energy consumption test

- 16 Measuring points, including.

    1 - Humidity, one point.
    2 - Compressor Power, four points for each refrigerator.
    3 - Motor energy consumption, four points for each refrigerator.
    4 - Pressure measurement, two points.
    5 - Hot chamber air temperature reading, one point.
    6 - Hot chamber relative humidity, one point.
    7 - Supply Voltage, one point.

- Computerized graphical diagram of yhe refrigerator performance data sheet.
- Test measurement tolerance for temperature reading 0.3 degree centigrade.
- Computerized data processing system.
- Full color test sheet system reporting.

- On screen and data reporting system ability with following characteristics;

1 - Test number.
2 - Product name.
3 - Product model
4 - Product internal volume
5 - Compressor name
6 - Compressor model
7 - Compressor cooling capacity
8 - Compressor current
9 - Thermostat setting
10 - Thermostat type.
11 - Total test running time.
12 - Ambient temperature.
13 - Voltage rating
14 - Working percentage
15 - Evaporator mean air temperature
16 - Cabin mean temperature
17 - Evaporator bulb temperature
18 - Crisper temperature.
19 - Actual compressor running time
20 - Energy consumption
21 - Compressor motor winding temperature
22 - Compressor shell temperature.
23 - Compressor discharge temperature.
24 - Condenser inlet temperature.
25 - Condenser out let temperature.

26 - Condenser mid temperature
27 - Evaporator inlet temperature
28 - Evaporator outlet temperature.
29 - Freezing temperature.
30 - Refrigeration system condition display.

Azmayesh Service Center Hot Chamber Technical Characteristics

AZMAYESH Co.'s After Sale Service Support Center in Tehran has a small chamber, for testing all Converted products to determine and define all external failure happening at costumers' place, where the product is running for a long time, this hot chamber is designated to be used for research as well as trouble shooting. The existing chamber in Tehran facilities is not able to perform all check and testing functions, because all tests are done manually (even temperature reading is done in a very poor condition), the chamber has no ambient temperature and humidity control device. The new converted hot chamber is able to fulfill all ISO and IJISI standards test requirements. The after sale service hot chamber technical specification are as follows:

- Hot Chamber Dimension 3 mt. by 3 mt.
- Refrigerator test ability simultaneously, 2 units
- Ability to perform following operational tests and report:

    1 - Pull down test.
    2 - Continuous run test.
    3 - Cyclic run test.
    4 - Ice Freeze test.
    5 - Energy consumption test

- 16 Measuring points, including.

    1 - Humidity, one point.
    2 - Compressor Power, four points for each refrigerator.

3 - Motor energy consumption, four points for each refrigerator.
4 - Pressure measurement, two points.
5 - Hot chamber air temperature reading, one point.
6 - Hot chamber relative humidity, one point.
7 - Supply Voltage, one point.

- Computerized graphical diagram of yhe refrigerator performance data sheet.
- Test measurement tolerance for temperature reading 0.3 degree centigrade.
- Computerized data processing system.
- Full color test sheet system reporting.
- On screen and data reporting system ability with following characteristics;

1 - Test number.
2 - Product name.
3 - Product model
4 - Product internal volume
5 - Compressor name
6 - Compressor model
7 - Compressor cooling capacity
8 - Compressor current
9 - Thermostat setting
10 - Thermostat type.
11 - Total test running time.
12 - Ambient temperature.
13 - Voltage rating
14 - Working percentage
15 - Evaporator mean air temperature
16 - Cabin mean temperature
17 - Evaporator bulb temperature
18 - Crisper temperature.
19 - Actual compressor running time

20 - Energy consumption
21 - Compressor motor winding temperature
22 - Compressor shell temperature.
23 - Compressor discharge temperature.
24 - Condenser inlet temperature.
25 - Condenser out let temperature.
26 - Condenser mid temperature
27 - Evaporator inlet temperature
28 - Evaporator outlet temperature.
29 - Freezing temperature.
30 - Refrigeration system condition display.
31 - Refrigerant flow measurement system.

ACTIVITIES

The following activities were generally accomplished toward achievement of the contract requirement as set forth by UNIDO and the counterpart.

1 - .Planning for;

a) Hot chambers system management.
b) Hot chambers graphic display management.
c) Hot chambers calibration setting parameters.
d) Hot chambers test standards management

2 - Preparing material requirement list.

3 - Component and material supply source evaluation.

4 - Technical data collecting.

5 - Engineering drawing for electronic and electrical system

6 - Hot chamber design review.

7 - Data processing software planning.

8 - Data processing hardware planning.

9 - Thermal amplification electronic cart design

10 - Pressure sensor amplification electronic cart design.

11 - Initial test of data loggers electronic cart.

12 - Initial connection of data loggers to the computers.

13 - Interface electronic cart design for PC and operating system.

14 - RTX3 electronic diagram design.

15 - RTX electronic diagram design.

16 - UNIDO, CRC - 386 design.

17 - UNIDO, TC- 100 design.

18 - UNIDO, in-out CRC design.

19 - Preparation of operating system display flow chart.

20 - Preparation of timer 1 flow chart.

21- Activities at home office and project area:

- Visiting Marvdasht plant.
- Visiting and coordinating with UNDP office in Tehran four times.
- Technical negotiation with Azmayesh engineers in Tehran headquarter in order to coordinate activities in Tehran and Marvdasht.
- Visiting Tehran hot chamber several times in order to coordinate activities.

21 -1 - Reviewing and evaluating the existing hot chamber for the purpose of:

a) Hot Chamber Heat Control Design;
b) Hot Chamber Heat Capacity;
c) Hot Chamber Heat leaks;
d) System Control Placement;
e) Refrigerator Unit Placement;

21 - 2 - Following steps were taken to manufacture hot chamber hoods:

a) Designing;
b) Fabricating;
c) Preparation;
d) Hood Installation;
e) Sensor Preparation;
f) Sensor Check and Test;
g) Sensor Installation;
h) Wiring;
I) Wiring Control;
k) Selecting Blower and Fans;
l) Blower Check and test;
m) Blower Installation;

21 - 3 - Following Components and parts were designed and manufactured:

a) Complete Data Logger System;
b) Thermal Amplifier;
c) Electrical Control Panel;
d) Electronic Control Panel;

e) Complete Heat Control System;
f) Hot Air Circulating System;
g) Voltage Regulator for 220 Volts and 50 Htz;
h) Refrigerator Unit Power Supply;

21 - 4 - Following Components were installed in hot chambers at Tehran Service Center:

a) Data Programme Logger in CPU;
b) Data Logger Check and Test;
c) Power Supply Installation;
d) Refrigerator Power Supply Installation;
e) Hot air circulation hoods;
f) Electrical Control Panel;
g) Main Control Panel;

21 - 5 - Initial Check and test of thermal measurement system and relevant sensors.

21 - 6 - Man Hours spent at home office:

a) Engineer:	210	Man Hours
b) Technician:	580	Man Hours
c) Technical Assistance: (Direct Labor, by helpers)	1200	Man Hours
d) Management:	120	Man Hours

21 - 8 - Project Area at Marvdasht plant.

a) Two engineers for the execution of the contract and converting of

existing hot chamber facilities at Marvdasht plant for three man months;

b) Two technicians for the execution of the contract and converting of existing hot chamber facilities at Marvdasht plant for four man months;

21 - 9 - Man months services at Project Area at of Tehran Service center

a) Engineers	One and half months
b) Technicians	Two months

21 - 10 - Totally 54 man/travels to Shiraz - Marvdasht, for accomplishment of duties assigned to the experts involved in the project .

21 - 11 - Evaluating operating condition of the hot chamber to insure proper performance, and giving corrective action to correct discrepancies.

21 - 12 - Installation of the new refrigeration system in the hot chamber and regulate air flow system, in order to get desired ambient temperature.

21 -13 - Design, manufacturing and installing new logical evaluating system, this new system will improve the efficiency of the hot chamber and will enable the operator to determine automatically all the possible discrepancies, that may occur during the operation of the system.

21 - 14 - Redesign and replacement of previously installed hood and installing the hood in the new position.

21 - 15 - System optimizing, in order to prolong system retirement life.

21 - 16 - System calibration in order to ensure the accuracy of the reading data and improve management information system.

21 - 17 - Performing necessary modification to the air flow circulation in order to ensure a stable and steady air temperature in the all hot chamber space.

SUPPLY PARTS AND MATERIALS

In order to fabricate components and electronic kits following material and parts have been purchased so far.

1 - Thermocouple type "J " for measuring temperature from - 30 to + 200 degree centigrade. 40 each

2 - Electronic pressure measurement sensor 4 each

3 - Electronic data logger cart for temperature measurement 12 each

4 - Electronic data logger cart for humidity measurement 12 each

5 - Z80 micro processor IC for system integral management.

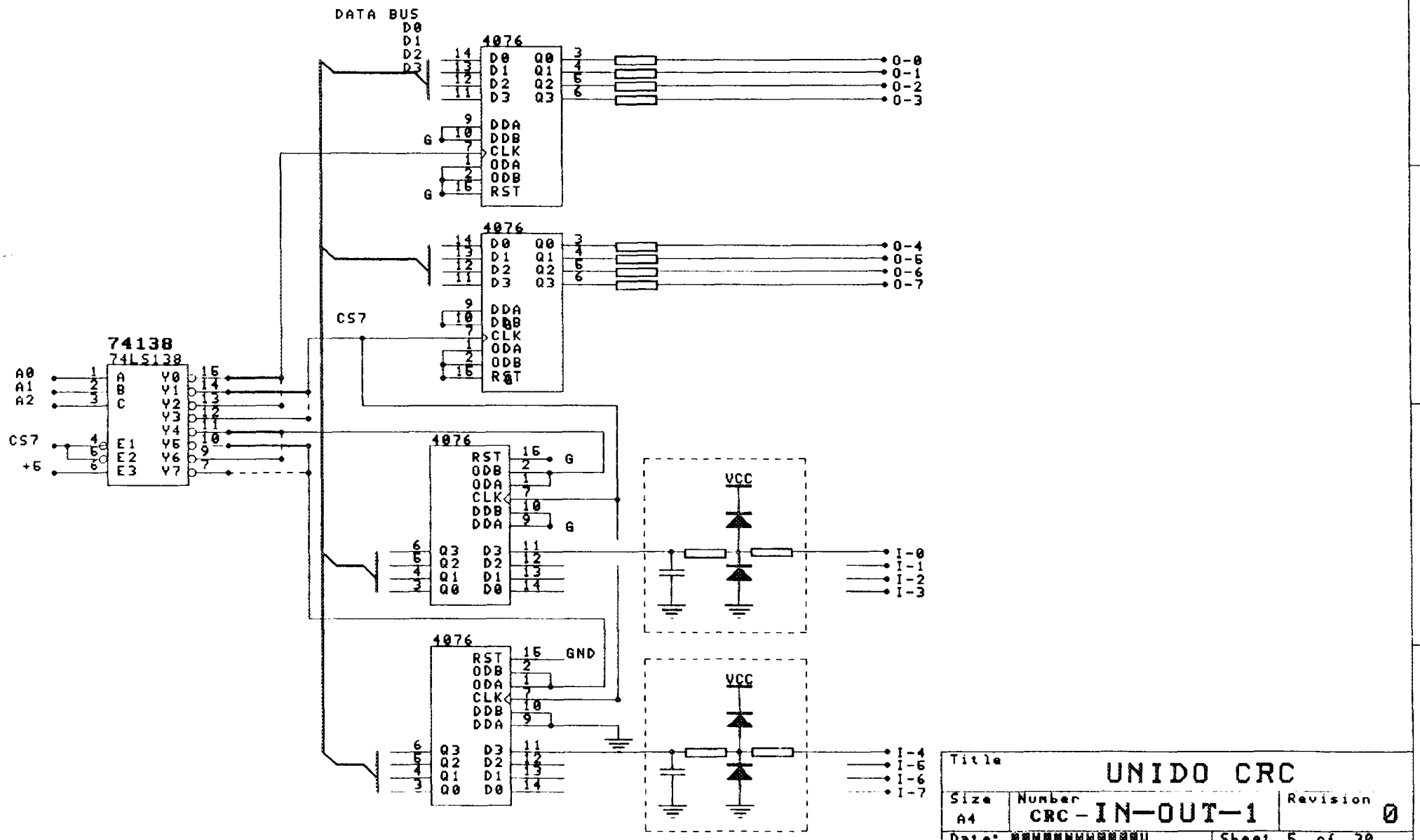
6 - Electronic parts consist of resistor. IC, capacitor, and diode, 2760 each.

7 - Following Components and Parts were procured for each hot chamber:

a) Heat generator;
b) Air Blower;
c) Three Phase Thermal Control System(10 KW) with relevant integrated analog control (0 to 100 % rated);
d) Refrigerator Compressor Motor Current Measuring System Data Logger;
e) Sensor Socket Support Bracket;
f) Socket Channels;
g) Two room air conditioner units for maintaining hot chamber ambient

temperature at 18 and 32 degree C;

h) Two Humidifiers units for hot chambers;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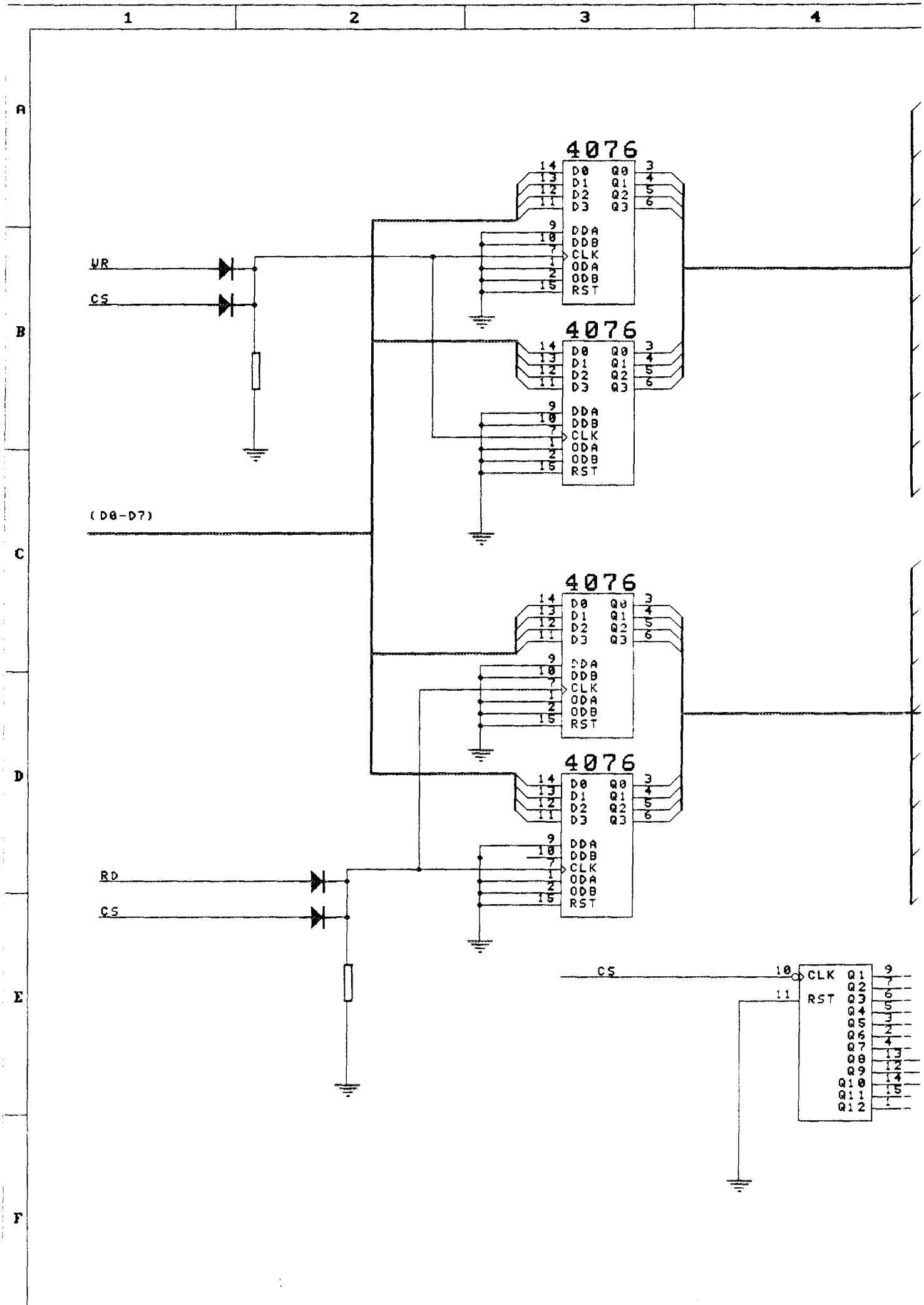
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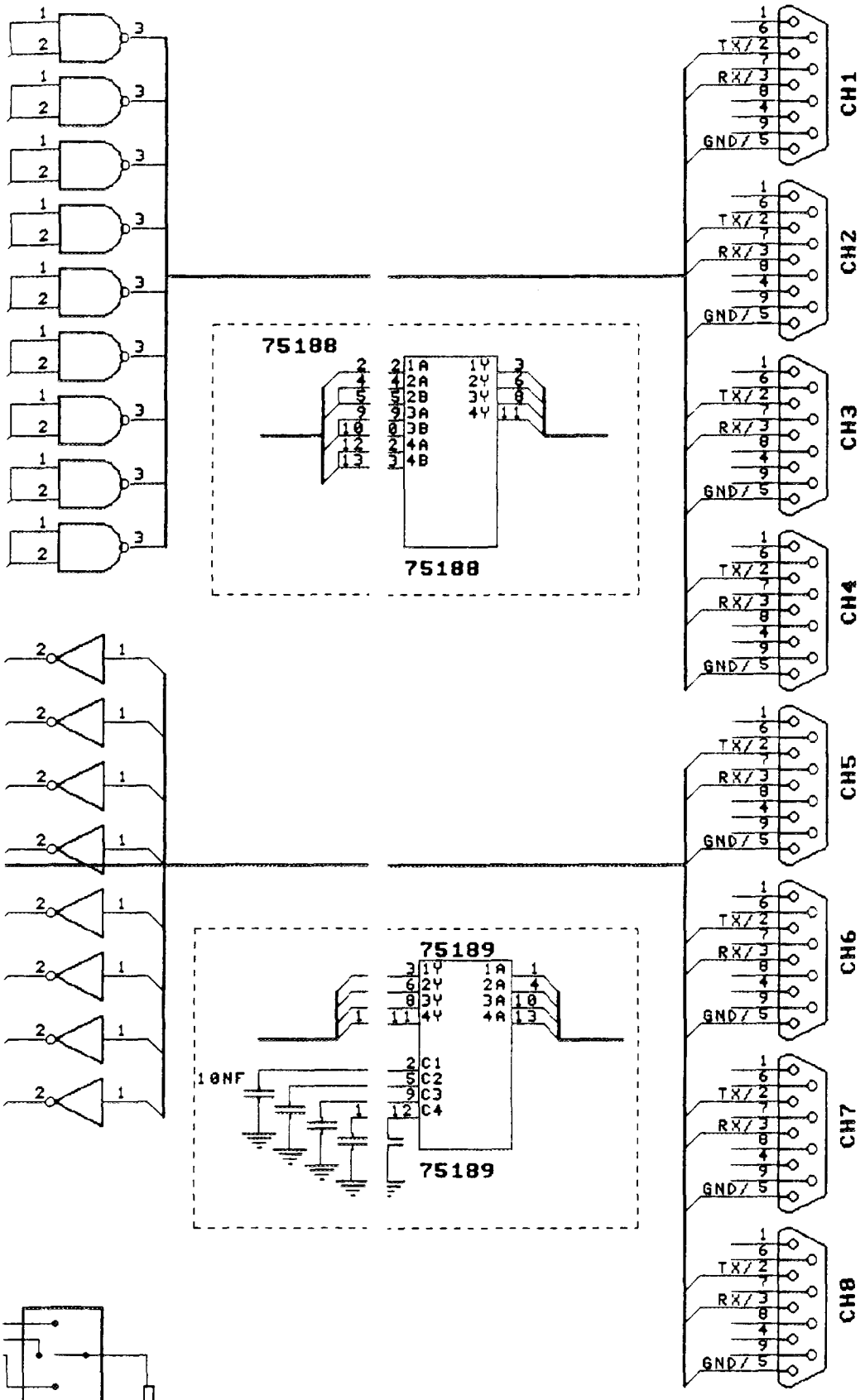

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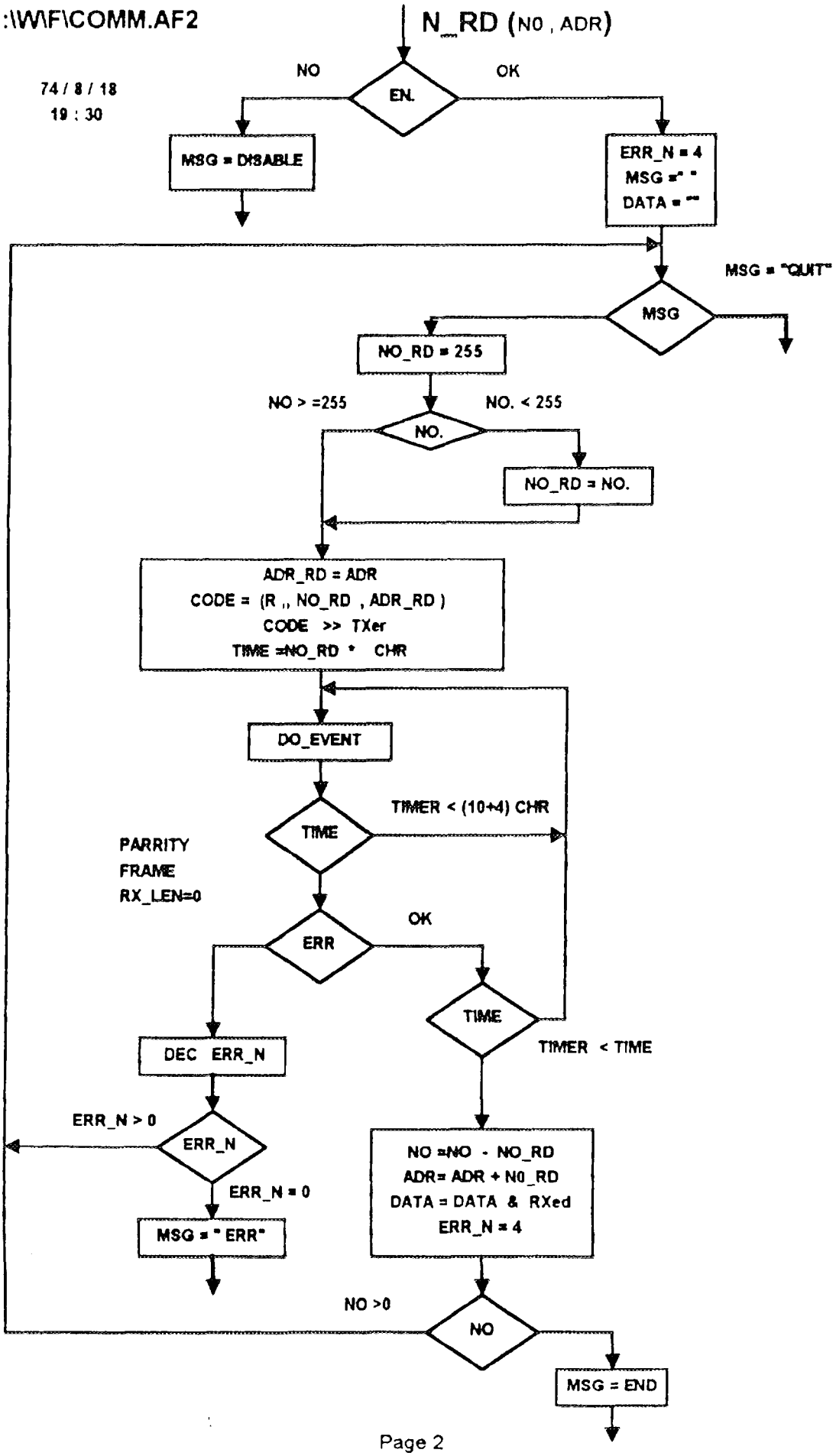

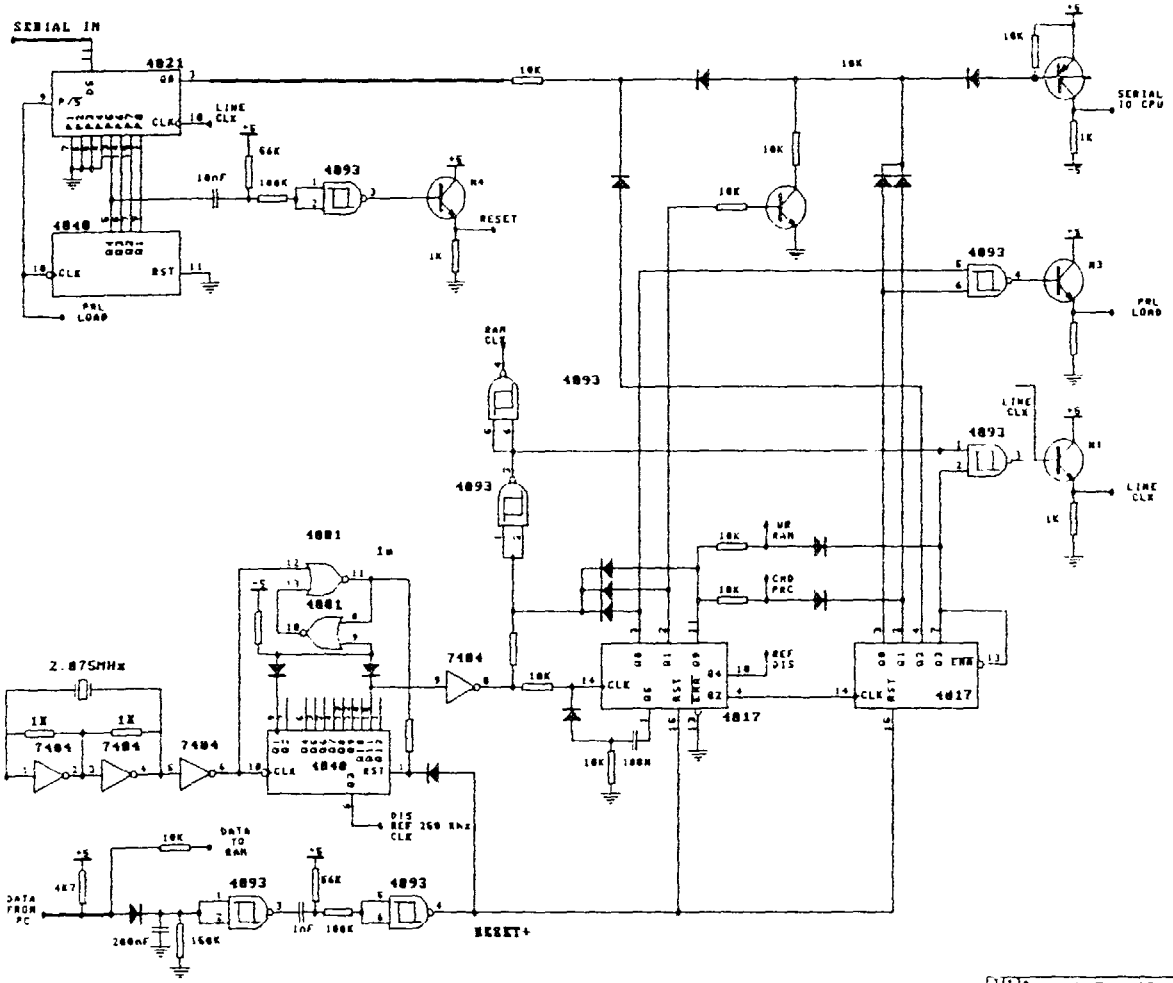

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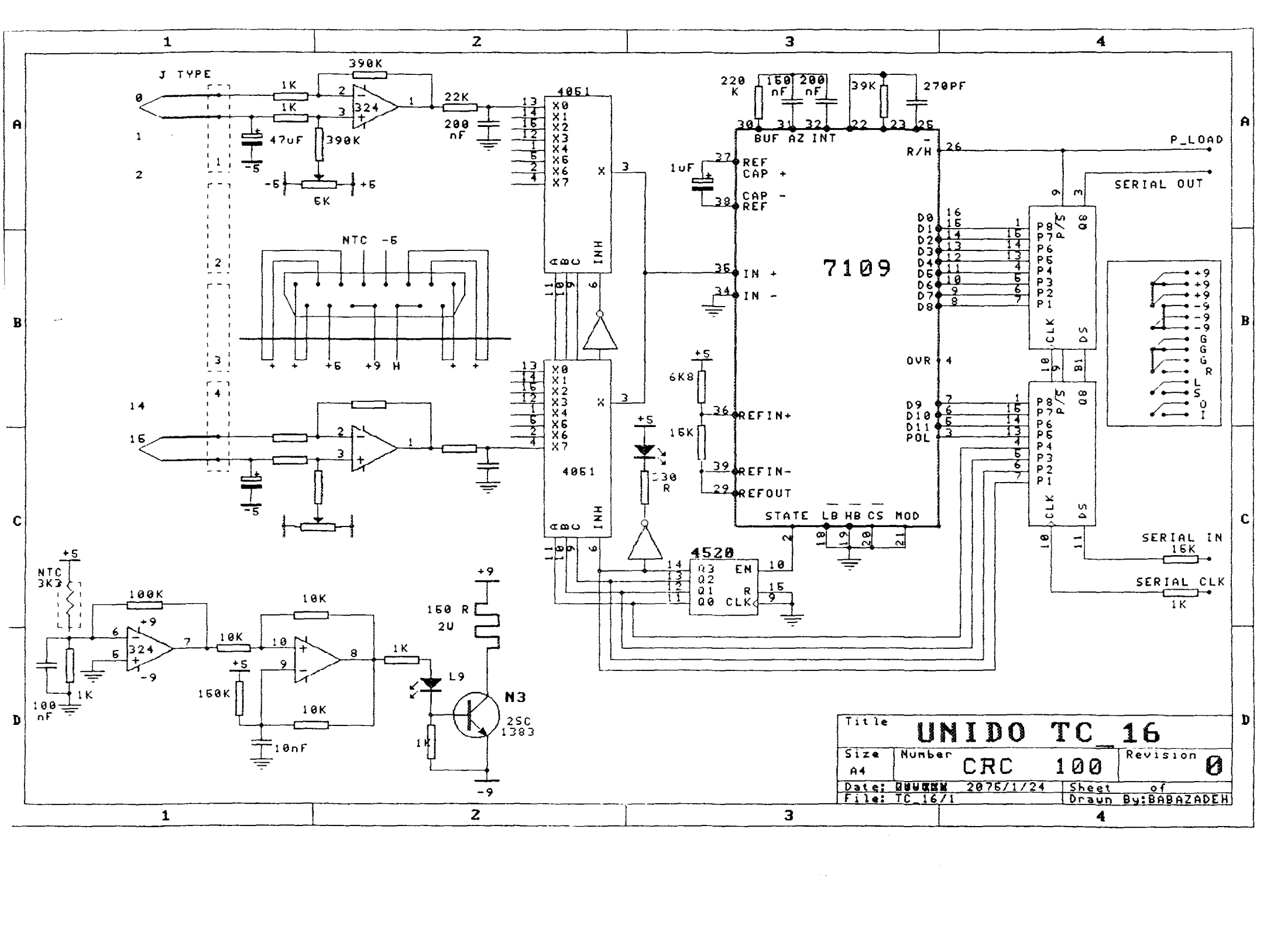
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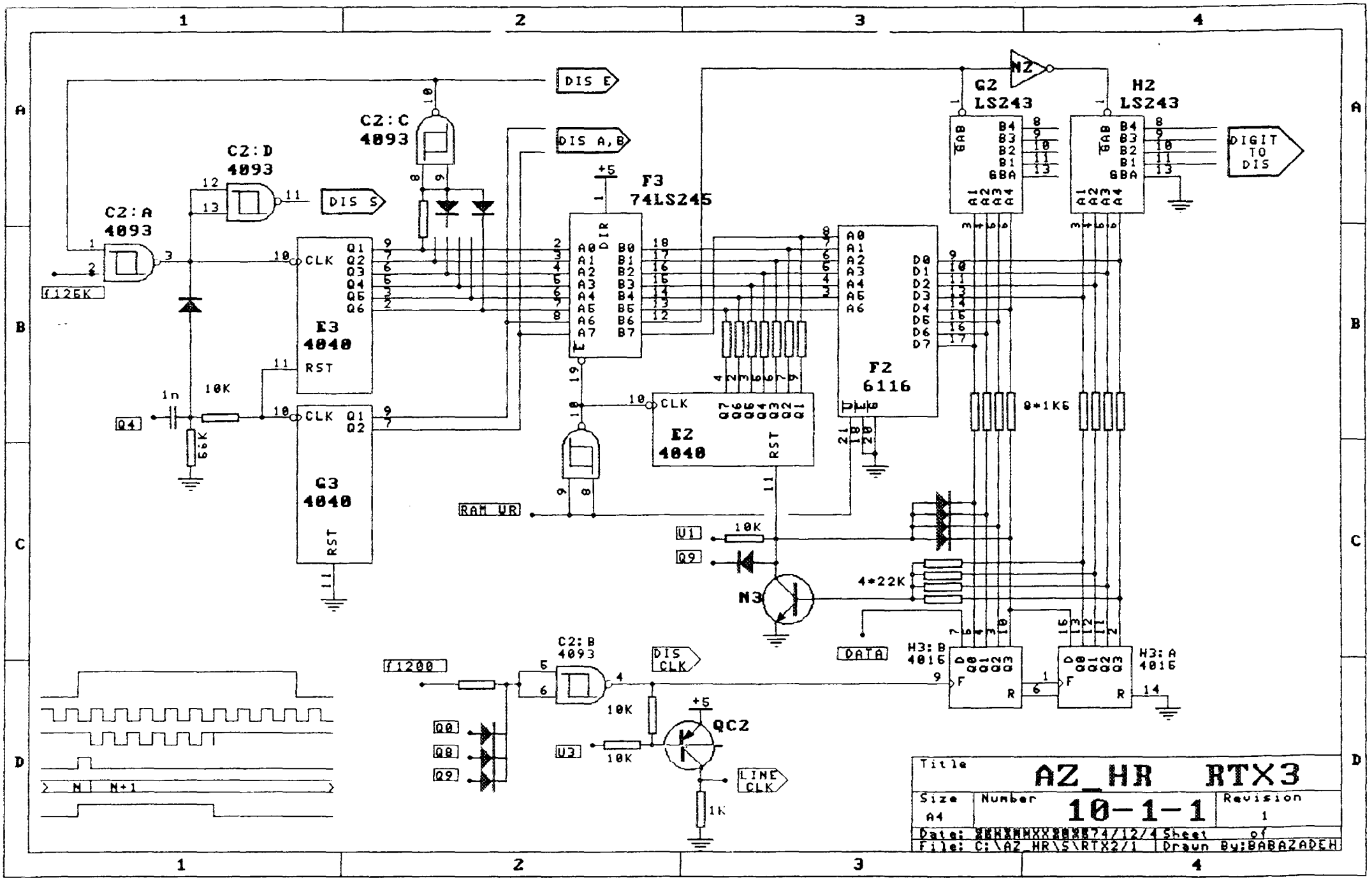
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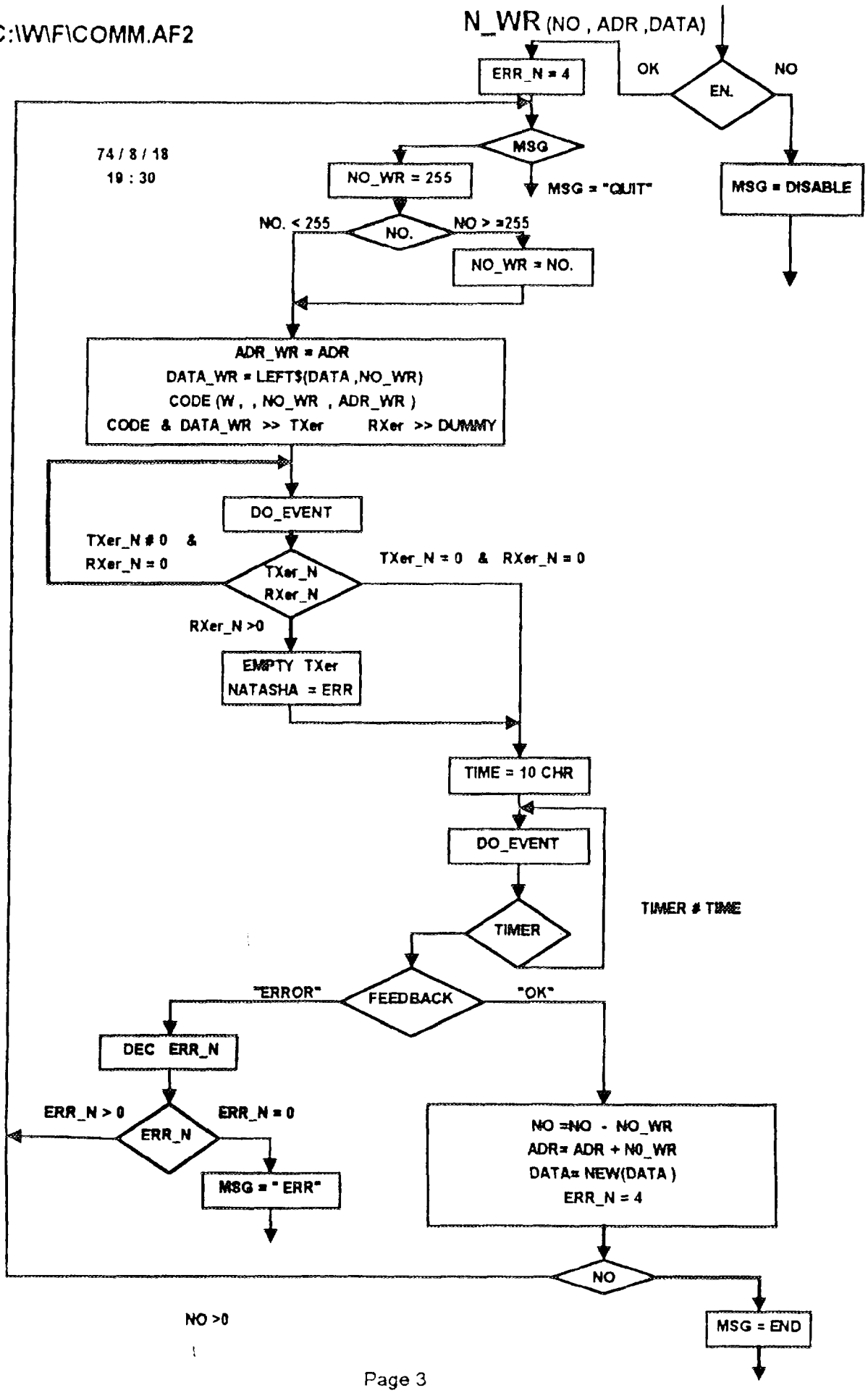
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74 / 8 / 18
19 : 30
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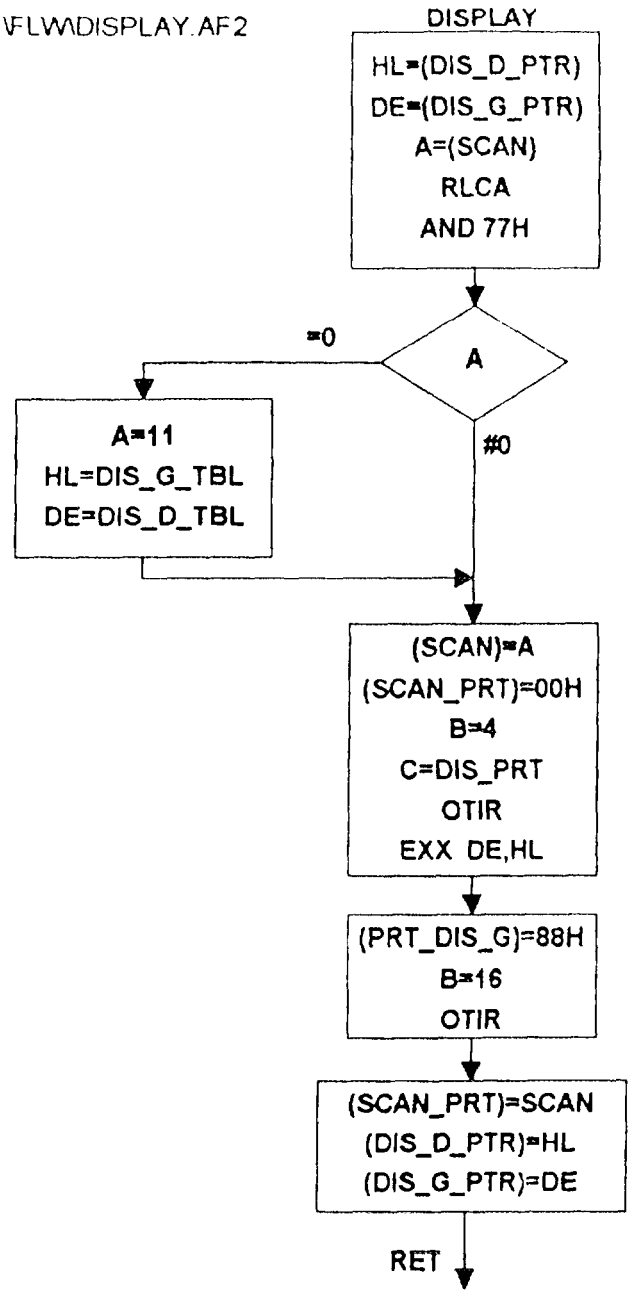

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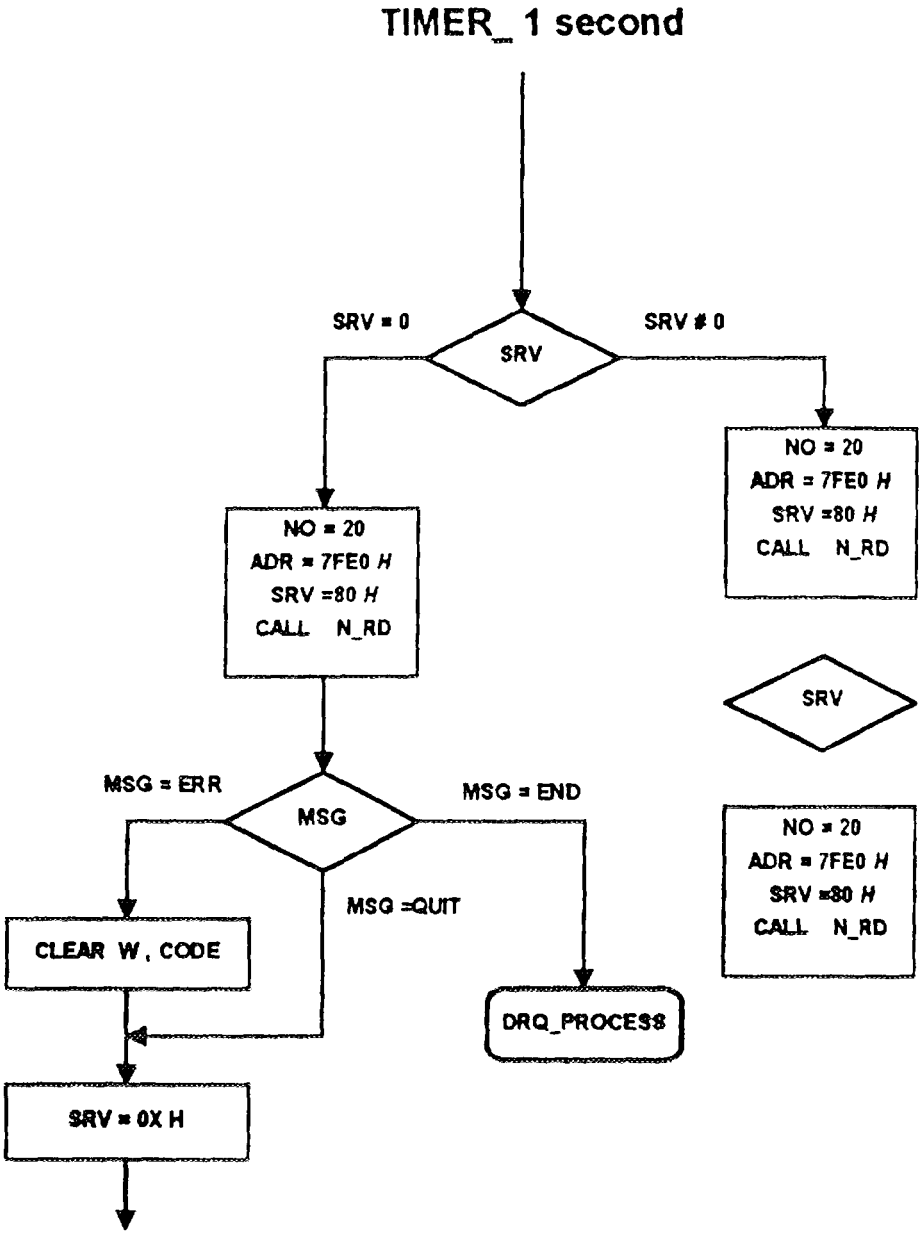

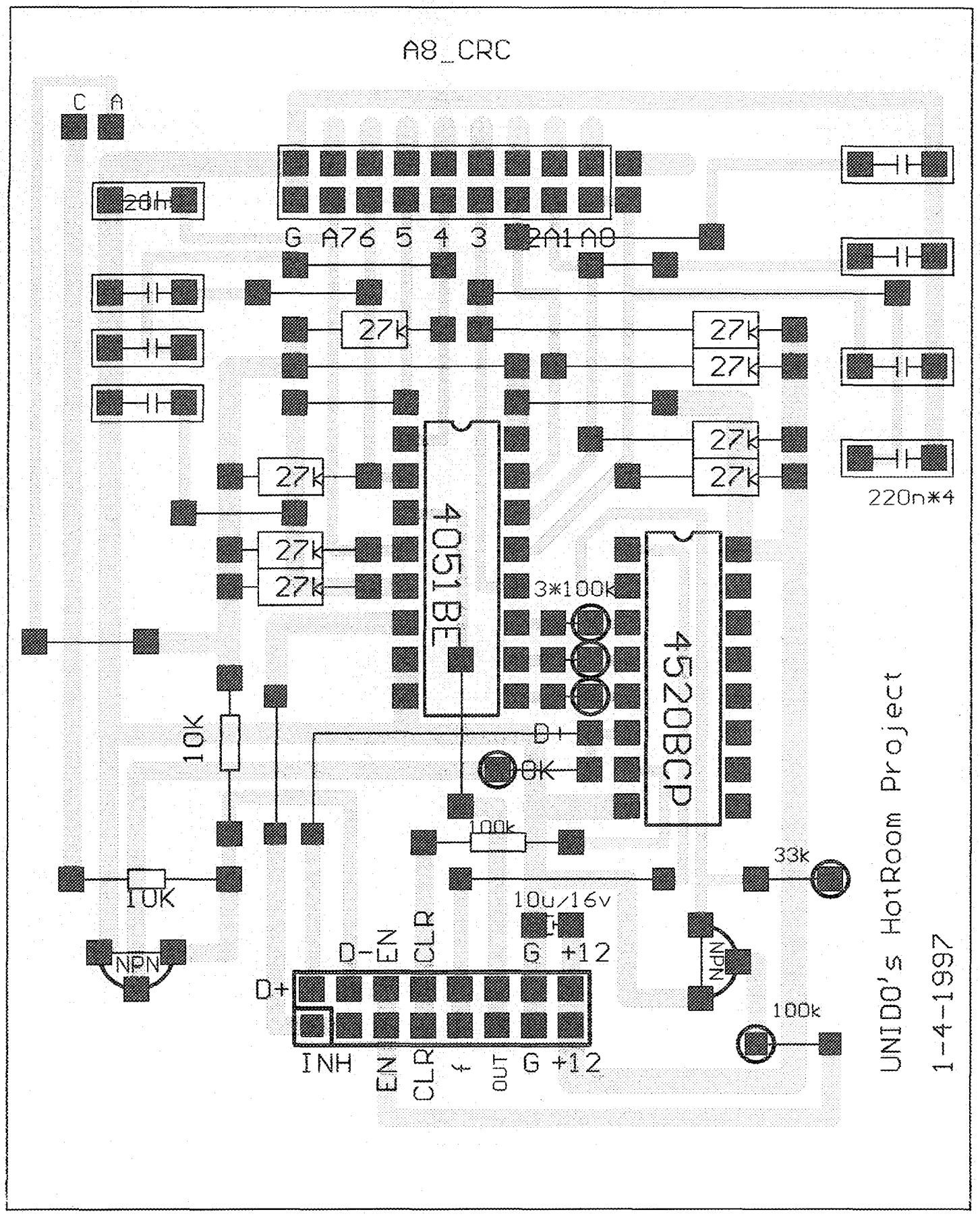
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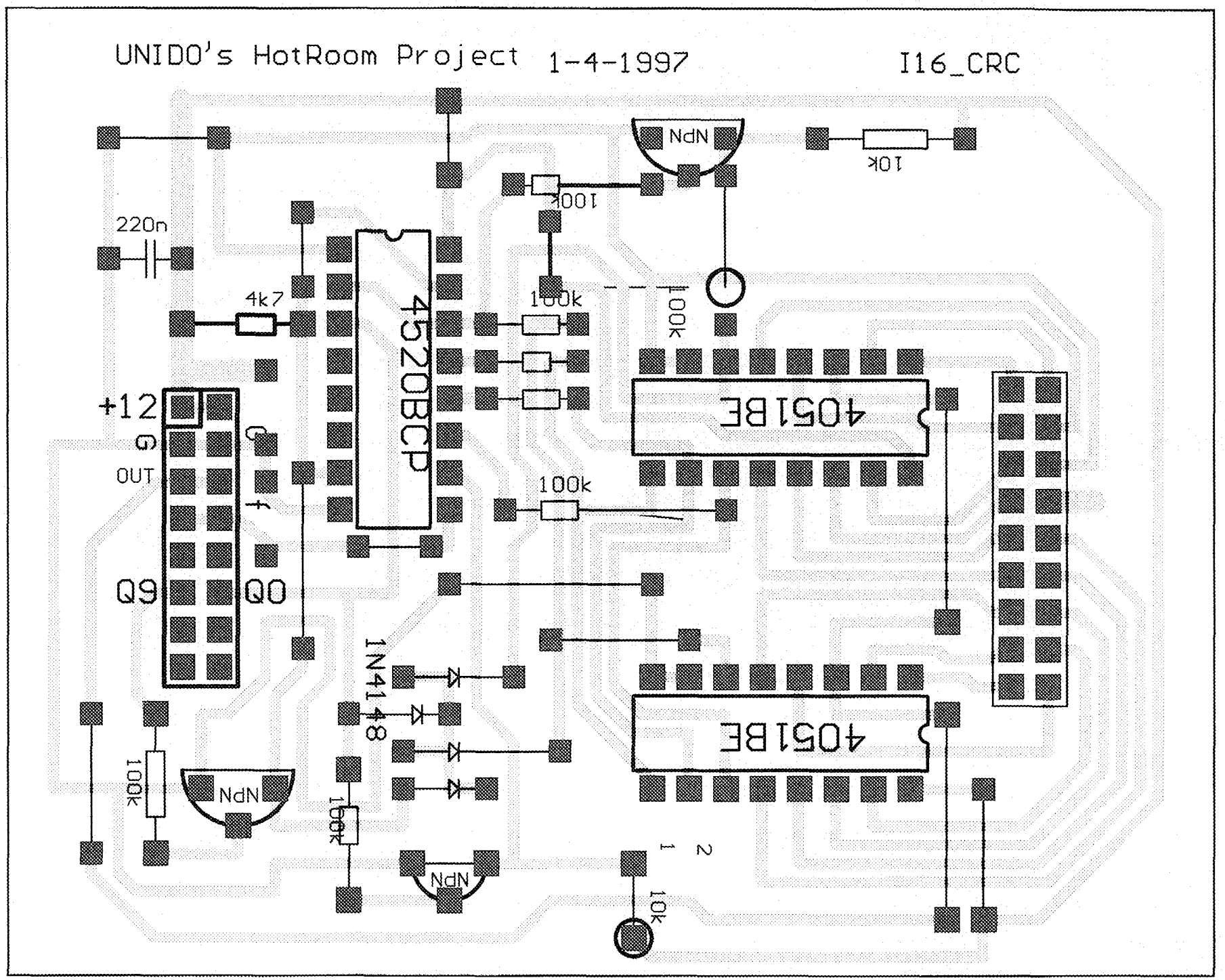
UNIDO's HotRoom Project
1-4-1997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UNIDO'S HotRoom Project

1-4-1997